



CGCRI-NeST Product reaches US Market

ERBIUM doped Fibre Amplifier (EDFA), a product developed by the Central Glass & Ceramic Research Institute (CGCRI), Kolkata, in collaboration with its industrial partner Network Systems Technology (NeST), Cochin, has penetrated into the US market. The product has been developed for use in optical fibre network. The amplifier is designed using CGCRI made erbium doped optical fibre. The amplifier is a key component of cable TV networks. It is an assembly of a special kind of optical fibre and a series of electronic inputs with controls which when fitted intermittently along optical fibre cable lines restores energy loss during transmission and ensures high quality picture, sound and connectivity. The developed instrument is expected to help in implementing "Fibre to the Home (FTTH)" technology in future.

The product has been developed under a CSIR Network project "Development of Key Technologies for Photonics and Optoelectronics". A commercial agreement was entered into in January 2004 for developing completely packaged EDFA for cable TV network with Network System Technology (NeST), a medium scale multinational Indian company located at Cochin. **First commercial module was launched in August 2005 [CSIR News, 44 (2005), 345].**

The EDFA proved its commercial viability by successfully penetrating into the national and international markets by competing with international manufacturers during the past one year. During this phase of commercialisation process, there have been sustained interactions between CGCRI and NeST to optimise the performance of the amplifier based on the user and market feedback.



Shri U.M. Shafi, Vice President, NeST group of companies hands over royalty cheque to Dr H.S. Maiti, Director, CGCRI. On Shri Shafi's left is Dr K. Suresh Nair, Director, R&D, NeST and on Dr Maiti's left is Dr S.K. Bhadra, Scientist, CGCRI



Altogether, 40 amplifier modules – each costing around Rs 2.0 lakh for applications in Cable TV (CATV) have been sold in the national and international markets. **Out of these sixteen have been exported to USA after obtaining the qualification certificate from the competent authority. A few more orders are awaiting delivery.**

A non-commercial agreement has also been signed by Director, CGCRI and the Vice-President of NeST



Commercial EDFA module for CATV

Group of companies at Cochin on 28th February 2007 for making two prototype WDM-EDFA modules for telecommunication applications.

Molecular wires to vesicles and blue emitting organogels

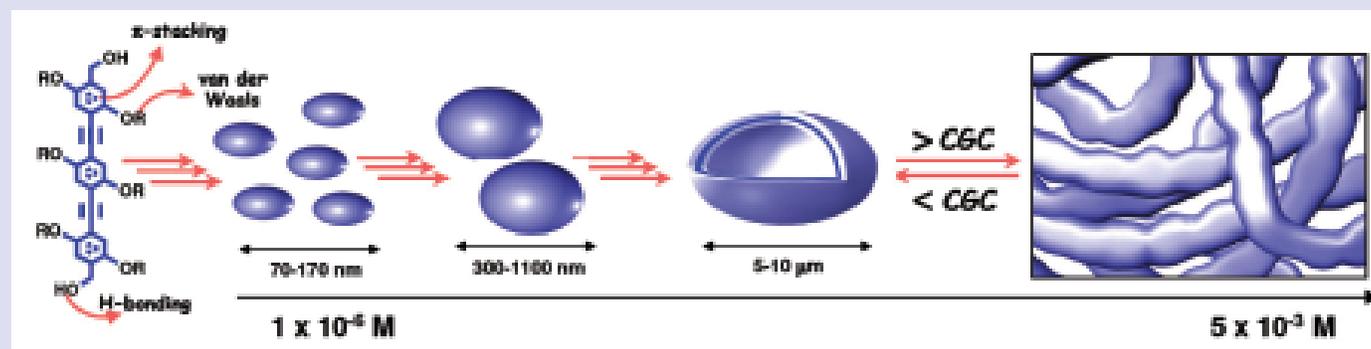
A Ajayaghosh, R. Varghese, V.K. Praveen, and S. Mahesh of the National Institute for Interdisciplinary Science and Technology (NIST), Thiruvananthapuram, in their paper in *Angew. Chem. Int. Ed.* 2006, Vol 45, pp 3261-3264 have reported the self-organization of oligo (*p*-phenyleneethynylene) which is a short molecular wire, in decane solution to form vesicular nanoparticles, microspheres, fiber bundles and eventually to blue-emitting organogels. The morphology of these structures was

confirmed by AFM, SEM, and TEM analyses.

The figure given below depicts the self-assembly processes. At a concentration of 1×10^{-6} M, nanoparticles with average size of 100 nm were formed whereas up to a concentration of 1×10^{-4} M, microspheres of 5-10 μm with blue fluorescence were obtained. However, at higher concentrations bundles of elongated fibers of micrometer size were formed as evident from the SEM analysis. The absorption spectrum of OPE1 in decane showed a red-shifted

shoulder at 419 nm corresponding to the initially formed kinetically controlled aggregates which undergo a time-dependent change to more stable thermodynamically controlled spherical aggregates.

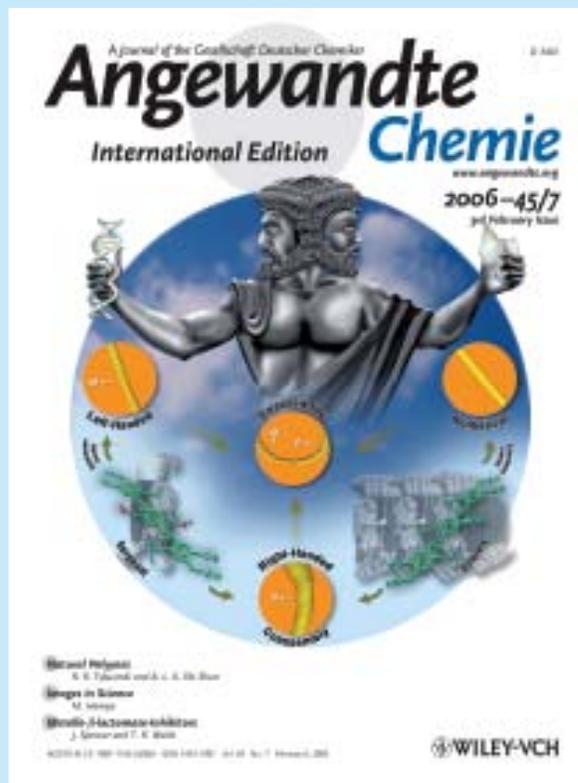
The present report provides a simple method to prepare stable spherical and extended self-assemblies of a linear π -conjugated molecule with different size and shape from a single solvent. This approach is significantly different from the previous reports on aggregation of OPEs using solvent mixtures.





Supramolecular helical structures of electronically active molecules

NATURE has the ability to create left and right handed (helical) objects as in the case of DNA, proteins, virus and bacteria. Nature's technique to create such assemblies can be applied to design artificial helical structures using small molecules. The properties of left and right handed helices will be dramatically different from each other. **Ajayaghosh and coworkers at the Photosciences and Photonics Group of the National Institute for Interdisciplinary Science and Technology (NIST), Thiruvananthapuram**, have achieved the design of artificial helical architectures of photo- and electroactive molecules. Using an approach called "sergeants and soldiers" effect, they have succeeded in inducing the coassembly of *p*-phenylenevinylens (a class of molecules used in organic electronic devices) resulting in left and right handed helices. They have used the technique of circular dichroism (CD) and atomic force microscopy (AFM) to prove their findings. This work appeared in *Angew. Chem. Int. Ed.* 2006, Vol. 45, pp 1141-1144, which is highlighted as a very important paper with a front cover picture. Currently they are investigating the optoelectronic properties of these unusual molecular self-assemblies.



The cover picture shows Janus, the double faced Roman God, holding a left-handed DNA helix and a right-handed conch which epitomize the marvels of natural creations

Cholesterol helps controlling the helical packing of molecules

PRECISE control of molecules to supramolecular architectures of nanometer-to-micrometer dimension is a challenging task to the design of advanced organic electronic devices. Through a rational approach **Ajayaghosh and coworkers of the Photosciences and Photonics Group of the Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology (NIST),**

Thiruvananthapuram, have exploited cholesterol moieties in directing chromophore assemblies in two different pathways leading to helical structures with distinct optical, chiroptical and morphological features. Attachment of a single cholesterol unit to a oligo(*p*-phenylenevinylene) molecule prefers a tilted chromophore packing which showed red-shifted bands in the absorption and emission spectra. However,

attachment of two cholesterol units facilitates a twisted chromophore arrangement having blue-shifted absorption and emission bands. The circular dichroism (CD) spectra of the bischolesterol OPV showed bisignate signals whereas those of the monocholesterol derivative were of non-bisignate in nature. Due to the differences in chromophore packing, the monocholesterol derivative forms strong gels in hydrocarbon solvents whereas the

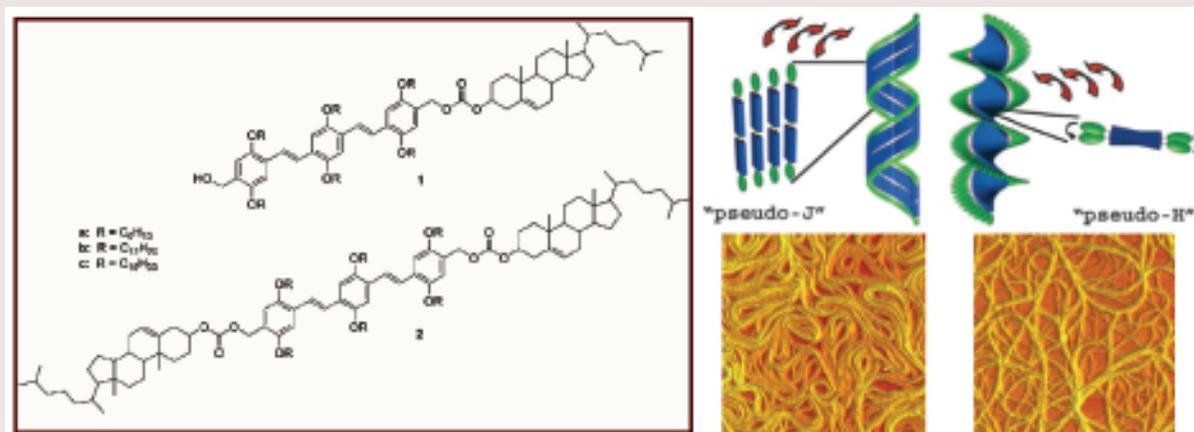


R&D Highlights

bischolesterol derivatives were weak gelators. The gels obtained from the two derivatives exhibited different morphological features as illustrated with optical polarizing and atomic force microscopy

pictures. The morphological features of the hierarchical assemblies generated from the bischolesterol derivatives resulted in twisted helical structures whereas the monocholesterol derivatives

resulted in coiled helical structures as shown in the figure. This high impact work has been published in *Angew. Chem. Int. Ed.* 2006, Vol. 45, pp.456).



Centre for Cellular & Molecular Biology (CCMB), Hyderabad Basic Research Highlights: 2005-06

THE Centre for Cellular & Molecular Biology (CCMB), Hyderabad's R&D output is well reflected in the large number of publications in some of the top-ranking journals of the world. The total number of papers published during the 2005-06 was 120 (in addition, 31 were in press) while maintaining the Average Impact Factor of about four. The Centre has also been successful in generating substantial cash flow from external sources. During 2005-06 three patents were granted (1 Indian; 2 US) and five patents (3 Indian; 2 US) were filed.

The highlights of basic research carried out at the laboratory are presented here; the contributions towards 'Socially

Relevant' and 'Applied' research will be covered in one of the forthcoming issues.

CCMB: Basic Research

Molecular basis of sex reversals

Differentiation of embryonic gonads into either testis or ovaries according to their genetic make-up is the key step in mammalian sex determination. Identification of sex determining genes has relied on naturally occurring deletion/duplications/translocations, because linkage studies are hampered by relative rarity of large sex-reversed pedigrees.

CCMB scientists have analyzed 60 sporadic and 15 familial cases of XY sex reversals for mutations in the androgen receptor (*AR*), *SRY*, *DAX1*,

SOX9, and *DMRT* genes and found four novel substitutions in the *AR* gene, leading to complete androgen insensitivity syndrome (CAIS) in three individuals and partial androgen insensitivity syndrome (PAIS) in one individual. In addition, CAG and GGN repeat length variations in *AR* gene were analyzed in a total of 69 XY sex reversed females. This study revealed a significant difference in the mean repeat length and the range of the CAG repeat between the cases and controls. Upon further categorization of the cases into PAIS and CAIS, it was observed that the mean number of CAG repeats was much smaller in the PAIS cases in comparison to CAIS cases.

Genetic causes of male infertility

Oligoasthenospermia, one of the causes of male infertility, is characterized by poor semen quantity and motility. Sperm motility is greatly influenced by mutations in the components of the respiratory chain of the mitochondrial DNA (mtDNA). Although mtDNA has been most extensively studied for the past two decades, there are very limited studies available to demonstrate the involvement of mtDNA mutation in male infertility. CCMB scientists have analysed the mitochondrial DNA of 34 oligoasthenozoospermic men along with 150 normozoospermic fertile men from the Indian subcontinent. A novel Missense mutation in ND4 (C11994T) gene, which replaces threonine with isoleucine, was observed in all the oligoasthenozoospermic men, but not in any of the normozoospermic fertile men. This study provides useful information to the infertility clinics for treating/adopting suitable assisted reproduction methods for male infertility.

Genetic analysis of pancreatic disorders in the Indian population

Chronic pancreatitis is a complex disease with high prevalence. In their earlier study, scientists at CCMB had established the genetic basis of chronic pancreatitis and shown it to be different from that in the Caucasians by identifying a founder mutation in trypsin inhibitor (SPINK1) gene, rather than mutations in the cationic trypsinogen gene. Now they have established cathepsin B, a lysosomal

protease, to be the trigger for intra-pancreatic activation of cationic trypsinogen and identified cathepsin B mutations to be strongly associated with tropical calcific pancreatitis. By sequencing the whole gene, they identified mutations in the signal peptide region of the protein and proposed that mislocalization of cathepsin B to zymogen granules leads to premature activation of trypsinogen and chronic pancreatitis. Thus, this work provides the first evidence to the 30-year old cathepsin B hypothesis on human pancreatitis.

Human rerogenomics and chromosome biology

Genetics is gradually occupying the centre stage in understanding the mechanisms of normal pubertal development, fertility and fecundability. CCMB provides an efficient chromosome analysis for a gamut of reproductive disorders and other genetic disorders. An extensive analysis in a total of 2726 referred cases showed chromosome anomalies in the form of numerical and constitutional changes in 520 individuals. A distinguishing finding is a Turner variant with a mos 45.XO/46,X,dup(X)(q²) karyotype having two distinct cell lines showing 45, XO in 54 nuclei and 46,X,dup(X)(q²) in 46 nuclei. CCMB has taken up new initiatives in the reproduction-related disciplines. The scientists present the germline status of the coding regions of *TGFBR3* and *ACVR1B* genes consisting 16 exons and 9 exons, respectively. The sequence analysis of *TGFBR3* gene revealed a total of 46 sequence variants including 22 novel variants. They are the first to

report the case control study for this gene associated with ovarian failure. The sequence analysis of *ACVR1B* gene revealed seven novel and three reported variants. They provided the first report of gain of function mutation in this gene associated with ovarian failure. A novel SNP in intron 6 of endothelial nitric oxide synthase gene was found to be significantly associated (P-value 0.023) in homozygous condition with the risk recurrent pregnancy loss in the South Indian population. Novel variants were detected in *CYP2D6* namely E278K and M279K present at a frequency of 3% exclusively in women with recurrent miscarriages. A synonymous G↔A polymorphism in exon 6 of anandamide hydrolase was also found exclusively in women with recurrent miscarriages. Other novel polymorphism revealed by the present study include an A↔C transversion in the 3' UTR region of *HLA-G* and A214S of *NAT1*.

First-ever evidence of bacteria from the stratosphere

CCMB scientists for the first time in the world have sampled air collected from the stratosphere and identified four new species of bacteria namely, *Bacillus aerius* sp. nov., *Bacillus aerophilus* sp. nov., *Bacillus stratosphericus* sp. nov. and *Bacillus altitudinus* sp. nov. These species are unique in their ability to withstand high levels of ultra violet radiations and also in their ability to utilize very low levels of sugars and other organic compounds as the only source of carbon. The isolates are now being used as model systems to understand their resistance to high levels of ultra violet radiations.



Discovery of a new fatty acid desaturase gene involved in cold adaptation

The molecular basis by which microorganisms adapt to low temperature is dependent on the ability to modulate their membrane fluidity. Normally this is achieved by changing the saturated : unsaturated fatty acid ratio. Therefore, genes involved in regulating this event would be very crucial to cold adaptation. Using a cyanobacterium from Antarctica, a new gene has been discovered from a *Nostoc* sp. and its functional ability to induce unsaturation in fatty acid has been established. This gene is probably involved in regulating the fluidity of the membrane in cyanobacteria.

Molecular basis of cold adaptation

CCMB has established over the years an Antarctic psychrotrophic bacterium *Pseudomonas syringae* Lz4W as a suitable model system for understanding the molecular basis of cold adaptation. It has been established that growth and survival at low temperature (<0 – 4°C) is highly dependent upon membrane properties, DNA repair system, RNA metabolism, and carbon catabolite repression system of the bacterium. A few genes, such as *recB*, *recC*, and *recD* of the DNA repairing RecBCD pathway, *rnr* encoding the exoribonuclease Rnase R of RNA degradation machinery have been found essential for growth at low temperature. During the last year the group has recorded two novel findings. RNase R is involved in the 3' end processing of 16S rRNA in the cold-adapted bacterium, the deficiency of which leads to accumulation of

unprocessed rRNA in polysomes and inefficient protein synthesis. The nature of 3' end processing enzyme of the 16 S rRNA in any bacteria including the laboratory workhorse *E. coli* is not known. It has also been found that ssDNA dependent ATPase but not the helicase activity of RecD is essential for RecBCD function and growth of *P. syringae* at low temperature.

Genetic analysis of repeat-induced point mutation (RIP)

Translesion DNA polymerases are specialized polymerases that can synthesize DNA across a damaged template. DNA synthesis by translesion polymerases can be mutagenic due to the miscoding nature of most damaged nucleotides and these polymerases have been shown to be involved in many mutational and hypermutational processes in systems ranging from bacteria and yeasts to mammals and plants. CCMB scientists have shown that translesion polymerases are, however, not essential for RIP (repeat-induced point mutation) in *Neurospora crassa*. RIP is a fungal genome defense process, that hypermutates DNA sequences that are duplicated in an otherwise haploid genome.

Eukaryotic transcription mechanisms

CCMB scientists have shown that the yeast U6 snRNA (SNR6) gene sequence works as nucleosome positioning signal. The binding of its two basal factors, TFIIC and TFIIB leads to remodeling of the chromatin structure on and around the gene region. They have shown that the sequence-specific binding

of a protein can regulate both the nucleosome spacing as well as positioning. Number of binding sites and the distance between them also decides the number of positioned nucleosomes in a single register. These results have helped devise a novel method of getting positioned nucleosomes in chromatin assembled *in vitro*.

Lamins in disease

ATR kinase, a key sensor of DNA damage, has been demonstrated to be mislocalised in cells expressing disease-causing lamin mutants. Mutations in the human lamin A gene cause highly debilitating genetic diseases such as Emery-Dreifuss muscular dystrophy, dilated cardiomyopathy, familial partial lipodystrophy and Hutchinson-Gilford progeria. Cells expressing a subset of lamin mutants, as fusions with green fluorescent protein, have been shown to be deficient in formation of DNA repair foci containing phosphorylated histone H2AX after short-term cisplatin treatment or mild UV irradiation. These mutants also hindered the recruitment of p53 binding protein 1 to repair sites. In order to understand how lamin mutants affect the cellular response to DNA damage, the localization of specific signalling components of DNA damage pathways were studied, and it was observed that ATR kinase was mislocalised to the cytoplasm in cells expressing these mutants. Lamin mutants also disrupted interactions with inner nuclear membrane proteins, and were likely to alter lamin-chromatin associations, and thus affect the binding of ATR kinase to chromatin.

Mechanism of targeting of a protein tyrosine phosphatase to the endoplasmic reticulum

T-cell protein tyrosine phosphatase gives rise to two splice forms: TC48, which is localized to the endoplasmic reticulum (ER) and TC45, a nuclear protein. The present study was undertaken at CCMB to identify proteins that are involved in targeting TC48 to ER. CCMB scientists have identified two TC48-interacting proteins, p25 and p23 from a yeast two hybrid-screen. p23 and p25 are members of a family of putative cargo receptors that are important for vesicular trafficking between Golgi-complex and ER. Both p23 and p25 associated with overexpressed TC48 in Cos-1 cells as determined by coimmunoprecipitation. A significant amount of TC48 colocalized initially with ERGIC and Golgi complex markers (in addition to ER and nuclear membrane localization) and was then retrieved to the ER. Coexpression with p25 enhanced ER localization of TC48, while coexpression with p23 resulted in its trapping in membranous structures. Coexpression of a mutant of p25, which is defective in ER-localization signal KKXX, resulted in enhanced Golgi localization of TC48. C-terminal 40 amino acids of TC48 (376-415) were sufficient for interaction with p23 (but not with p25) and targeted green fluorescence protein to the Golgi complex. Targeting of green fluorescence protein to ER required C-terminal 66 amino acids of TC48 (350-415), which showed interaction with p25 and p23. They suggest that TC48 translocates to Golgi complex along

the secretory pathway, while its ER localization is maintained by selective retrieval enabled by interactions with p25 and p23. These results not only provide a mechanism of targeting of TC48 to the ER, but also identify the first cargo protein for the putative cargo receptors p23 and p25 in mammalian cells.

Plant-pathogen interaction

In the ongoing studies on virulence functions of *Xanthomonas oryzae* pv. *Oryzae* (Xoo), an interesting observation has been made that the Xoo homolog of FeoB (the major bacterial ferrous transporter) is essential for virulence on rice. A mutation in the FeoB homolog of Xoo was created by plasmid integration and found to be severely virulence deficient. Siderophores are small molecule iron chelators that are involved in ferric uptake. Using bioinformatics, the scientists have identified the Xoo homolog of the vibrioferrin (a siderophore) biosynthetic gene cluster of *Vibrio vulnificus*, a fish pathogen. Mutations in the Xoo homologs of two vibrioferrin biosynthetic genes resulted in total loss of siderophore production indicating that they had located the genes in Xoo that are involved in siderophore biosynthesis. Both of the siderophore-deficient mutants of Xoo were virulence-proficient indicating that siderophore is not essential for growth within the rice plant. Overall, these results provide insights into the mechanisms that are used by Xoo to obtain iron, an essential nutrient, during the growth within its host.

They had previously described a novel genomic locus of Xoo strain BX01 that affects lipopolysaccharide (LPS) production and virulence. Interestingly, this locus is absent from the BX08 strain, a variant Indian pathotype of Xoo. During the year under review, the scientists have used long range PCR to amplify a ~ 19.0 kb sequence that is present at the *lps* locus in BX08. A shotgun sequencing strategy was used to sub-clone and completely sequence this fragment. The final assembled sequence of the BX08 *lps* locus included 15 ORFs and two insertion sequence elements. Except for a minor rearrangement involving one of the ORFs, the BX08 *lps* locus is highly homologous in gene content, sequence and order to the *lps* locus of *Xanthomonas axonopodis* pv. *citri* (Xac), a citrus pathogen. They have shown that one of the genes in the BX08 *lps* locus is necessary for virulence and LPS production, thus demonstrating the role of this locus in the elaboration of these important functions by the BX08 strain.

Studies on onconase and human gliomas

Onconase, an anti-tumour, anti-viral RNase, has been found to preferentially cleave tRNA at specific G-G sites. This is unusual for a homologue of pancreatic RNase and may be the basis of its special biological action. In other studies they identified 29 proteins showing differential expression in human gliomas. One striking observation was the destabilization of the intermediate filament protein – GFAP in the tumours. The destabilization is accompanied by



The phosphorylation of the protein at hitherto unreported sites.

Studies on heat shock proteins

The studies have mainly focused on: (1) understanding the molecular basis of stress response and (2) Hsp90, in the regulation of tumour cell survival and death. Towards understanding the stress response in tumour cells, for the first time they have demonstrated that a transcription factor, HSF2, is heat-inducible with enhanced DNA-binding activity which is required for the chaperone-mediated autophagy in a rat histiocytoma. HSF2 otherwise is reported to function during development and differentiation. Towards understanding Hsp inhibition in antitumour treatments, and to inhibit non-specific actions of Hsp90 inhibitors, *in vitro* combinatorial therapy has been developed with the natural compound, curcumin. For the first time the combination of curcumin with Hsp90 inhibitors has been demonstrated to result in reversible cell cycle inhibition and mitogen signaling in human neuroblastoma cells.

Drosophila genetics

Evolution of size and forms of appendages in different insect groups is one of the main topics in evolutionary developmental biology. It is generally believed that the Hox protein Ultrabithorax specifies the differences between forewing and hindwing in all insect groups, the mechanism of which is not well understood. The latest results suggest modulation of a morphogen gradient by Ultrabithorax to specify organ size and shape in fruitfly *Drosophila*.

Functional organization of complex genomes

Eukaryotic genome is packaged in a complex way, which can be classified into two major classes – the Heterochromatin and the euchromatin. The transition regions between heterochromatin and the euchromatin of human Y chromosome have been investigated to look for elements that may block the spread of repressive heterochromatin into the adjacent gene-rich euchromatin. The CCMB scientists had earlier identified such boundaries within the euchromatin that define domains of differentially regulated genes, but a boundary that separates heterochromatin and euchromatin is not known. By comparing combinations of such transition regions from the Y chromosome they have identified several conserved sequence motifs. They then used the transgenic approach using human cell lines as well as the fruit fly and showed that these motifs are capable of blocking the enhancer-promoter interaction. Their studies suggest that these motifs have chromatin domain boundary activity that can functionally subdivide the genome and can be assayed in evolutionarily distant organisms.

Molecular biology of skeletal muscle growth and regeneration

Investigations were continued into the molecular correlates of quiescence in a culture system that models skeletal muscle stem cells. Their interest in the quiescent state derives from its potential importance in survival and self-renewal of stem cells. Earlier, using gene trapping and microarrays, the

scientists had identified a large number of genes that were specifically induced in G₀ myoblasts and analysed two chromatin-modulatory proteins: p8, an HMG box protein and MLL5, a putative histone methyl transferase that are specifically induced during reversible arrest. Using RNAi, the scientists had found that both are involved in regulating the cell cycle and differentiation. A yeast two-hybrid screen has yielded interaction partners that give CCMB scientists further insight into the function of both genes.

The study concerning the signaling pathways that govern quiescence, has suggested that mechano-chemical signaling pathways modulate transcription factor expression, and thereby regulate cell fate. The scientists have used gene transfer and pharmacological disruption to delineate the signaling pathways that lead to arrest and extinction of the transcription factor MyoD, a regulator of differentiation competence. In particular, their work this year has focused on a new branch of the Rho pathway that regulates both cytoskeletal dynamics and MyoD expression. Finally, they have found a strong expression signature of 14 genes belonging to a single pathway in microarray analysis. Interestingly, this pathway has relevance for the regulation of MyoD expression, bringing together the two streams of investigations in the lab.

Protein aggregation, heat shock proteins and membrane interactions

Protein folding is a major unsolved problem in biology. Protein

misfolding and aggregation is shown to be the molecular basis for growing number of diseases. The role of molecular chaperones and heat shock proteins in protein folding, misfolding and aggregation both in amorphous aggregates (myopathy, cataract) and ordered fibril formation (Parkinson's, Alzheimer's etc.) is being investigated. Earlier studies from this laboratory have identified a putative Heat Shock Factor 1 binding site upstream of Hsp22 translation start site. These studies also experimentally demonstrated stress inducibility and chaperone activity of Hsp22. Small heat shock proteins are oligomeric and possess β -sheet structure. In contrast, Hsp22 is monomeric and natively unstructured. Studies from the group using confocal microscopy and spectroscopy showed that Hsp22 interacts with membranes. This interaction depends on the nature of lipids. Interactions lead to conformational changes. It appears that such membrane interaction plays an important role in cellular functions of Hsp22. α -Synuclein, a protein associated with several neurodegenerative diseases including Parkinson's disease, also interacts with membranes. However, the role of membrane interaction remains controversial. Using membrane mimetic systems, scientists from the CCMB could demonstrate that there are two distinct ensembles – one with enhanced fibrillogenicity, while the other significantly decreased fibrillogenicity. This observation explains controversial reports in the literature.

Membrane receptor biology

The Smith-Lemli-Opitz Syndrome (SLOS) is an autosomal recessive disorder characterized clinically by mental retardation, physical deformities, failure to thrive and multiple congenital anomalies. Although SLOS has devastating effects on the nervous system, the effect of SLOS on neural receptors, which play a crucial role in the functioning of the nervous system, remains an unexplored area. A study of the function of the serotonin_{1A} receptor, implicated in the generation and modulation of various cognitive and developmental functions, in SLOS-like condition was taken up. To generate SLOS-like condition *in vitro*, they used a specific DHCR7 inhibitor AY 9944 on CHO cells stably expressing the human serotonin_{1A} receptor. The results show an increase in 7-DHC and 8-DHC contents as the concentration of Ay 9944 is increased. Interestingly, the 8-DHC was found to appear beyond a specific concentration of the inhibitor. It was further observed that treatment with AY 9944 does not lead to any significant alteration in the phospholipid content of these membranes. More importantly, the results showed a progressive inhibition in the agonist binding of the human serotonin_{1A} receptor with reduction in the ratio between cholesterol and dehydrocholesterol. The extent of G-protein coupling of serotonin_{1A} receptors and downstream signaling are found to be inhibited under these conditions. These results could be useful in understanding the membrane lipid interactions of this transmembrane receptor in healthy and diseased states.

Modelling spatiotemporal organization in biological systems

Understanding the space-time development of a disease requires methodology that can visualise spatial progression and temporal variation from a mass of data tables. A dynamic visualisation method has been developed and used to map the epidemiological data of prevalence of malaria in India from 1961 to 1995. The spatiotemporal map of malaria for 35 years indicates that the disease progression among the states has been significantly different at different periods of time. The temporal changes were more or less stable during 1961-68 and 1984-95, whereas during 1969-75 and 1976-83, they showed strong increasing and decreasing trends, 1976 being the epidemic year. For studying the temporal association of malarial prevalence in 22 States and one Union Territory (for which complete data was available) in these four time periods, pair-wise linear correlation analysis of their SPR values were used. During 1969-75, i.e., when the epidemic was in the building up phase, almost all states showed highly correlated temporal behaviour. The trend is similar with relatively less correlation during its controlling phase (1976-83), and more or less evenly distributed around zero in the two periods (1961-68) and (1984-95). These results show that the spatiotemporal spread of malaria during the build-up phase of the epidemic (1969-75) had been fast and highly synchronized. Thus, in an otherwise uncorrelated background, the interactions leading to the spread of the disease in space and its control follow different mechanisms.



Neuronal calcium sensor-1 enhancement of InsP_3 receptor activity is inhibited by therapeutic levels of lithium suggesting a role of NCS-1 in psychiatric disorder

Neuronal calcium sensor-1 is a high-affinity, low-capacity calcium-binding protein generally expressed in the neuronal tissues. This protein is myristoylated at the N-terminus. The structural and functional role played by this fatty acid chain in calcium-binding has been identified.

Regulation and dysregulation of intracellular calcium (Ca^{2+}) signaling via the inositol 1,4,5-trisphosphate receptor (InsP_3R) has been linked to many cellular processes and pathological conditions. Addition of neuronal calcium sensor-1 (NCS-1) to the purified InsP_3R type 1 ($\text{InsP}_3\text{R1}$) has been found to increase the channel activity in both a calcium-dependent and independent manner. In intact cells, enhanced expression of NCS-1 resulted in increased intracellular calcium release upon stimulation of the phosphoinositide-signaling pathway. Lithium was found to inhibit the enhancing effect of NCS-1 on $\text{InsP}_3\text{R1}$ function, suggesting that the $\text{InsP}_3\text{R1}$ /NCS-1 interaction is an essential component of the pathomechanism of bipolar disorder.

Structural Biology: Editing mechanism during translation of the genetic code

Aminoacyl-tRNA synthetases (aaRSs) that are posed with difficult substrate recognition problems use editing mechanisms to remove non-cognate substrates attached to tRNA. CCMB scientists have determined the structure of a unique editing domain from an archaeal threonyl-tRNA synthetase (ThrRS), which showed substantial structural and functional homology to D-amino acid deacylases (DTDs) of eubacteria and eukaryotes. To understand the structural basis of the editing mechanism and enantioselectivity of these modules, they have determined the structure of the editing domain from *Pyrococcus abyssi* (Pab-NTD) in complex with several substrate analogs. The structural analysis reveals a novel two-step strategy for recognizing the amino acid substrates in which the chirality of the incoming amino acid is probed in the first step followed by further embedding and hydrolysis. They have identified a single residue filter for enantioselectivity in these modules and the study provides insight into the processes by which these primordial-editing modules inverted enantioselectivity for ensuring a high fidelity and for enforcing homochirality during translation of the genetic code.

Conference on Decentralised Innovation: Focus on rural and small urban enterprises

D E C E N T R A L I Z E D Innovation is about innovation in rural/semi-urban unorganized sectors. This is a major thrust area of Eleventh Five-year Plan of Government of India and CSIR's Five-year Plan as well. It has become a key paradigm for the sustainable development and growth of tiny enterprises and the SMEs in the wake of rapid globalization of technologies as well as economies. Policies and instruments, as well as the institution and organizations for innovation in and by rural artisans, rural households or micro/tiny entrepreneurs are a necessarily very different from the policies adopted or advocated for organized innovation in large or even medium business.

The National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, organized Conference on Decentralised Innovation: Focus on rural and small urban enterprises during 16-17 March 2007.

This conference was about stock taking, reflecting upon and exploring institutional moorings on such decentralized innovations. It was held in three sessions each followed by panel discussions. The first session was on 'Introduction to Decentralised Innovation', second one was on 'Bundling of Technologies' and third session was on 'Managing Stakeholders & Using P-to-P and Social Management.' The conference was attended by eminent personalities from industry, top Indian institutions like JNU, IITs and IIMs, universities and several CSIR labs.



Dr P. Banerjee, Acting Director, NISTADS, delivering his welcome address

In his introductory remarks, Dr P. Banerjee, Acting Director, NISTADS, laid stress on focussing the discussion more on the “institutions” and less about the “markets”. He also suggested that NISTADS could become instrumental in bridging the gap of technologists with the countryside areas.

Dr A. B. Mandal, Acting Director CLRI spoke on the success

story of CLRI in transforming R&D to practice in rural and small enterprise segment. The IHBT Director, Dr P.S. Ahuja laid stress on interaction between local innovators and institutions for value addition. Prof. B. Saha, IIM Kolkata, described his idea of decentralised innovation through a success story of Homeopathy physicians who could innovate through practise. Dr Pawan Kapoor, Director, CSIO, described how technology is adapted to suit the local requirements. Dr Praveen Arora of DST, briefed on the role of DST in encouraging innovation in

the country. Dr A.S.Mehta of CSMCRI, discussed how CSMCRI has helped in transferring technology to local people. Prof. S. Dutta of IIM Ahemdabad, spoke on the management perspective on decentralised innovation. Shri Abhiram Seth highlighted the work taken by PEPSICO in collaboration with CSMCRI to help self help groups on sea weed cultivation. Shri Niloy Ganguly of IIT, Kharagpur, spoke on P-to-P networking. Shri Tamal Sarkar of UNDP, laid stress on importance of information flow, which leads to productivity and direct market link which leads to innovation.

Other prominent speakers were Ms Deepanita Chattopadhyay from ICICI Knowledge Park; Prof. S. Jain, JNU; Prof. I. Vignesh of IIT, Delhi; Dr F. Chakraborty, Vidyasagar University; Dr R.N. Yadav, RRL, Bhopal; Prof. P. Biswas, DU; Shri Abhishek Goel of IIT, Kolkata; and Shri Dinesh Abrol, Dr A.K. Mukhopadhyay, Dr A.K.Mathur, Shri S.S.Solanki, Dr Subhan Khan, Dr Kavita Mehra, from NISTADS.

Dr Ashok Jain, former Director of NISTADS, expressed his happiness on the concern of NISTADS towards the issue of Decentralised Innovations and the deliberations held. He being the editor of the Journal “*Innovation*” extended invitation to bring out a special issue of the journal based on the proceedings of the conference.



The Conference on Decentralised Innovation: Focus on Rural and Small Urban Enterprises



Meet on Indigenization of Medical Instrumentation

DR Pawan Kapur, Director, Central Scientific Instruments Organisation (CSIO), Chandigarh, represented CSIO in the congregation of about 50 scientists, doctors, researchers and equipment manufacturers from different parts of the country who met at Alagappa College of Technology (A. C. Tech) to deliberate on methods to develop equipment indigenously for infectious diseases. It is worth mentioning that about 90% of the medical instruments currently in use are imported and of these very few can diagnose infectious diseases. Since the majority of instruments are imported, the cost of diagnosis is very high thus escalating the cost for the treatment. The participating scientists called for developing indigenous instrumentation that can be later transferred to the public for use on the lines of the soil testing kit, the technology for which has been transferred for use to farmers.

The following three Chennai based companies participated in the meet: Svapas, K.B. Chandrasekhar Foundation, which has set up a new technology incubation facility at Chromepet, Span Diagnostics, that has developed several indigenous diagnostic products during the past 50 years and Sygennics Biotech, participated in the event.

Dr T. Ramasami, Secretary, Department of Science and Technology (DST) and Director General, CSIR, called upon the scientists to focus on problem solving with zero risk. DST is supporting many projects in the area. CSIO has long been involved with the medical instrumentation with vast domain knowledge in the area. The speakers at the technical session included Uma Sekar from Sri Ramachandra Medical College; S.L. Hoti from Vector Control Research Centre, Puducherry; Mohan Rao from Centre for Cellular & Molecular Biology, Hyderabad; T. Venkatesh from St. John's Medical College and M.S. Thakur from CFTRI, Mysore.

Dr Pawan Kapur highlighted the need for indigenization of medical instrumentation in the country in order to bring down the cost of medical diagnosis. The talk was well received and appreciated by all.

NEIST celebrates Foundation Day

THE North East Institute of Science & Technology (formerly Regional Research Laboratory), Jorhat, celebrated its 46th Foundation Day on 18 March 2007. The function was presided over by Dr H.S. Maiti, Director, Central Glass & Ceramic Research Institute (CGCRI), Kolkata. Dr S.P.S. Khanuja, Director, Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, was the Chief Guest and delivered the Foundation Day Lecture. A large number of distinguished invitees, guests, members of press and media, science fans, students, teachers besides the scientific brethren of NEIST attended the lecture.

Dr P. G. Rao, Director, NEIST, welcomed the distinguished audience and briefly narrated the genesis of the laboratory and reminisced with deep gratitude the contributions made by the former colleagues towards the growth and development of the laboratory. Delivering the Foundation Day Lecture on a new emerging area of biotechnological research titled '*Harvesting green wealth for healthier society: Phytochemicals show the path*', Dr Khanuja dwelt at length on the biotechnology involved in making 'Designer Crops' for the benefit of mankind. He mentioned that the only difference between plants and animals lies in the fact that the former cannot move whereas the later can move freely and protect themselves from the adverse conditions of environment. Being unable to move, the plants have to subject themselves to all sorts of stresses of the environment and for that they evolve and adopt the mechanisms to fight back the environmental stresses. It is primarily because of this characteristic of plants that the plants secrete various secondary metabolites such as terpenoids, alkaloids, steroids, fats, oils, etc. which are very often come into use as human health care products. Depending on the environmental conditions, the yields of these metabolites vary from one geographical location to other and we have to look for the plant species with higher yields for our use. But so far as the biotechnology is concerned, we do



not have to rely on just one or two particular species. The general genetic make up of some plant species in a particular geographical location is the same with alterations of quantity of certain genes to a lesser or greater numbers. By manipulating the genetic constituents of these plants with the help of biotechnology, we can evolve 'designer crops' according to our choice for producing such products of human use.

In his presidential remarks, Dr Maiti congratulated the NEIST staff for getting a new name for the laboratory and wished the continued prosperity of the laboratory under its new name. Dr Maiti also inaugurated a newly built 'Weather Monitoring Station' in the Geoscienc division of the laboratory which is expected to be of immense help not only for various projects of the laboratory but also for others in the region.

On this occasion, a Memorandum of Understanding was signed between NEIST and CIMAP by the Directors of the two labs for establishing a '**CIMAP Resource Point**' at NEIST which will act as a technology dissemination window of CIMAP for the benefit of the people of North East and also facilitate joint research projects between the two laboratories. Dr Khanuja thanked the Director and staff of NEIST for providing the space for the CIMAP Resource Point. He hoped that the window will further strengthen the already existing working bond between the two labs.

Certificates of appreciation were awarded to the staff members who excelled in the areas of their activity during the year. Retired RRL staff was also felicitated on the occasion in recognition of their valuable contributions to the growth and development of the institute.

CIMAP celebrates Annual Day : Knowledge Aroma — Reaching the Unreached



Dr S.P.S. Khanuja, Director, CIMAP, delivering the welcome address

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, celebrated its Annual Day on 26 March 2007 with great enthusiasm. The celebrations comprised taking stock of the performance; signing of an MoU with Ocimum Biosolutions Ltd, Hyderabad, felicitating the meritorious workers, release of new products and technology and observing 'Open Day'. The institute remained open for general public in the forenoon and a large number of people including the general public, farmers and students of various colleges visited CIMAP.

In his welcome address at the Annual Day function, Dr S.P.S. Khanuja, Director, CIMAP recalled the famous saying of Arland Gilbert, "When we accept tough jobs as a challenge to our

ability and wade into them with joy and enthusiasm, miracles can happen", and said that the saying appears to be translating truly today with zeal filled CIMAPians craving for bigger and greater challenges of "Science for Society". With multidisciplinary teams using the complementary skills and expertise, end-to-end technologies have emerged which are making possible a working partnership between 'far looking' ends – farmers and pharma industry. The success of this novel enterprise strategy amplified further in *Artemisia annua* variety 'CIM Arogya' towards combating malaria, the deadly disease of developing and under-developed world (especially, Asia and Africa). Dr Khanuja further said that the research at CIMAP has been also able to add fragrance to life through 'Patchouli Mission' in



Annual Day Celebrations

Southern India, which is taking shape, linking aroma industry with farmers while adding recurring income options. 'Khus' (*Vetiver*) is likely to add a parallel option in North Indian marginal and unutilized stressed soils affected by salinity, sodicity or waterlogging. CIMAP is planning a mission programme on this high-value crop for low value lands for rural wealth generation.

Dr Khanuja said that the ABC (Agro-Bio-and-Chem Sciences) teams of CIMAP are setting a new example of real time multidisciplinary working to achieve what appears unachievable. Salient R&D leads have been particularly on quality front to provide precision of estimating the active principle(s) like the novel bioenhancer 'Niaziridin' in drumstick plants by HPLC method while HPTLC provides chemical fingerprints for nutraceutical 'CIM Paushak' recently developed by CIMAP. Dr Khanuja further said that CIMAP has established windows (CIMAP Resource Points) in Gujarat (Gandhinagar) in collaboration with IAR (Indian Institute of Advanced Research) and RRL, Jorhat (NEIST) which will now provide the node to cater to needs of Western India and North-eastern India, respectively, for MAPs technology dissemination.

The chief guest on this occasion Prof. Panjab Singh, Vice Chancellor, Banaras Hindu University, delivered the Annual Day lecture on "Excellence in Science: Research



Prof. Panjab Singh, Vice Chancellor, BHU, delivering the Annual Day Lecture

and Development in Medicinal and Aromatic Plants". Prof. Singh said that the knowledge and educated people are the resource for development. Societies depend on institutions, which create knowledge and educate people. The knowledge is generated in higher educational institutions and research organizations. Achieving special skills in a selected area is the prelude to excellence. He emphasized that the main goal of CIMAP should be to institute a system of long-term sustainable and equitable use of medicinal and aromatic plants. The objective should be to improve resource conservation and livelihood security in rural and marginalized communities. The mechanism

to achieve these goals and objectives should be the design, support and coordination of holistic research programme to strengthen linkages between stakeholders within the medicinal and aromatic plant production to consumption chain and this can be achieved through strategic research, partnership building and the promotion of regional, national and international networking.

Lauding CIMAP's research efforts in the area of medicinal and aromatic plants, Prof. Panjab Singh said that the medicinal and aromatic plants also provide crucial livelihood options for millions of rural people in South Asia, particularly women, tribals and the very poor.

CIMAP signed memorandum of understanding (MoU), first of its kind, with a biotech company Ocimum Biosolutions Ltd. Hyderabad, for pursuing joint projects on developing cost effective microarray chip with *Catharanthus*



Exchange of MoU documents with industry



roseus as model for plant genomics and metabolomics.

On this occasion, Er. Atul Prakash Kahol, ex-Scientist G was awarded 'CIM-RACE-2007' while 'CIM-One' award was conferred to Shri Gopinath, Technical Officer at CIMAP Resource Centre, Bangalore. Dr A.K. Shasany, Scientist E-II was awarded 'CIM-Fellow' award. This fellowship, meant for the scientist of below 45 yrs. of age, has been instituted from this year. A team of scientists led by Dr S.P.S. Khanuja with the research scholar Dr (Ms) Shilpi Paul who developed artemisinin- rich variety 'CIM-Arogya' and had won Best Invention Award (AIIE-2007) from All India Industrial Exhibition, Hyderabad, earlier, was felicitated. The



Chief guest honouring CIMAP Scientist

scientists who received different awards this year in their areas of research were also honoured and the CIMAP team members who had participated in different games at institute level and CSIR level were also felicitated, on this occasion.

The Chief Guest released a high herbage and bacoside rich-high yielding variety 'CIM-Jagriti' of

Brahmi (*Bacopa monnieri*). A newly developed product technology for cottage industry (A natural rose agarbatti) was also released, besides farm bulletins on Khus, Patchouli, *Mentha piperita*, CIMAP Project Planner, CIMAP Newsletter and a new book on plant disease management, *Healthy Plants for Health- A complete treatise on major disease of medicinal & aromatic plants and their management*.

Later in the evening CIMAP's concept garden 'Manav Upavan' and tree arboretum 'Taruvar Khoj' were visited by a large number of people from different walks of life who they interacted with scientists and gained knowledge about how medicinal plants contribute to drugs and health care.

AMPRI organizes Kisan Mela

A Kisan Mela was jointly organized by the Advanced Materials and Processes Research Institute (AMPRI), Bhopal; Fly Ash Utilisation Programme (FAUP), TIFAC, New Delhi; and M.P. Power Generation Corporation Limited (MPPGCL), Sarni at Bakud village, Sarni, Betul district of Madhya Pradesh under the ongoing project 'Demonstration trials in the Farmers' fields for the Popularisation of the Bulk Use of Pond Ash in Agriculture.'

About 60 progressive farmers from the nearby villages along with the invited guests from MPPGCL and other officials participated in the mela. The farmers were taken to the field where the Pond ash from MPPGCL, Sarni had been applied.



MPPGCL and FAUP officials visiting the fly ash demonstration fields (Paddy crop) of Shri Ashok Warathe, farmer, village Bakud, Sarni (MP) during Kisan Mela



The Kisan Mela was addressed by Shri S.Murali, Scientist, AMPRI; Dr Rajendra Rai, Project Officer, FAUP, New Delhi; Shri T. N. Singh, Superintending Engineer, M P P G C L, Sarni; Shri A.S. Thakur, Horticulture Officer, M P P G C L, Sarni; and Shri Bisen, Manager, State Bank of India, Betul. The mela and the meeting was followed by a question-answer session, organized at the demonstration sites and the queries of farmers on various aspects of farming techniques and use of fly ash in agriculture were attended to.

Dr Amalendu Sinha takes over as Acting Director of CIMFR

DR Amalendu Sinha Scientist G, has taken over as Acting Director, Central Institute of Mining & Fuel Research, Dhanbad, with effect from 4 May 2007.

Dr Sinha (b. 5 July, 1955) obtained M.Sc. Applied Geology with First Class in 1976 and M.Sc.(Tech) First Class, in Mineral Exploration in 1977 and did Ph.D. in Applied Geology in 1988 from Indian School of Mines, Dhanbad,

Dr Sinha joined CMRI in 1977 as Scientist 'B' and gradually elevated to the position of Scientist 'G' by virtue of his dedication to R&D in the areas of Geo-mechanics and Mining Technology.

His areas of research cover Development & application of geo-mechanical classification system for support design in coal mine roadways; Evaluation of in-situ stress field for stability analysis; In situ stress measurement in underground coal mines and its applications to stability analysis and assessment of Ground Behaviour and Stability for Planning and Design of Non-coal Mines.

He has coordinated and guided a number of R&D projects, industry sponsored projects, grants-in-aid projects in the field of mining technology, geo-environment, coal-bed methane, blasting and explosive. In addition he also completed successfully a good number of consultancy projects

sponsored by the industry.

Dr Sinha has a large number of research papers published in the journals of repute in India and abroad. He also edited a few proceedings. He has also a few patents to his credit.

Dr Sinha has carved out a niche in the field of his areas of research and is well known scientist in the field of geo-mechanics in particular and mining sciences in general.

Dr Sinha is a member of Academic Council of Indian School of Mines, Dhanbad, and National Expert Committees on Roof support in coalmines constituted by Directorate General of Mines Safety. He also represents CMRI as a member in a number of committees constituted by different government organizations and academic institutions and industries in the country.

Dr Sinha is member of the pioneer professional bodies like Mining Geological & Metallurgical Institute of India (MGMI), Indian Geo-technical Society (IGS), International Society of Rock Mechanics & Tunneling Technology, (ISRM/IT) etc. He is a fellow of the Institution of Engineers (India). He is presently the Vice-President of the National Institute of Small Mines (NISM).

Dr Sinha visited on deputation/ assignment to various countries like USA, Germany, Czech Republic and Iran.