FITT FORUM

ISSN-0972-2548
Vol 17 No 1, Jan 2011

Newsletter of Foundation of Innovation and Technology Transfer,
Indian Institute of Technology Delhi, New Delhi

A German Delegation on visit to FITT, IIT Delhi

A delegation from Indonesia

A Training Course in progress

Industry Clinic at FITT

CONTENTS

Ed....

At the dawn of the New Year albeit, the new Decade we ought to forget the various turbulent events of the past few years - 9/11, 26/11, economic meltdown etc that shook the world and nearly brought us to the point of despair! The resilience of people and institutions around the world ensured a rebound. Let's hope for a brighter next decade – one that captures and spreads the marvels of knowledge, technology and innovations. The challenge today is to fully harness the value of research. More importantly, large underprivileged, under-developed and under-fed sections of our society need to be attended to for ensuring equitable and sustainable growth. The knowledge institutions can be key stakeholders in this development effort. Even otherwise, the ability and scale of University outreach towards business and the community, more particularly, in addressing the challenges and needs of the world outside its boundaries is a key determinant of our capacity to face the modern day challenges and to create new frontiers of knowledge and technological solutions. Towards creating a vibrant ecosystem, adequate policy support is of great significance and fortunately, we see a lot of Government backing now.

FITT, the Research and Business interface platform at IIT Delhi now moves into the third consecutive decade having begun its operations in 1992. With the onward journey comes the responsibility of strengthening the existing programs and embarking on newer initiatives without losing sight of our goal of enabling innovations and knowledge transfer from IIT Delhi. The pioneering efforts towards technology development through partnership approach, capacity building amongst the industry units and techno-entrepreneurship at the Institute have taken us to a pedestal from where expectations and responsibilities only rise. While aiming for the sky, we keep on exploring newer models of engagement with the world outside our hallowed precincts.

The present issue captures shades of young academics at the Institute and we look forward to a productive and rewarding future in their company and wish them great careers. As always, the continued support of the Institute to us deserves comprehensive acknowledgement. Cheers !

Viruses and Cancer

Dr V Perumal, School of Biological Sciences, IIT Delhi, N Delhi 110016; Email: vperumal@bioschool.iitd.ac.in

1. Introduction

Cancer is a major global problem and a devastating disease associated with over 7 million deaths per year. A critical balance between the production of new cells and the death of old cells is normally maintained in the human body. Cancer is the uncontrolled growth of a cell that results in clonal expansion (formation of a clone of cancer cells) leading to a growing mass of cells/tissue. This clone of cancer cells has the potential to directly spread to adjacent tissue (invasion) or spread to other sites in the body through the lymphatic system and blood vessels (metastasis). The transformation of a normal cell into a cancer cell is usually a slow process and it may take several years to tilt the homeostasis towards unchecked growth. The genes that play a crucial role in tipping the balance towards cellular proliferation may be classified into two: (a) proto-oncogenes are host genes that augment cellular proliferation when mutated or over expressed (b) Tumour suppressor genes that serve as "gate keepers" controlling cell proliferation and also as "care takers" helping with DNA repair. Increased expression of proto-oncogenes or decreased expression of tumour suppressor genes lead to transformation of a normal cell to a cancer cell.

Though conceived nearly a century ago, it has been difficult to establish and acknowledge the causal role of viruses in cancer. The main challenges in linking viruses to cancer were (a) Viral infection is perceived as a communicable disease, while cancer was not (b) Neither every patient with a particular cancer has detectable virus nor every patient infected with the virus develops cancer. Rigorous research in the last 100 years now links 20 % of the overall cancer burden with viruses.

2. Historical perspective

Infectious agents were suspected to cause human warts (small local growth of tissue on the skin) and leukaemia (a tumour of the white blood cells) in chicken in the early 1900s. In 1911, Rous and colleagues transmitted sarcoma (a tumour of connective tissue such as bone, cartilage etc.) to healthy chicken using cell-free filtrates. Despite being the first of its kind to document the association of a transmissible agent with solid tumours, this study by Rous et al. failed to gain widespread acceptance based on skepticism that avian (bird) models may not be comparable to human disease. It took over 50 years for the scientific community to recognize the importance of the contribution by Rous et al. Finally, Rous received the Nobel Prize for this work in 1966. Epstein et al. were the first to document the role of viruses in human tumours by identifying the association of Epstein –Barr virus with Burkitt's lymphoma (a tumour of the jaw). This work by Epstein et al. and the Nobel Prize awarded to Rous rekindled interests to search for human tumour viruses. Major breakthroughs were achieved in the early 1980s: (a) A strong epidemiological association between liver cancer and persistent hepatitis B virus (HBV) infection was demonstrated (b) The human T-cell leukaemia virus (HTLV-1) was isolated from human T-cell leukaemia cell lines (c) DNA from human papilloma virus (HPV) was isolated from cervical cancer tissue. Subsequently, several mechanisms of virus-induced cancers were revealed in the next three decades.

3. Viral carcinogenesis

In general, viruses associated with cancer have the ability to evade the host immune system and establish persistent infection in the host cells without killing the host cells. Constant interactions between the infecting virus and the host cells trigger a cascade of events at the molecular level leading to carcinogenesis (transformation of normal cells into cancer cells). The contributory role of viral infections in oncogenesis is now well accepted. However, viral infection per se may not be sufficient to cause cancer. Several co-factors, including host genetics, host immune response and environmental factors (including chemicals) are major players in virus-induced cancers.

The genetic information in viruses is encoded either in DNA (DNA viruses) or RNA (RNA viruses). DNA and RNA viruses differ in their fundamental mechanism of inducing carcinogenesis. Viral Proteins encoded by DNA tumour viruses that are essential for viral replication and do not have human protein homologues serve as viral oncoproteins (proteins encoded by viral oncogenes) inducing oncogenesis. RNA tumour viruses with the exception of HCV could carry transduced cellular oncogenes (host cell sequences that are incorporated into the viral genome by accident) that are dispensable for viral replication but can induce transformation of host cells. The mechanisms of virus-induced carcinogenesis are summarized in Figure 1.

4. Viruses and human cancers

The list of viruses includes:

a) Human papilloma virus (HPV): It is now well accepted that HPV is the causative agent of most cervical and anal cancers. In addition, HPV has been implicated in vulvar-, penile-, orophrangeal- and skin cancers. There are over 100 different types of HPV described. Some HPV types (high risk types) have greater oncogenic potential than others (low risk types). HPV lacks a polymerase gene, making virus replication dependent on cellular DNA synthesis machinery. Integration of the HPV genome into human chromosomal DNA is a frequent event in HPV induced cancers. However, during integration some viral genes are lost resulting in the termination of active viral replication. But the viral proteins expressed post-integration into the host chromosome are sufficient to induce carcinogenesis. Among the HPV proteins E6 and E7 are consistently expressed in cervical cancers and represent the most well studied HPV oncoproteins. The HPV E6 and E7 proteins dysregulate human proteins p53 and pRb (retinoblastoma protein) respectively. Both p53 and pRb are tumour suppressors and the inhibition of their function hinders apoptosis (programmed cell death) and DNA repair resulting in increased cell proliferation. Interestingly, the HPV E2 protein, that inhibits expression of E6 and E7 proteins is often lost during the process of integration into the

host genome, resulting in increased expression of the two oncoproteins.

b) Hepatitis B virus (HBV): HBV is a major global problem with over 350 million chronic carriers worldwide. Only a very small proportion of chronically HBV infected individuals develop liver cancer or hepatocellular carcinoma (HCC) and not all patients with liver cancer have chronic HBV infection. However, epidemiological studies have shown that chronic HBV infection increases the risk of liver cancer by over a hundred fold. The causal role of HBV in liver cancer is well accepted. Aflatoxin B (a toxin produced by fungi and ingested through consumption of contaminated food) and alcohol are notable co-factors that accelerate HBV-induced liver cancer. Integration of the HBV genome into human chromosomal DNA, though not a prerequisite for HBV-associated liver cancers, is frequently detected. HBV integration into the human genomic DNA results in activation of proto-oncogenes and genomic instability. The HBx protein is a HBV encoded protein that has been implicated in several mechanisms leading to oncogenesis including transactivation of cellular promoters and enhancers, negative regulation of proteasomal function (the major mechanism of degradation of unwanted proteins), dysregulate mitochondrial function and up regulation of proto-oncogenes. Additionally, the chronic inflammation associated with persistent HBV infection of the liver plays a major role in accelerating the progression to liver cancer.

c) Epstein-Barr virus (EBV): Nearly 95% of the world's population is EBV infected. Majority of primary infection in young children is asymptomatic, while primary infection in adults may present as infectious mononucleosis or glandular fever, a self-limiting illness. EBV is associated with nasopharyngeal carcinomas and Burkitt's lymphoma (a cancer of the lymphatic system often affecting the jaw). In addition, EBV is also linked to Hodgkin's lymphomas (tumour originating from lymphocytes), T-cell lymphomas (a tumour of originating in T-lymphocytes) and gastric cancer. There is a high occurrence of nasopharyngeal carcinomas in Southern China and some parts of Southeast Asia. EBV-associated Burkitt's lymphoma is common in Africa and Brazil. The geographical distribution of EBV-associated cancers strongly suggests the role of accompanying co-factors. Consumption of salted fish is believed to be associated with a higher incidence of nasopharyngeal carcinomas and malarial infections and immunocompromised states (eg. HIV infection) are co-factors for Burkitt's lymphoma. The EBV latent membrane protein (LMP1) has been shown to be indispensible for EBV-induced carcinogenesis. The LMP1 promotes cell growth and inhibits apoptosis by interacting with several signaling pathways. Other EBV encoded proteins including EBV nuclear antigens 2 and 3 represent viral oncogenes that play key roles in EBV-induced malignancies.

d) Kaposi's sarcoma-associated herpesvirus (KSHV): KSHV is the etiological agent of Kaposi's sarcoma (KS), a disease that originates in the cells that line the blood- or lymphatic vessels and manifests as abnormal growth of tissues in the skin, oral cavity and the nose. KSHV is also linked to other lymphoproliferative disorders. KSHV is transmitted through saliva. There are four forms or types of KS: (a) Classical KS is seen in elderly people of the Mediterranean origin (b) Epidemic or acquired immune deficiency syndrome (AIDS)-associated KS is seen in human immunodeficiency virus (HIV) infected patients as a result of their immunocompromised status. This is an aggressive form of KS and can spread to multiple organs. Of note, KS is the most frequently detected tumour in AIDS patients (c) Endemic KS is seen in sub-Saharan Africa. It can affect men, women and children regardless of their HIV status. (d) Transplant-associated KS is seen in organ transplant recipients on immunosuppressive therapy (immunosuppression reduces the risk of rejection of the transplanted organ) post-transplantation. The diverse nature of the four forms of KS reiterates the complex nature of KS and its association with several co-factors such as host genetic makeup, host immune response and perhaps environmental factors. Several oncoproteins have been identified in KSHV. High cytokine (cytokines are secreted proteins that are signalling molecules that play key roles in developmental process and immunomodulation) levels and growth factor (growth factors stimulate cell proliferation) levels are hallmarks of KSHV-associated cancers.

e) Human T-cell leukaemia virus type-1 (HTLV-1): HTLV-1 is a retrovirus (an RNA virus that replicates with a DNA intermediate) that is associated with adult T-cell leukaemia (ATL). HTLV-1 is endemic in some parts of Japan, Africa and South America. Increasing rates of infection with HTLV-1 are reported from Western Europe and North America. Individuals infected with HTLV-1 remain infected for their lifetime. Despite persistent infection most infected individuals do not manifest major clinical symptoms and several decades later a small proportion (<5%) develop ATL. TAX is a HTLV-1 encoded protein that has been identified as the major viral oncoprotein in ATL. Apart from regulating viral replication, TAX activates several cell-signalling pathways, inhibits apoptosis and DNA repair. Other HTLV-1 encoded proteins have been linked to oncogenesis and increased proliferation of infected cells.

f) Hepatitis C virus (HCV): Over 170 million people are chronically infected with HCV worldwide. Chronic HCV infection is a major risk factor for developing liver cancer. HCV is a RNA virus well known for its genetic variability resulting in quasispecies (closely related but non-identical viruses that are a result of mutations / recombination). The HCV core protein modulates several transcription factors resulting in the dysregulation of key tumour suppressor genes and proto-oncogenes. HCV core protein along with three HCV encoded non-structural proteins modulate cytokine production, oxidative stress and apoptosis leading to hepatocyte proliferation. HCV lacks the ability to integrate itself into the human genome. The chronic inflammation associated with immune-mediated damage of the HCV infected hepatocyte followed by regeneration is believed to augment HCV-induced liver carcinogenesis.

In the last decade a few more viruses including JC virus, BK virus, human mammary tumour virus (HMTV) and Merkel cell polyomavirus (MCV) have been linked to human cancers, however

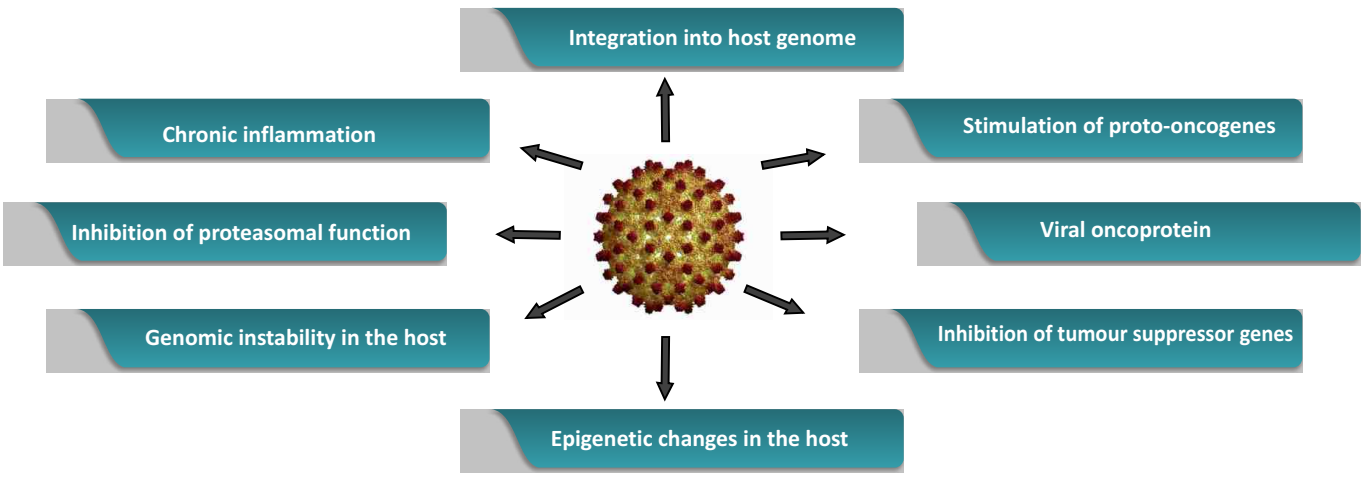


Figure 1: The underlying mechanisms in virus-induced carcinogenesis.

a causal relationship of these viruses to cancer remains to be established. JC virus and BK virus are polyomaviruses. JC virus has been linked to brain cancer and colorectal cancers, while BK virus has been linked to prostate cancer. MCV has been implicated in Merkel cell carcinoma, a rare but aggressive form of skin cancer. Studies suggest that HMTV is linked to breast cancer. The lack of large-scale epidemiological studies and convincing evidence weakens the association between JC virus-, BK virus-, HMTV- and MCV- and cancer. Additionally, the role of HIV-1 in human cancers is currently being investigated. The increased incidence of cancers (Eg. Kaposi's sarcoma) and an aggressive course of certain cancers (Eg. Invasive cervical cancer) in HIV-1 infected patients suggest a role for HIV-1 in these cancers. It is believed that HIV's involvement in carcinogenesis could be indirect through HIV-associated immunosuppression or direct through activation of oncogenes of other viruses through HIV-1 proteins.

5. New insights into viral oncogenesis: epigenetic changes and role of microRNAs

Epigenetic changes are changes other than in the encoding DNA sequence that affect gene expression. An EBV oncoprotein (LMP1) has been shown to induce increased expression of host DNA methylatransferases (DNMTs) which are enzymes that can lead to hypermethylation (increased methylation) of promoters of tumour suppressor genes. Promoter hypermethylation of tumour suppressor genes results in decreased expression of the encoded protein, tipping the balance towards increased cell proliferation. Recent studies have demonstrated the induction of DNMTs by HBV replication. It has also been hypothesized that methylation of viral genomes associated with decreased production of viral proteins could potentially play a role in viral persistence by evading host immune responses.

MicroRNA are short (21-23 nucleotides) RNA molecules that are now recognized to play an important role in regulating gene expression. MicroRNAs are encoded by host (human) as well as the virus genome. Viral integration into human chromosomal DNA could modulate the expression of host encoded microRNA. Furthermore, it has been predicted that EBV encoded microRNAs could modulate tumour suppressor genes and genes involved in apoptosis.

6. Virus-induced cancers: role of vaccines

A safe and efficacious vaccine against HBV has been available since the early 1980s. HBV vaccination is part of routine immunization in several countries. The incidence of HBV-induced liver cancer has decreased considerably following over two decades of mandatory vaccination, especially in Asia. Of note, HBV-induced liver cancer is the first vaccine-preventable cancer. In 2007, a vaccine that confers protection against 4 types of HPV that cause cervical cancer was launched. The HBV and HPV vaccines are the only available vaccines against virus-induced cancers.

7. Conclusion

Our understanding of the mechanisms of virus-induced tumours has improved considerably in the last two decades. However, therapies targeting the oncogenic viral proteins are lacking. In general most currently available therapeutic options target the transformed host cell rather than the infecting virus; therefore the lack of specificity and the associated cytotoxicity (not only transformed cells but also normal are killed) are the major problems with these therapies. The development of viral vaccines and therapies that target viral oncoproteins may help reduce the morbidity and mortality associated with virus-induced cancers.

Acknowledgements

We regret the omission of several important references due to space constraints.

References

1) Butel JS. Viral carcinogenesis: revelation of molecular mechanisms and etiology of human disease. Carcinogenesis. 2000; 21(3):405-426.

2) Damania B. DNA tumor viruses and human cancer. Trends Microbiol. 2007; 15(1):38- 44 2007; 15(1):38-44.

Ionic Liquids as Novel and AlternateMedia in Chemistry

Siddharth Pandey, Department of Chemistry, IIT Delhi, New Delhi – 110016. *E-mail: sipandey@chemistry.iitd.ac.in*

To date, most chemical reactions have been carried out in molecular solvents. For almost two millennia most of our understanding of chemistry has been based on the behavior of molecules in the solution phase in molecular solvents. Recently, however, a new class of solvent has emerged: the ionic liquids. The term “ionic liquids (ILs)” has certainly captured the imagination of chemists across the globe. The burgeoning interest in this field is very obvious given the innumerable benefits of the ILs. One of the primary driving forces behind the extensive research into ILs is the perceived benefit of substituting traditional industrial solvents, most of which are volatile organic compounds (VOCs), with nonvolatile ILs. Replacement of conventional solvents by ILs would prevent the emission of VOCs, a major source of environmental pollution. ILs are not always intrinsically “green” - some are extremely toxic too, however they can be designed to be environmentally benign with huge potential benefits for sustainable chemistry. They have no detectable vapor pressure, and therefore contribute no VOCs to the atmosphere. But this is not the only reason for such huge interest in ILs. The most important reason why ILs are garnering increased attention from both academic and industrial research communities is that at least a million binary ionic liquids and 1018 ternary ILs are potentially possible. For a little comparison in this context only 600 molecular solvents are in use today whilst more than 1500 ILs have been already reported to be used by chemists in scientific literature. Thus, another reason for such a phenomenal interest in ionic liquids is that the synthetic chemists are limited by the number of available molecular solvents in which they can conduct chemistry. The diversity in the prospective types of ILs enables the chemists to design the ILs to meet their requirements and to tune it to optimize the yield, selectivity, substrate solubility, product separation, and even enantioselectivity. As they are made up of at least two components which can be varied (the anion and the cation), the solvents can be designed with a particular use in mind, or to possess a particular set of properties. Hence, the term “designer solvents” has come into common use. The physical, chemical and biological properties of ILs can be tailored by switching anions/cations or by designing specific functionalities into the anions/cations and mixing two or more simple ILs. The scientific potential for research on ILs is thus virtually unlimited

Now, coming back to the basics of the ILs - what are ionic liquids in reality? The term “Ionic liquid” is referred to liquids consisting exclusively of ions having melting point below 100 ºC. ILs that are liquid at or around room temperature are known as room-temperature ionic liquids (RTILs). RTILs generally consist of bulky and asymmetric organic cations (nitrogen- or phosphorous-containing) such as 1-alkyl-3-methylimidazolium, N-alkylpyridinium, N-methyl-N-alkylpyrrolidinium and ammonium ions. A wide range of anions are employed, from simple halides, which generally inflect high melting points, to inorganic anions such as nitrate, tetrafluoroborate and hexafluorophosphate and to large organic anions like bis(trifluoromethanesulfonyl)imide, trifluoromethane sulfonate and tosylate.

Dating back to the history of the ILs, the first IL, ethanolammonium nitrate (m.p. 52-55 °C), was reported in 1888 by S. Gabriel and J. Weiner. The literature reports ethylammonium nitrate (m.p. 12.5 °C) to be the first RTIL synthesized by Paul Walden in 1914. The unique physicochemical properties of ILs which bestows it with a superior status as compared to the conventional organic molecular solvents are non-volatility, non-flammability, thermal stability, high ionic mobility, good electrical conductivity, excellent chemical stabilities with wide range of solubilities and miscibilities and a broad electrochemical window. Due to the exclusive architectural platform imparted to the ILs by these properties, they are capable of dissolving enzymes, forming versatile biphasic systems for separations and extractions, forming polymers and gels for device applications, acting as media for a wide range of organic and inorganic reactions and as catalysts in chemical synthesis. Consequently, ILs can be exploited potentially

as solvents and new materials for varying range of applications in organic chemistry, inorganic chemistry, biochemistry, material science and pharmaceuticals. Thus, ILs can contribute considerably to the development of Green Chemistry and Green Technology by replacing the toxic and flammable VOCs and thereby preventing environmental pollution to a great extent. Some novel industrial applications of ILs are as electrolytes in lithium ion batteries, in dye-sensitized solar cells, and as super capacitors.

We have been investigating the solvation and aggregation processes within IL-based systems using UV-vis absorbance and fluorescence probes. Imidazolium ILs are found to be optically transparent in the visible region and in much of the UV region and hence are perfect media for optical studies of the probe behavior. ILs, in spite of being good solvents, have certain limitations. Some of their physicochemical properties could be restrictive, e.g., limited viscosity, density, refractive index and dipolarity. This has led us to investigate the mixtures of ILs with water or with ethylene glycols (which are themselves environmentally friendly solvents) with much greater interest. An aqueous mixture of IL or a mixture of IL with another environmentally-benign solvent (the so-called 'hybrid green' system) allows for the modifications in the physicochemical properties in order to satisfy the needs for a particular application.

Through our research work on the fluorescence probe fluorescein, we have demonstrated its unusual prototropic behavior in the presence of a hydrophilic IL 1-butyl-3-methylimidazolium tetrafluoroborate ([bmim][BF4]) where the micro-heterogeneity of the aqueous IL solution appears to play a crucial role. Fluorescence from the cationic form of fluorescein that is only observed from aqueous solutions of extremely high acid strength could be observed from mildly acidic solutions in the presence of [bmim][BF4].

The IL [bmim][BF4] appears to have another interesting and unprecedented effect on the prototropic behavior of fluorescein. It causes efficient lactonization when added to buffer solutions of fluorescein. The apolar nature of this IL as a solvent is demonstrated in the predominant existence of the lactone form of fluorescein, which is devoid of any significant optical density, as well as the fluorescence emission in neat [bmim][BF4]. The IL [bmim][BF4] is amply demonstrated to have modulated the prototropism and the solvatochromism of fluorescein.

We have investigated the binary mixture of IL [bmim][PF6] and tetraethylene glycol (TEG) and have observed unexpectedly large polarities that not only exceed the weighted averages of the pure component polarities but, incredibly, exhibit apparent polarities above those of the pure phases themselves. This unusual observation of “hyperpolarity” and anomalously low “microfluidity” within ([bmim][PF6] + TEG) mixtures was validated by accompanying results from several solvatochromic ?uorescent probes. Based upon our collective probe responses, we attribute this unusual behavior to the formation of localized, self-segregated, hydrogen-bonded nanostructures within ([bmim][PF6] + TEG) binary mixture.

We have also investigated the effect of ILs on surfactant behavior and have shown the effectiveness of an IL in changing the properties of an aqueous surfactant system. The physicochemical properties of aqueous micellar solutions may change in the presence of ILs. The average size of the micellar aggregates within aqueous sodium dodecylbenzene sulfonate (SDBS) was observed by dynamic light scattering (DLS) and transmission electron microscopy (TEM) to increase in a sudden and drastic fashion as the IL 1-butyl-3-methylimidazolium hexafluorophosphate ([bmim][PF6]) was added. Similar addition of [bmim][PF6] to aqueous sodium dodecyl sulfate (SDS) results in only a slow gradual increase in the average aggregate size. While addition of the IL [bmim][BF4] also gives rise to sudden aggregate size enhancement within aqueous SDBS, the IL 1-ethyl-3-methylimidazolium tetrafluoroborate ([emim][BF4]), and the inorganic salts NaPF6 and NaBF4 only gradually increase the assembly size upon their addition. It is proposed that bmim+ cations of the IL undergo coulombic attractive interactions with anionic headgroups at the micellar surface at all [bmim][PF6] concentrations in aqueous SDS, however, in aqueous SDBS, beyond a critical IL concentration, bmim+ becomes involved in cation-π interaction with the phenyl moiety of SDBS within micellar aggregates with the butyl group aligned along the alkyl chain of the surfactant. This relocation of bmim+ results in an unprecedented size increase in micellar aggregates. Aromaticity of the IL cation alongside the presence of sufficiently aliphatic (butyl or longer) alkyl chains on the IL appear to be essential for this dramatic critical expansion in self-assembly dimensions within aqueous SDBS. The most noteworthy outcome of our investigation perhaps is that the effect of ILs on properties of aqueous surfactant systems is different from that of the common salts.

Thus, through our research work we have tried to exploit the unique properties of ILs and IL containing 'hybrid green' media. Our research has clearly expanded the possibilities of future applications of ILs and IL-based systems.

For further information please visit:
http://web.iitd.ac.in/~sipandey/

The Corporate Membership Scheme at FITT

FITT invites the industry / industry associations / R&D organisations and financial institutions to become corporate members of FITT at a nominal annual fee. A corporate member client can participate in technology transfer and joint R&D programmes of the Institute on a priority basis with FITT providing the interface. Membership Form can be mailed on request or can be downloaded from www.fitt-iitd.org.

Contact: meenakshikanojiaiit@gmail.com

The new Corporate Members of FITT (July-December 2010)

JBM Industries
LG Electronics
ELICO
RAUNAQ INTERNATIONAL LIMITED
BHUPENDRA STEELS (P) LIMITED
ESTER INDUSTRIES LTD.
Danfoss
NEERI
JCB
Canon
BIRLA INSTITUTE OF APPLIED SCIENCES BIAS
JONEJA'S
AMERICAN SAFETY & HEALTH INSTITUTE www.ashinstitute.org
LNM Auto Industries Pvt. Ltd.
STL FASTENERS

Techno-entrepreneurship supports

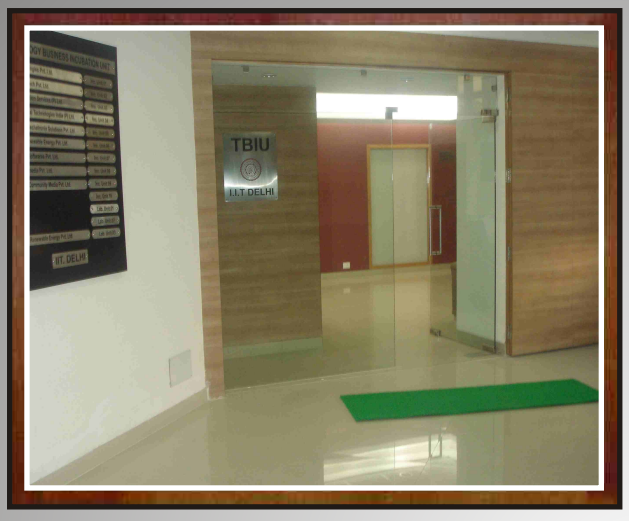
In Helping Power the Ideas .. FITT extends following supports under approved Government Schemes:

Technological Incubation and Development of Entrepreneurs (TIDE), DIT : to financially support technology ventures(IT and IT& ES) at incubators during early stages of their development, (www.mit.gov.in)

Technopreneur Promotion Programme (TePP), DSIR : to enable innovators to become technology entrepreneurs through financial support / mentoring – upto Rs 15 / 45 lakh (www.dsir.org)

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

The Team at FITT and IIT Delhi academicians have been largely responsible for our successful outreach efforts including extensive S&T collaborations



Glimpses of the new Technology Business Incubator Unit (TBIU) at IIT Delhi

News and Views

IITs to help tech institutes

BANGALORE: Mushrooming technical institutes and engineering colleges, often accused of poor standards, can now look forward to some handholding by the IITs. The four-decade-old Institutes of Technology Act is being amended so that IITs shoulder additional responsibility of supporting and collaborating with technical education institutions and advising state governments on technological problems within the zone they are located.

(Source : TNN, Dec 6, 2010)

From techno-clerks to scientists

The President of the National Association of Software and Services Companies (NASSCOM), Mr Som Mittal, last week joined a raft of industry leaders who want to position India as an innovation hub. That aspiration gathered momentum after the emergence of Indian IT companies on the global scene and the rapid development of the IT industry. As India became the favoured destination for outsourced IT services, it seemed reasonable to assume that a brave new world of innovation was around the corner.

(Source : blfeedback@thehindu.co.in - Ashok Upadhyay)

US-based Indian creates first artificial kidney

NEW DELHI: US-based Indian origin researcher Shuvo Roy has created the world's first implantable artificial kidney. What's sensational about Roy's creation is that the organ, no larger than a coffee cup, will be able to mimic the kidney's most vital functions like filtering toxins out of the bloodstream, regulate blood pressure and produce the all- important vitamin D. The artificial kidney has been tested successfully on a small number of animals. Large-scale trials on animals and humans are expected over the next five years. Once available, and if affordable, this creation by the Roy-led team at University of California will do away with the need for kidney dialysis.

(Source : TNN, Dec 4, 2010)

Corporate R&D rises, but isn't enough

NEW DELHI: Research and development (R&D) took a back seat in a world grappling with the worst financial crisis of a generation. In a year when global corporate investments in R&D declined 3.5% for the first time in more than a decade, India Inc bucked the trend. According to a study by ETIG, R&D expenditure of the top 100 Indian companies increased 8% to Rs 11,582 crore in 2009-10. As companies in the West cut down on R&D investments, and the centre of gravity for research gradually shifts eastwards, it is perhaps the best time for Indian industry to seize the initiative and look for 'in-house' technology breakthroughs that would further accelerate their growth.

(Source : 7 DEC, 2010, TR VIVEK,ET BUREAU)

WSJ on TECHNOLOGY – Intellectual Ventures sues nine tech firms

Technology companies on Wednesday received troubling news that some had feared for years: Intellectual Ventures LLC has started suing. The secretive firm co-founded by former Microsoft Corp. Chief Technology Officer Nathan Myhrvold has raised $5 billion to amass thousands of patents over the past decade. Unlike most specialists in the field, Intellectual Ventures has avoided litigation, persuading big tech companies to become investors in his firm--along with payments that sometimes came to hundreds of millions of dollars. But, Mr. Myhrvold never ruled out lawsuits if negotiations failed. But on Wednesday, Mr. Myhrvold's firm, unable to secure payments from nine companies, announced three patent- infringement suits. One suit names the best-known players in security software--Symantec Corp., McAfee Inc., Trend Micro Inc. and Check Point Software Technologies Ltd.

(Source : wsj@livemint.com)

Scientific innovation should be harnessed to needs for conservation: Manmohan Singh

The Prime Minister, Dr. Manmohan Singh, on Wednesday said scientific innovation should be harnessed to the needs for conservation, adding that it is time that the new generation of Indian scientists take on the responsibility of thinking about the future of Indian science."I sincerely believe that we need to make a break with the past. We need to create new systems, new structures and new ways of doing things that not just encourage individual excellence but also harness it effectively into socially productive multiplier outputs," said Dr Singh, after giving away the Shanti Swarup Bhatnagar prize for exceptional contribution in the field of Science at a ceremony here today.

"This is a major challenge before our government but more particularly before our scientific community. We need to think boldly about how to go forward. If the leaders of the scientific community can build a consensus on what needs to be done and what the new rules of the game should be, it will be a powerful impetus for the government to act," he added.

(Source : New Delhi, Oct 20 (ANI)

Professional development Programmes

Some forthcoming Training Programmes

Sl. No.	Title	Date	Sponsored/Participation based	Faculty/Dept.
1.	Basic Data Structures & Algorithms	Jan 20-July 14, 2011	DKOP Labs Pvt. Ltd., Noida	Naveen Garg, Computer
2.	International Workshop on Advances in Asbestos-free Friction Composites-III (IWAAFC-III)	February 9-10, 2011	Participation fee based	Jayashree Bijwe, Tribology
3	Embedded Systems and Applications	February, 14-25, 2011	Participation fee based	Subrat Kar, Electrical
4	Professional Candidate Registration (PCR) (First Semester 2011-12)	July to Nov., 2011	Working professionals can register for a single PG course (two/three 1 hour dasses in a week)	All

Professional Candidates' Registration Programme

Applications are invited from qualified professionals working in industry and Research Organizations for a unique knowledge augmentation and skill enhancement programme at IIT Delhi. This involves a semester-long registration for a regular PG course. 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. In the case of a few select courses, on-site course delivery using the two way video link systems can be considered. All major disciplines of Science and Engineering, and also relevant courses from the Humanities, Social Science and Management streams which are being conducted at IIT Delhi are covered.

Eligibility: Degree in Engineering or Masters Degree in Science, Management or any other Post Graduate Degree with relevant industry experience. The two semester sessions in the academic year start in the months of July and January ,the exact dates being notified in advance. **Contact:** *kirityroy@yahoo.com, uttamaswal@hotmail.com*

New Innovations / Opportunities for IP Licensing

A multipurpose toilet-cum-bathing unit for elderly, A. Singh, Design

Method of producing ZnO nanorods by two-step spray pyrolysis technique, V. Dutta, Energy

Plant cell / hairy root cultivation on inert solid supports, A. K. Srivastava, Biochemical

A new high capacity gas distributor-cum-support plate for packed columns for Mechanical Vapor Recompression of Steam-Carbon Dioxide Mixture for Energy Recovery, D. P. Rao, Chemical

Coconut dehusking machine, S. N. Singh, Appl. Mechanics

Foot Step Electricity Generator for low power generation, S. N. Singh, Appl. Mechanics

A new and aesthetic design of the toy Game (Monkey Tree), V. M. Chariar, Rural

Intruder detector for security system, Subrat Kar, Electrical

A system for Secure Communication in Wireless cooperative Communication, Manav Bhatnagar, Electrical

A process for the preparation of scaffold of polycaprolactose by in-situ coagulation for tissue engineering, Bhuvanesh Gupta, Textile

Conductance Based Decoupled Electronic Load Controller for Isolated Asynchronous Generators in Small Hydro Power Generation, Bhim Singh, Electrical

Developing Impermeable concrete for improving the strength and durability of marine structures, Supratic Gupta, Civil

A Novel Four-leg Voltage Source Converter based Voltage and Frequency Controller for an Autonomous Wind Energy Conversion System, Bhim Singh, Electrical

Microbial process for removal of toxic phorbol esters from de-oiled Jatropha Seed cake, S.K. Khare, Chemistry

A low cost efficient system for wireless measurement of ECG, Prof. Sneh Anand, Biomedical

Technology Profiles

Novel Enzyme for Treatment of Tumor

The present technology relates to a novel and stable mutant of asparaginase enzyme and process of preparing the same thereof.

Need for the technology

Although the potent activity of asparaginase is very well established and many micro-organism strains are available which can be used for production and extraction of the said enzyme. Some examples include production from E.Coli, Er. Chrysanthemi.

However all such processes suffer the drawback of high host toxicity like hepatic, renal, splenic, pancreatic dysfunction and pronounced immunosupression.

Another of the side effects includes unintended considerable reduction in splenic germinal centers.

Also, the available enzymes are unstable, have reduced half life thereby requiring multiple dose administration.

Advantages of current technology

1. More stable enzyme
2. Drastic reduction in side effects
3. Increased Substrate specificity.
4. Enzyme is active in mesophilic conditions.

Package available for Tech Transfer

1. Novel and stable mutant of L-asaparaginase
2. Know-how for the process
3. DNA sequence information for strain development

Applications

1. Food industry
   Pharmaceutical industries.

Fabric Evaluation and Grading

The current technology is related to a method of evaluation and grading of textile or fabric or garment appearance. The main objective is to identify seam puckers in readymade garments as they affect the appearance and therefore value of a garment considerably.

Need for Seam pucker identification

With the advent of new types of synthetic fabrics such as microfiber fabrics, it has become apparent that though such fabrics have high aesthetic value but at the same time they are more prone to deformations during garment manufacture. Seam puckers are such common deformations.

Any apparent deformation will reduce the value of the garment and so need to be detected, analyzed and removed. This can be accomplished through evaluation and grading as they serve as a measure for quantifying and developing a standard for seam puckers.

Prior Art

1. Subjective Evaluation: Suffers the drawback of difference in opinion of experts. Therefore the need for objective evaluation was realized and this lead to development of 5 grades for evaluation
2. Many other imaging and non imaging systems exist but none is able to commercially quantify the appearance.

In the present technology two methods have been developed which overcome the difficulties of prior art and are based on 2D image analysis and 3D image analysis respectively.

The technique based on 2D analysis uses Phase shifting optical fringe profilometry. Here images are captured and digitally processed. The method is based on projection of structured light over fabrics of appropriate sizes and capturing their images.

The technique based on 3D analysis uses a grid projection technique where the three dimensional shape of the fabric is obtained in terms of X, Y, Z co-ordinates. These are then analyzed for seam puckers, by employing the technique of multiple regression analysis. The attributes thus obtained can be used for the purpose of the technology.

New Faculty

Profiling a few young Academics.....

Jayati Sarkar (Ph.D., 2005, IIT Kanpur) joined Chemical Engineering Dept., IIT Delhi in 2010. She has of Post Doctoral research experience at Max Plank Institute for Dynamics and Self-Organization, Gottingen, Germany during 2007-2008. Her research interests are in the fields of Instabilities, Adhesion, Debonding, Dewetting and Pattern formation of soft thin films, Interfacial Science, CFD, Self Organization of Complex Fluids and Granular Materials. She has nearly 3 years' of Industry experience.

Dipti Ranjan Sahoo (Ph.D., Structural Engineering, 2008, IIT Kanpur). Worked as Post-doctoral Fellow at the Univ. of Texas at Arlington, USA for two years. He joined Department of Civil Engineering, IIT Delhi in December, 2010. His areas of research includes Dynamic and inelastic behaviour of steel and reinforced concrete structures, Large-scale testing of structural systems, Performance-based plastic design, Finite element modelling, Seismic evaluation and strengthening, Supplemental damping and passive energy dissipation devices and Steel fibre reinforced concrete structures. He is the reviewer for many international and national journals, and a member of several professional organizations.

Shveta Singh, Finance, joined the Department of Management Studies, IIT Delhi in 2010. She has been a Faculty member with IIIT Allahabad earlier for 6 years. She three years of industry experience.

Bhanu Nandan, Ph.D., Applied Chemistry (Polymers), 2003, Kanpur University. Post-Doctoral Fellow (2003-06) at the Department of Chemical Engineering, National Tsing-Hua University, Hsinchu (Taiwan). Also, Post-Doctoral Fellow (2006-10) at Department of Nanostructured Materials, Leibniz Institute of Polymer Research, Dresden, Germany. Joined Department of Textile Technology, IIT Delhi in 2010. His area of research includes Self-Assembly in Polymers, Self-Assembled Polymer Nano-templates, Self-assembly Under Confinement, Polymer Crystallization, Electro-spinning, Nanostructured Fibres, Organic-Inorganic Hybrid Fibres etc.

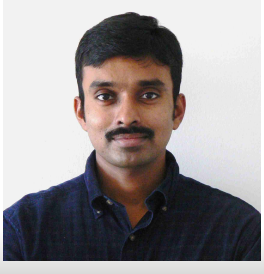
Ragesh Jaiswal, B.Tech. IIT Kanpur, 2003; Ph.D., 2008, University of California, San Diego. Postdoctoral research scientist at the Columbia University, New York.. Joined IIT Delhi in 2010 in the Department of Computer Science & Engineering,. His doctoral research work was on direct product theorems which are fundamental results that have applications in cryptography and computational complexity. He is interested in algorithms, complexity, theoretical cryptography, and machine learning.

Nidhi Jain, Ph.D, Chemistry, Delhi University. Post –Doctoral fellow at the Univ. of Rhode Island, USA from 2005-08. Worked in Amity Univ. From 2008-10. Joined IIT Delhi in 2010 in the Department of Chemistry. Her interest is to develop ionic liquid stabilized nano-particles as catalytic systems for carbon-carbon, carbon-oxygen, and carbon-nitrogen bond forming reactions under mild conditions. The other research area of interest is chemical carcinogenesis involving structural studies of DNA-adducts formed by interaction of DNA with environmental carcinogens.

Manav Bhatnagar, Ph.D. 2008, Wireless Communications, University of Oslo, Norway. Post doctoral fellow at UNIK- University Graduate Center, Kjeller, Norway in 2008-09. Joined IIT Delhi in the Dept. of Electrical Engineering in 2009. His areas of interest include signal processing for MIMO & cooperative communications, distributed algorithms for cooperative networks, ultra-wideband (UWB) communication systems, and cognitive networks. Interested in collaborating with industries working over next generation mobile communication related technologies, LTE, WiMAX, UWB, and physical layer security.

S. Pradyumna, Ph.D., 2009, IIT Kharagpur. Joined IIT Delhi in 2010 in Dept. Of Civil Eng. Earlier worked for two years at NIT, Rourkela. His research interests include computational mechanics, composite structures, structural dynamics and stability. Dr. Pradyumna is interested to work in projects having academic and industrial importance.

Manidipa Banerjee, Ph.D., 2005, University of California, San Diego (USA). Post-doctoral research at Scripps Research Institute (USA). Joined School of Biological Sciences, IIT-Delhi in 2010. Awarded the Ramalingaswami fellowship for new investigators by DBT. Her research interests include understanding the molecular mechanism of cellular entry by non-enveloped viruses like Hepatitis A virus & engineering viruses into nanoparticles for specialized drug delivery.



Vivekanandan Perumal, PhD, Christian Medical College, Vellore. Postdoctoral fellow at Johns Hopkins School of Medicine, Baltimore, MD. His research interests include HBV replication, HBV pathogenesis and the role of microRNA in HBV-related liver cancer. His contributions in the field include : a) elucidation of novel mechanisms leading to occult HBV infection b) pioneering wok in epigenetic regulation of HBV and its proteins and c) epigenetic changes in liver cancer. He joined the School of Biological Sciences, IIT Delhi in 2010.

Miscellaneous

A high level Danish delegation visited IIT Delhi on 12th October 2010 for an interactive meeting with IIT Delhi / FITT officials.

FITT in association with CII conducted i3 National Fair at IIT Delhi on 22nd November 2010. The i3 National Fair was the forum for innovators / entrepreneurs with active participation of students, scientists and representatives from various academic institutions and industry.

FITT AWARDS

FITT Award for Best Industry Relevant Ph.D and M.Tech/M.Tech(Dual Degree)/M.S (R)/M.Des/MBA Projects in IIT Delhi during 01.06.2009 to 31.05.2010 was conferred during the 2010 Convocation on:

Mr.Abhijay Awasthi (2005CH50101) - Student of M.Tech. (Dual Degree) Programme Project title "Hydrogen Production by Porton Exchange Membrane Water Electrolysis: Numerical and Experimental Investigations"

Faculty Supervisor : Prof.S.Basu (Chemical Engineering Department)

Research and Development

Examples of Development / Investigative Projects	Principal Investigator (Prof/Dr), Dept/Centre
Optimisation and design of Speciality Polymer Nanoparticles for digital imaging and related application	H Singh, Biomedical
Design of solar energy systems for ITDC Hotels at Jaipur and Bharatpur	V Dutta, Energy
Barrier design for noise mitigation along the new runway at IGI Airport, New Delhi	AK Darpe, Mechanical
An apparatus and method for Packet Error Correction in Networks	R Bose, Electrical
Fundamental studies and industrial applications in membrane adsorbers	AS Rathore, Chemical
Performance evaluation of a new device for electricity production	VS Modak, Mechanical
Development of real-time platform radiated noise simulator for classifier testing using unbounded underwater channel	A Kumar, Electronics
Security issue for Network management in a converged Network with suggested Network architecture and configuration, training and development on Cyber Security Tools	SK Gupta, Computer
Investigation on integrity analysis of pipeline weld joints & process parameters development using fracture mechanics (CTOD) approach	RK Pandey, Applied Mechanics
Operational control centre design & ergonomic study for BMRC Ltd	LK Das, Energy
Support to entrepreneurial and managerial development of SMEs under MSME Scheme	A Rawal, Textile
Use of bio-separation technologies in PAT and QbD based process	AS Rathore, Chemical
Analysis of a 20 foot folding container with doors on the side panel and a 180 degree top opening roof and development of a concept of a 40 foot foldable container	A Chawla, Mechanical
A symmetrical beams for spectrum efficiency	R Bose, Electrical
Modeling and impact assessment component of India – climate change impact and adaptation of coastal Cities study	AK Gosain, Civil
CARS - simulation studies and evaluation of infrasonic based avalanche localization system	A Kumar, Electronics
Development of composites for low friction low wear applications	J Bijwe, Tribology
Development of the iontophoratic kit for a transdermal delivery of methotrexate and insulin and validation of iontophoratic parameters for diclofenac	S Anand, Biomedical
Operational control centre design & ergonomic study for BMRC Ltd (Phase-II)	LK Das, Energy
Developing compliant surfaces and lubricating oils for reduced oil consumption	J Bijwe, Tribology

Examples of Development / Investigative Projects	Principal Investigator (Prof/Dr), Dept/Centre
AsianCitiesAdapt – Impact of climate change in target cities in India and the Phillippines and local adaptation strategies	SK Dash, Atmospheric
Investigation of hydrodynamics in Rotary Fluidized Bio-Reactor	S Roy, Chemical
Vetting of technical computation methodology for FY 2009-10	S Jha, Mechanical
Simulation software for Power Distribution Management System	S Jha, Mechanical
Automated fault detection and diagnostics rules for HVAC Systems (Ph.-I)	S Jain, Mechanical
Hydrological modelling of the identified drainage systems to access the water resource availability	AK Gosain, Civil
An interpretation of some of the statements defined in standard test method “UIC 564-2”	A Rawal, Textile

A meeting with personnel from the Corporate R&D Divison of BHEEL

Dr Woo Sung Lee, Dr Seogwon Hwang and Lee Joo-Ryang from STEPI Korea visited FITT on a study mission

FITT Team

Chairman, Governing Council : Prof. Surendra Prasad, Director, IIT Delhi
Managing Director: Dr. Anil Wali
Executive Team : Shri. K.K. Roy, Shri Mohit Mahajan
Staff : Shri A Gupta, Shri RK Mehta, Mrs. S Lamba, Shri V Bhattacharya, Shri J Singh, Shri U Aswal, Shri M K. Rajoriya
Associates : Mr P Bhattacharya, Ms M Kanojia
Ed.: A Wali

Foundation For Innovation and Technology Transfer

Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110 016

Phone: 91-11-26857762, 26597285, 26597829, 26581013

Fax: 91-11-26851169, **Email:** mdfitt@gmail.com , **Web:** www.fitt-iitd.org