



NCL's process for sevelamer, a phosphate absorbing polymer, gets US patent

The National Chemical Laboratory (NCL), Pune, has received a US patent for innovative process to make sevelamer, a generic polymer that treats toxic excess amount of phosphate in the body caused by chronic renal problem. The patent is a culmination of work done by NCL on a mandate initially given by Mumbai-based drug company USV Ltd. USV had acquired the patent rights from CSIR last year, following which it further undertook the prosecution of the application. Dr M.G. Kulkarni's team at NCL has developed the alternative process that received the patent.

The recent patent success comes against the backdrop of the CSIR's efforts to get more public-funded institutions to file patents and work with the industry to commercialize research efforts. With 128 patents in 2006-2007, the CSIR accounts for about 47% of the total US patents granted to Indians, excluding non-resident Indians and foreign assignees. According to Pharmaceutical Patent Attorneys, LLC, the New Jersey-based firm who prosecuted the patent for its Indian client, the final patent on the CSIR-developed innovative polymer will be issued by the US Patent Office in approximately four months.

As per the agreement, USV had the first right to license the know-how and acquire the patent rights, and USV exercised this option. USV had approached NCL in mid-2003 to develop an innovative process to manufacture the polymer. NCL's scientists developed this cost-effective process to manufacture sevelamer, the phosphate-absorbing polymer. In this process, NCL has reduced the manufacturing time and the process chemicals requirements and the process is easy to scale up.

[Ref: www.ncl-india.org/Chemical News, June 2008]



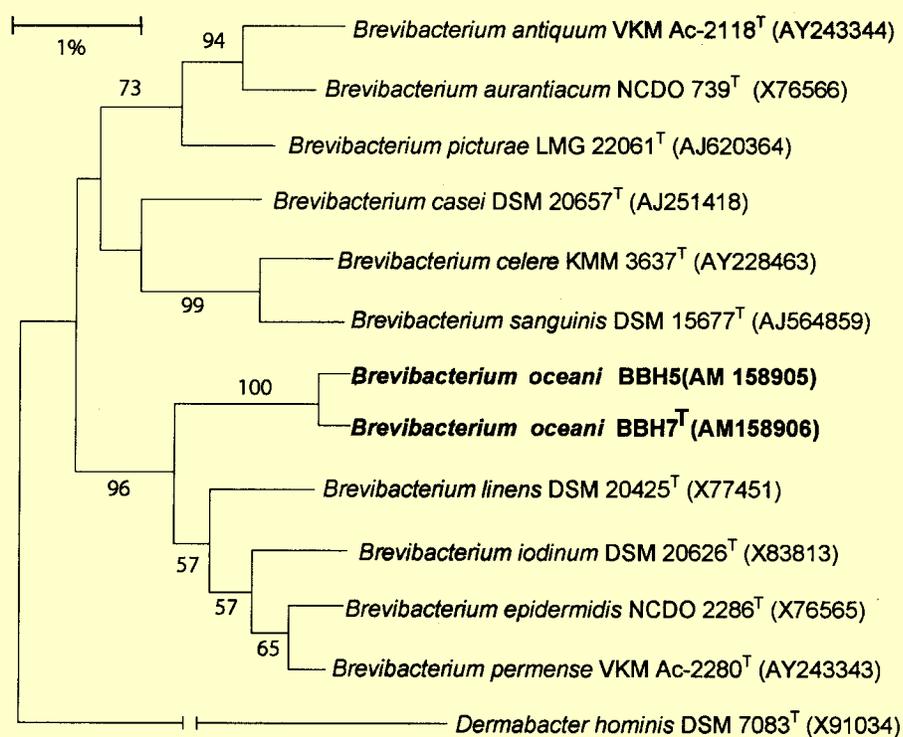
Two new bacteria isolated from the deep-sea sediment sample

Scientists of the Centre for Cellular and Molecular Biology (CCMB), Hyderabad, in collaboration with National Institute of Oceanography, (NIO), Goa, have isolated culturable bacteria from deep-sea sediments collected from the Chagos Trench in the Indian Ocean below the water depth of 5904 m. Bacteria were isolated from 50-70 cm section of a 4.6 m long sediment core. These sediments were approximately 50,000 years old. Two strains of bacteria belonging to a new species *Brevibacterium oceani* were described from these sediments using 16S rRNA sequencing. The almost-complete 16S rRNA gene sequences of these two strains showed 99.9% similarity among themselves. Following BLAST analysis, the two strains showed 97.9 to 98.4 % similarity to other *Brevibacterium* species (see Fig.). DNA-DNA dot-blot hybridization of these two strains with other known *Brevibacterium* species showed relatedness of only 35-41%. A DNA-DNA relatedness of 70% is used as the cut-off point for species delineation. Based on these results and differences in other phenotypic characteristics, it was concluded that these two strains belong to a novel species and the new species name *Brevibacterium oceani* was proposed. [Int. J. Systemat. Evolut. Microbiol.: 58(1); 2008; 57-60].

From the same sediments, two more new strains belonging to a new species *Microbacterium indicum* were described. Biochemical characteristics, fatty acid profile, polar lipid contents and levels of DNA-DNA hybridization techniques were used to report this new species. 16S rRNA gene sequence similarity between the two strains was 99.7% and with other species of *Microbacterium* it varied from 97.2 to 97.4 %. However, the two new strains exhibited only 32-

34% DNA-DNA relatedness to other species of *Microbacterium*. Therefore, based on differences observed in the phenotypic and chemotaxonomic characters, these two strains belong to a novel species of *Microbacterium* to which the name *Microbacterium indicum* was proposed. [Int. J. Systemat. Evolut. Microbiol. : 57(8); 2007; 1819-1822].

These results indicate that deep-sea sediments hold a hidden wealth of microbial diversity which remains to be explored.



Neighbour-joining phylogenetic tree based on 16S rRNA gene sequences showing the position of new bacteria and closely related species of the genus *Brevibacterium*. Accession number given in parentheses

NIIST develops RFNC Rubber Sheet Drier

Rubber sheets prepared by coagulating rubber latex with acid followed by pressing in between rollers are cured (dried) by contacting with smoke and hot air. Different types of driers/smoke curing houses are available for the curing operation for big and medium rubber planters/processors. However, there is no cost-effective drying system for the marginal farmers. They resort to drying in open space/keeping the sheets on tarred roads/hanging the sheets above the fire place in kitchen, etc. To meet the requirement of these farmers, the **National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram**, has developed a new drier in which hot smoke and air mixture flows in a downward direction, contacting the



The technology transfer document being handed over by Prof. T.K. Chandrashekar, Director, NIIST, Thiruvananthapuram, to Shri Johnson, Anna Industries, Angamally, Ernakulam Dist. Kerala.

wet rubber sheets kept in hanging position. In fact, during the past few years, NIIST has developed a number of reverse flow natural convection driers for indirect drying of a variety of agricultural products.

The new design for the drying of rubber sheets is an extension of the principle of reverse flow natural convection (RFNC) system.

The drier consists of two chambers, made by partitioning vertically. One of these is used for

housing the furnace mixture and the other for hanging the wet rubber sheets in two layers. Each layer can accommodate a maximum of 30 sheets. The hot smoke enters the drying chamber at the top and travels in a downward direction and after contacting the rubber sheets, escapes to the atmosphere through the slot provided at the bottom of the drier chamber.

Agricultural waste materials like coconut husk, firewood, etc. can be used as fuel for the generation of hot air-smoke mixture. For wet rubber sheets weighing 500 g after drying, the time required for drying is 2 days, provided the instructions are followed properly.

Two types of designs for the same capacity have been developed. One is portable and the other is fixed type. The drier chamber of the first type is made using iron angles and flats, plywood, etc. The drier chamber of the second type is constructed using hollow cement bricks.



A view of the portable type RFNC Rubber Sheet Drier made with M.S. angles, flats and bamboo plywood



The licence for the fabrication and sale of RFNC (Reverse Flow Natural Convection) rubber sheet driers to farmers has been transferred to M/s Anna Industries, Manjapra, Angamally, Ernakulam Dist.

Patent application has been filed in India (No. IPA No 0896 del 06 dated 14/06/2006). NIIST developed this drier jointly with M/s Mitraniketan, Vellanad, Thiruvananthapuram, a premier NGO, with the financial support from Department of Science and Technology, Government of India, New Delhi.



A view of the Fixed type RFNC Rubber Sheet Drier constructed with hollow cement bricks

Patents granted to NAL

The patents granted to the National Aerospace Laboratories (NAL), Bangalore, during March-April 2008 include:

Patent No 215684: An improved process for the preparation of boehmite / alpha alumina or mixture thereof, P.K. Panda, V.A. Jallel, T.S. Kannan of Material Science Division (21 March 2008).

Patent No 216783 A process for shaping thermoplastic sheets for wind shields / windows for vehicles, using an unique vacuum technique, R.M.V.G.K. Rao, C. Pragalathan, S.S. Desai of Fibre Reinforced Plastic Division (28 March 2008).

Patent No 216788 A chemical milling plant, A. Pourassamy, K.S. Rajam, K.S.P. Kumar of Surface Engineering Division (28 March 2008).

Patent No 216819 A protective device for controlling stall and surge in centrifugal compressors, S. Ramamurthy, Murugesan, Shankarnarayanan, Rajendran of Propulsion Division (28 March 2008).

Patent No 217563 An improved process for the hydrothermal synthesis of boehmite, alpha alumina or their mixtures in doped form, P.K. Panda, V.A. Jallel, T. S. Kannan of Material Science Division (11 April 2008).

Patent No 217572 Modified chain stitch process for stitching stiff and large size composite materials, R.S. Verma, J.S. Nair of Advanced Composite Division (11 April 2008).

Patent No 217586 An improved process for the preparation of low apparent density and bright white alumina trihydrate, P.K. Panda, V.A. Jallel, T.S. Kannan of Material Science Division (11 April 2008).

Process for mosquito repellent Herbal Agarbatti

The North East Institute of Science and Technology (NEIST), Jorhat, has developed a new process for the production of mosquito repellent *Agarbatti* from herbal preparations. Being herbal based the process is eco-friendly as well. This cottage level knowhow can be had by paying a fee of just Rs 20,000. Suitable for small and marginal entrepreneurs, the process has recently been released to the first client in Sivasagar district of upper Assam.

Central Leather Research Institute, Chennai

R&D Highlights: 2006-07

The Central Leather Research Institute (CLRI), Chennai, has emerged as the global leader in leather research. It has global shares of 30% in peer reviewed publications, 7-10% in IPR products and 35% in human capacity built annually in leather.

With a wide core competence encompassing biology, chemistry, engineering and leather science the institute has been able to gain peer recognition for valuable contributions made to R&D. CLRI's two lead and integrated outputs of network projects, namely Zero Emission Research Initiative Leadership (ZERIL) and Winning Water from Wastes for Leather (WWWL) have been commissioned during 2006-07. The institute made efforts to consolidate on leads gained for technology standardization of bioresources for and from leather and provided viable technology solutions for achieving Total Dissolved Solids (TDS) norm and management of solid wastes generated from the processing sector. Apart from TDS reduction through in-plant measures, chilling as a method of preservation, use of *Neem* and other bioresources for preservation, low salt preservation and enzymes as dehairing and fibre opening agents have paved a way in leather processing area.

Global visibility of the research outputs has been gained through a total of eight collagen based biomaterial products, which have

found clinical applications in burn management and wound healing. Newer chemicals and products have been synthesized, which have potential applications in leather industry. Two NMITLI programmes to which CLRI is linked, i.e. 'Biotechnology for Leather' and 'Development of environmentally secure rare earth colorants for surface coating applications' have moved into the second phase, while some of institute's successful technological leads are moving to stages of pilot scale demonstration and commercial evolution.

During 2006-07, ten patents were granted to CLRI abroad, eight were granted in India, three patents were filed abroad, while nine were

filed in India. One copyright was filed for software, and the following technologies were transferred to six parties:

A total of 138 papers were published during the year. The external cash flow (ECF) of the institute during 2006-07 was Rs 9.5 crore.

Highlights of significant R&D achievements during 2006-07

Leather Processing Technology

The leather processing group made focused efforts to address the Total Dissolved Solids (TDS) issue

Technology	Patent Application No	Party
Sustainable Landfill	125Del2006	Ranipet Tannery Effluent Treatment Co. Ltd, Wallajah, Ranipet (through CLE)
Sustainable Landfill	125Del2006	TALCO Pernambut Tannery Effluent Treatment Company Ltd, Pernambut (through CLE)
Chicken feed from limed fleshing	328Del2004	M/s Dindigul Proteins and Feeds
Waste water treatment	2497Del2005	M/s Tesla Technologies & Oxidation Private Ltd
Waste water treatment	317Del2004	M/s Enhanced Wapp Systems (India) Pvt Ltd, New Delhi
Treatment of waste water	320Del2004	M/s UPL Environmental Engineers Limited Vadodara



through technology initiatives. Some of the technologies developed for reducing TDS in tannery effluent include in-plant measures for reduction of TDS, short term preservation methodologies such as chilling and low salt preservation techniques.

The suitable in-plant TDS reduction measures for the treated waste water were identified, implemented and standardized for two tanning clusters in Tamil Nadu directed by the Tamil Nadu Pollution Control Board (TNPCB). This has led to reduction in TDS to less than 7,000 mg/l.

The process conditions were standardized for fundamental microbiological and engineering aspects of chilling system as a method of preservation of hides/skins. A mobile chiller has been designed and field tested. Trials at semi commercial/commercial scale have been conducted. The overall cost-benefit that this system offers to salt curing has been analyzed and found to be a viable option.

The low salt based system has been tried and standardized. For preserving the skins for a significant span of time, common salt as low as 5% was used along with MgO and the cured skins could be preserved for a period not less than 40 days. The quality of leathers were on par with those made from conventional salt curing. Commercial scale trials have been conducted.

A new bacterial strain producing protease has been isolated and the protease tested for its efficacy in dehairing application.

Preliminary experiments indicate that the enzyme has good dehairing efficacy.

Leather Product Technology

The Shoe Design & Development Centre continued its efforts in the area of newer materials and product innovations in footwear, biomechanics, fashion forecasting and training.

A novel approach for sole bonding technique in full shoe manufacture using microwave heat activation was made. Bonding process in shoes generally takes place after the adhesive is activated with IR radiation followed by pressing and curing. Many a time, if temperature and time are not controlled properly, it leads to either weak bonding or material disintegration. To overcome this problem an alternative heat activation technique using domestic microwave oven was tried at different energy (wattage) levels and time duration of activation. Microwave heat activation as a method for sole bonding has been found to be effective at 20 seconds heat activation time.

Many viscoelastic materials are used in shoes to replace the shock-absorbing and pressure distributing functions of natural fat pad beneath the foot that was lost due to conditions such as diabetes, arthritis, age or overuse. Segmented polyether polyurethanes were synthesized and developed into sheets by blending with commercially available polyester

polyurethane. The cushioning and morphological properties of developed materials were studied for application in therapeutic footwear.

Integrated software for prescription of footwear design based on computational risk category estimation has been developed for diabetic patients.

Seventeen out of 20 colours for shoes and 10 out of 11 colours for garments feature from India for the Autumn/Winter 2007-08 season as predicted by MODEUROP. Fashion intelligence has been disseminated through Foot Prints, Food hold, Trend Forecast, Bag Picture and Revisit.

Leather apparel and accessories group has worked extensively on materials, methods and applications and developed unique combination products with leather. Since emerging trends offer immense opportunities for combination products, exclusive products from natural materials such as pineapple fibre have been designed and developed as fashion accessories.

A suitable novel natural fabric made out of pineapple leaf fibre (PALF) has been identified for combination with leather to fabricate a range of products. The South Indian Textile Research Association (SITRA) has successfully produced yarns from 100% PALF. The yarns are loomed into fabrics. PALF has been combined with leather and a range of products have been developed.

As a luxury fiber, cashmere commands high price.

Combination of cashmere

fabrics with leather has led to a range of products.

Environment Technology

Environment research group has continued to address the environmental issues of the leather processing sector. Efforts aimed at providing technology solutions for solid waste management, waste treatment, removal of organics from water and methods for effective Common Effluent Treatment Plant (CETP) Operation and Maintenance (O & M).

Total Dissolved Solids (TDS) in tannery effluent being a cause of serious environmental concern, Common Effluent Treatment Plants (CETPs) and Effluent Treatment Plants (ETPs) recover and reuse the water through Reverse Osmosis (RO) plants. To increase the life of the RO membrane, pretreatment of the waste water using sand filter, photochemical oxidizer, activated carbon filter, cartridge filter, dosing systems is essential. A membrane reactor combining conventional biological treatment processes with membrane filtration has been developed for organic and suspended solids removal. Membrane reactor eliminates the use of sand and cartridge filters.

Two CETPs were selected for evaluation and assessment. Data on chemical and electrical consumption, O & M expenditure and the respective rate of inflow of wastewater were collected. The cost of chemical consumption to remove Total Suspended Solids

(TSS) was calculated. Based on the information collected on hours of operation and efficiency of the process, cost control strategies were recommended.

Chemo autotropic Activated Carbon Oxidation (CAACO) is a mixture of biological and chemical oxidations in a single, chemoautotroph immobilized activated carbon, packed bed reactor. Oxygen required for the oxidation of organics is applied in the form of compressed air from the bottom of the reactor. The wastewater to be treated is applied across the cross section. The oxidation of organics in wastewater occurs while the fluid streams (air and wastewater) flow in the counter current direction. CAACO based treatment systems have been implemented for the treatment of wastewater discharged from leather, textile, chemical, pharmaceutical and food industries in India for volume of wastewater ranging from 50 m³/day to 2000 m³/day.

CLRI has designed and developed a decentralized secure landfill system for sludge generated from tannery sector with Reinforced Cement Concrete (RCC) structure with provision to collect leachate and treat in CETPs and also to accommodate more quantity of sludge with less area. This decentralized secure landfill system has been implemented in a major cluster in Tamil Nadu with financial assistance from Ministry of Commerce and Industry.

Leather Chemicals Technology

R&D initiatives aimed at

development of chemicals and formulations which have potentials for application in leather.

Bovine pancreatic enzyme was found to depilate the hairs on skins and hides. This finding leads to the development of a process for lime-sulphide free dehairing in leather processing.

Siloxane materials provide advantages such as low temperature flexibility, high thermal stability, hydrophobicity, oxidative resistance, biocompatibility and significant gas permeability. Polyimides exhibit thermal stability, dimensional stability and electric property and find application in aerospace and electronic industries. Polyimides with polysiloxane groups as side chains were synthesized to enhance thermal properties. A series of novel poly (imide-siloxane)s (PIS) were synthesized by the grafting of amine terminated soluble imides to the siloxane backbone. The polymers were characterized by FT-IR, ¹H and ¹³C NMR. The polymers were found to be stable up to a temperature of 350°C.

Benzothiazole moiety is a pharmacologically significant organic entity with application as antitumor agent. Thiazolidinone derivatives possess antimicrobial, antiviral and anticancer properties. A novel and efficient method has been developed at the institute to synthesize a single molecule containing both benzothiazole and thiazolidinone moieties with a view to increase the potency of the biological activity by increasing the number of sulfur and nitrogen atoms through the cyclization of imine



using Lewis acid as a catalyst.

The novel nanoparticle dispersion (NPD) of a high molecular weight copolymer (6.04×10^5 daltons) in aqueous medium was investigated for its application as chrome exhaust aid. The copolymer chain is made up of two types of monomers, viz. an acrylic ester and an amino acid derivative. It has been demonstrated that NPD could perform as a high exhaust chrome aid to provide 94% exhaustion of chromium when used during chrome tanning operation.

2-amino-chromenes are widely employed as pigments, cosmetics, potential agrochemicals and represent an important class of chemical entities being the main constituents of many natural products. Fused chromenes exhibit wide spectrum of biological applications as antimicrobial, antiviral, mutagenic, anti-proliferative and antitumor agents. An eco-friendly route to the synthesis of 2-amino chromenes and indolyl chromenes has been elucidated.

The indole moiety is probably the most common and important feature, of a variety of natural products and medicinal agents with significant biological activities including antimicrobial, antiviral and antitumor properties.

In recent years, attention has been focused on the synthesis of aryl-14H-dibenzo {a, j} xanthenes, owing to their significant biological activities, as antibacterial antiviral and anti-inflammatory agents. Xanthene based compounds have

been investigated for agricultural bactericide activity and some other benzoxanthenes find applications in industries such as dyes in laser technology and fluorescent materials for visualization of biomolecules. Ceric sulfate catalyzed synthesis of 14-aryl or alkyl-14H-dibenzo[a, j] xanthene under conventional heating and microwave irradiation has been carried out.

Compounds bearing 1,3 amino-oxygenated functional motifs are ubiquitous to a variety of biologically important natural products and potent drugs, including a number of nucleoside antibiotics and protease inhibitors, such as ritonavir and liponavir. A facile method for the construction of 1,3-amido alcohols, has been developed as these molecules are versatile precursors for 1,3-amino alcohols and ligands for asymmetric catalysts.

Core Groups in Basic Sciences

Basic research during the year was aimed at investigations on three step tanning methodology, coupled water in biomolecules, synthesis and characterization of polymers and organic compounds with potential applications in leather and other industries.

Leather Sciences

A three step tanning methodology has been developed by CLRI towards a near zero wastewater discharge leather processing. Cow hides were

dehaired using enzyme based dehairing method. Sides were treated with α -amylase and water for 3 h in a drum. Alternatively, the sides were treated with sodium hydroxide and water in a drum, for one day. A pickle basification free chrome tanning at pH 5.0 has been developed with and without masking. The pH of the pelts was adjusted to 5.0 using three different acids namely sulfuric, acetic and oxalic acid without sodium chloride. Speciation studies were carried out during the course of tanning in order to understand the mechanistic pathways associated in the novel processing method.

Chemical Sciences

A simple and environment friendly protocol for the Michael addition of indoles using water as solvent has been developed. This protocol eliminates the use of hazardous organic solvents and is operationally simple since the product can be easily isolated by a simple phase separation.

Investigations were made on the influence of ligand structure on the DNA binding and cleaving property of metal complexes. Complexes of terpyridyl derivatives with variety of metal ions have been synthesized and crystallographically characterized. Copper (II) complexes of these ligands show nuclease activity in the presence of a co reagent like hydrogen peroxide or ascorbic acid. On the other hand Cobalt (III) complexes of these ligands cleave DNA photolytically due to their high excited state potential.

Organized self-assembled monolayers (SAMs) of thiol on the metal surfaces are formed easily by soaking the substrates in thiol solution for few hours. These layers are stable since there is chemical bond formation between the substrate atom and the sulfur atom of the thiol and also the hydrophobic interactions of alkyl chains. A detailed study on the removal of SAMs by surfactants has been carried out at the institute. CV studies were carried out to elucidate the blocking properties of SAMs of thiol and also to investigate the stability of the thiol with respect to (i) electrode potential (ii) CTAB. CV experiments were carried out in the following potential ranges: -0.4 to +0.4 V (b) -0.2 to +0.9 V (c) -0.2 to 1.6 V in 0.5M sulfuric acid.

Hydrogen bonding has unique strength character ranging from few kcal/mol to 40 kcal/mol and directionality. It has been observed that the electron density at the hydrogen bond critical point increases linearly with increasing stabilization energy from weak hydrogen bonds to moderate and strong hydrogen bonds, serving as an indicator of the nature and a unified picture of Van der Waals to classical H-bonding to strong H-bonding. New nano materials have been designed based on H-bonding interaction. It has been shown that the linear water clusters exist in their own right.

Biological Sciences

The study on the causes leading to delayed wound healing in

diabetic foot ulcers showed high lipid peroxidation indicative of oxidative stress in the neuro ischaemic foot ulcer infective group. The level of cytokines IL-6 and IL-8 was upregulated in the neuropathic and neuroischaemic foot ulcer – infective groups. The proteolytic enzymes responsible for the degradation of extra cellular matrix (ECM) components during tissue remodeling are matrix metalloproteinases.

Investigations have been carried out to understand the biotoxicity of Cr on lymphocytes. Some of the signaling molecules which take part in the biotoxicity process have been identified and the sequence of activation arrived at using inhibitors for these signaling molecules. A signaling pathway has been elucidated for Cr induced apoptosis of lymphocytes. Reactive Oxygen Species (ROS) is an early event and activates down stream effectors such as Src family tyrosinekinases and caspase 3. Studies revealed zinc protects lymphocytes from Cr (III) induced apoptosis. The ³⁵S-cysteine labeling studies have indicated that in the presence of zinc, Metallothionein (MT) synthesis is induced in lymphocytes.

Biomaterial Development & Testing

Collagen based biomaterials have found extensive applications in health care systems. Process has been standardized for preparation of soluble collagen and reconstituted collagen sheet from calfskin and amniotic membrane. These scaffolds

were used as such or in combinations to develop novel wound dressing materials. *Aloe vera* – collagen based membrane has been developed as an active composite biomaterial, which elicited positive healing of burn wounds and acted as substrate for culture of human dermal fibroblast.

Collagen scaffolds were designed as controlled drug delivery systems in a wide variety of wounds with emphasis on mitigating infection and modulation of Matrix Metalloproteinase activity (MMP) to hasten healing. Effectiveness of Sodium Dodecyl Sulfate (SDS) loaded alginate Microsphere Impregnated Collagen Scaffold (SSDM-CS) System was assessed through infection (*Pseudomonas aeruginosa*) in deep second-degree burn wounds in rat model. SSDM-CS was able to hasten the healing process at a much faster rate.

Dermal, epidermal and full skin equivalents have been developed indigenously for clinical application using collagen and collagen-chitosan composites. All these equivalents were of 2-D nature. The 3-D tissue engineered construct was developed by adding the known number of fibroblast cell suspension in collagen solution and cast as gels. It is used as a dermal equivalent and a model for evaluation of active constituents *in vitro*.

Skin Biology

Investigations for understanding the biochemical and molecular mechanisms of abnormal wound healing have been carried out. In



the dermis of keloids more activated MAP kinase expression was seen whereas in hypertrophic scars, epidermis showed increased expression. Decorin levels in abnormal wounds have been studied. Interestingly RT-PCR analysis of dermal fibroblasts of keloids showed low expression of decorin compared to hypertrophic scars and normal skin. Expression of decorin has been evaluated using anti decorin anti bodies in mice. It is hypothesized that the up-regulation of MAP kinase activity and low levels of decorin may be the contributory factors for excess collagen deposition and its abnormal assembly in keloids. Based on the observations, the cDNA encoding decorin was prepared, sequenced, and cloned into the pGEMT-PCR cloning vector. The cDNA encoding decorin was excised from the PCR vector and subcloned into the bacterial expression vector for the preparation and purification of recombinant decorin. This recombinant used along with collagen as dressing material has been tested for its efficacy *in vivo*.

Engineering for Modernization & Safety

The chemical engineering group has been providing engineering inputs for the leather industry for preparation of techno economic feasibility reports and design engineering packages for establishment of complexes. The basic research activities of the group have aimed at providing insights into

the understanding of scale up and process engineering.

Process control systems for chemicals and water addition and PH control have been designed, developed and implemented in a number of tanneries in the country. In association with the tannery group in CLRI a device for odour control has been designed and developed and is ready for field trials.

Power ultra sound studies indicate potential applications in leather processing.

Different drying techniques like radio frequency drying and vacuum drying have been tried for the drying of leather for better productivity and physical properties. Methods for chemical and biodegradation of dyes in the tannery effluent streams have been developed.

A valuable and systematic protocol for the experimental identification of runaway potentials of reaction systems has been developed. Properties of firework chemical compositions have been studied to assess risk free preparations.

Bio calorimeter studies aimed at investigating the metabolic reaction of microorganisms in tannery saline effluent.

Network Programmes

CLRI under the Network programme of CSIR, had made efforts to (a) consolidate on leads gained by the institute for technology standardization of bioresources for and from leather and (b) provide

viable technology solutions for achieving Total Dissolved Solids (TDS) norm and management of wastes generated from the processing sector.

A process scheme and a range of options have been developed for zero wastewater discharge process from raw to tanning. Through the various recycling and reuse options developed and standardized, it is possible to reduce the water input from about 22 l/kg of skin to about 5.5 l/kg of skin. There is no wastewater discharge from the process system. An engineering package for this process scheme has also been designed. A pilot plant has been established for carrying out further research for zero discharge using various raw materials and products. The pilot plant is available to tanners for trying zero discharge process prior to standardizing the same at commercial scale.

The network project on bioresources has led to the development of a viable network of four CSIR laboratories to work on programmes of national importance on leather. Enzymes (proteases) for dehairing applications have been developed.

Nearly 50% of the bioresources available from skin or hide have been sub optimally used. This causes solid waste disposal problem. Utilization strategies have been developed for solid wastes. Some of the products developed from fleshing by CLRI are high value animal feed (dog biscuits, chicken feed).

Eight collagen based biomaterial products, which have

clinical application in burn management and wound healing have been developed. Three of the collagen products viz. collagen sheet, reconstituted collagen sheet and collagen sponge have already been commercialized and have entered clinical use.

New Millennium Indian Technology Leadership Initiative (NMITLI)

The NMITLI programme on 'Biotechnology for leather' in the first phase aimed at paradigm shift in processing of leather from chemical to bioprocessing. Extensive R&D by 12 research institutions has led to development of 18 product leads which offer technology options for salt less preservation, lime and sulfide free dehairing and fibre opening. Efforts are being made to convert the leads into commercializable products through technology partnerships with chemical companies.

A turnkey contractor for operation and management of the upscaling facility for production of enzymes has been identified.

A team from CLRI has been formed for ensuring smooth execution and operation of the upscaling facility.

MERADO – C-DAC MoU for collaboration



Dr Gopal P. Sinha, Director, CMERI (*left*) and Shri J.S. Bhatia, Director, C-DAC (*right*) signing the MoU. Standing (*from left*): Dr Pawan Kapur, Director, CSIO; Cdr. V.R. Dahake, Shri Baljit Singh (C-DAC) and Dr Pradeep Rajan of MERADO.

The Mechanical Engineering Research & Development Organization (MERADO), Ludhiana, an extension centre of CMERI, Durgapur, has taken initiative to forge collaboration and cooperation in the area of agricultural machinery leading to precision farming with the Centre for Development of Advanced Computing (C-DAC), Mohali. An MoU to this effect was signed by Dr Gopal P. Sinha, Director, Central Mechanical Engineering Research Institute (CMERI) and Shri J.S. Bhatia, Director, C-DAC, on 27 May 2008 at Mohali.

C-DAC (erstwhile CEDTI) Mohali, is an institute of the Government of India, which is known for the quality in conceptualization, design, implementation and monitoring of training programmes.

The present MoU will enable MERADO/CMERI and C-DAC to undertake joint research work in areas of mutual interest, viz Mechanical Engineering and Agricultural Machinery. MERADO had earlier designed and developed 'Black Box Housing for Automobiles' under a C-DAC sponsored project. Technology of the same was transferred to C-DAC. It was released by the Minister of State for I.T., Dr Shakeel Ahmad and Secretary DIT, Shri Jainder Singh in the exhibition, Elitex 2008 in New Delhi.

This MoU would foster a closer interaction between C-DAC, Mohali and MERADO, Ludhiana.

The occasion was graced by Dr Pawan Kapur, Director, Central Scientific Instruments Organisation, (CSIO), Chandigarh; scientists and staff members of C-DAC; Cdr. V.R. Dahake, Scientist Incharge, MERADO and other senior scientists of MERADO.



Second Meeting/Workshop of International Network Project on Seismic Hazard in Asia

The second meeting/workshop of an international network project entitled 'Seismic Hazard in Asia' was organized at CSIR Centre for Mathematical Modelling & Computer Simulation (C-MMACS) Bangalore, during 31 March – 11 April 2008.

Dr A.R. Upadhyya, Director, National Aerospace Laboratories (NAL), Bangalore inaugurated the workshop. The Scientist-in-Charge, C-MMACS Dr Ramamohan welcomed the delegates and gave a brief history of C-MMACS. Dr Parvez presented the genesis of the network project, the progress and the importance of such a network in the Asian region which is under high seismic threat. The geological system starting from Hindukush to Andaman and Nicobar through the Himalayas is quite complex and covers many political and national boundaries. Dr Parvez also welcomed three new members in the network, each from Indonesia, Thailand and Philippines.

Dr A.R. Upadhyya presided over the inaugural function and explained the seismological complexity of the region, highlighting the past catastrophic events in Asian region. He emphasized the importance of working together and integrating the findings from each country in order to mitigate the impact of such catastrophe.

Dr Fabio Romanelli, University of Trieste, Italy, welcomed the delegates on behalf of Prof. G. F. Panza and mentioned about the ongoing network project in North Africa and Latin America.

Prof. D. Balasubramanian delivers NSD Lecture at NGRI



Prof D. Balasubramanian releasing the *NGRI Research output-2007*.
Seen with him is Dr V.P. Dimri, Director, NGRI

As a part of the National Technology Day celebration at the National Geophysical Research Institute (NGRI), Hyderabad, Prof. D. Balasubramanian, Director of Research, LV Prasad Eye Institute, Hyderabad, delivered the 2008 National Technology Day Lecture "From Bench to Bedside – The Story of Translational Biology in India since Independence" at NGRI on 12 May 2008. Prof Balasubramanian summarized the revolutionary changes that took place in R&D in the fields of Agriculture, Biology, Dairy, Medicine and Pharma sciences since Independence. He explained how these changes helped when they were adopted and applied for the betterment of the Indian society. He complemented the scientists who were responsible for green and white revolution, Pharmaceutical development and also in the field of Biology and Medical sciences. He dwelt at length the impact of this transformation on the society.

After the lecture Prof. Balasubramanian released the '*NGRI Research Output 2007*'.

Earlier, Dr V.P. Dimri, Director, NGRI, introduced the distinguished speaker and also reviewed the progress made by NGRI in various projects during the last year.

Dr Y.J. Bhaskara Rao, Scientist 'G', proposed the vote of thanks.

Constrained peptides as inhibitors of protein - DNA and Protein-Protein Interactions

S.S. Bhatnagar Lecture by Prof. Siddhartha Roy



Dr J.S. Yadav, Director, IICT, is presenting a memento to Prof. Siddhartha Roy (*right*), who delivered the Bhatnagar Lecture

Assam Chief Minister visits NEIST

Shri Tarun Gogoi, Chief Minister of Assam, accompanied by his officials paid a visit to North-East Institute of Science and Technology (NEIST), Jorhat, on 1 February 2008. NEIST Director, Dr P. G. Rao welcomed the distinguished visitors and informed them about the research work being undertaken at the institute for the development of the state as well as the North East. The Chief Minister took keen interest in the research activities and evinced keen interest in the areas of Biotechnology and Geosciences. He visited both the departments and interacted with the scientists. He was later on taken to the NEIST Exhibition Hall where he was shown the various displays on the institute's accomplishments. Presentations of the individual departments were made by the concerned scientists. The Chief Minister expressed happiness over the R&D work being carried out at NEIST.

Prof. Siddhartha Roy, Director, Indian Institute of Chemical Biology (IICB), Kolkata, delivered the 16th S.S.Bhatnagar Memorial Lecture on the topic "Constrained peptides as inhibitors of protein - DNA and Protein - Protein Interactions" at Indian Institute of Chemical Technology (IICT), Hyderabad, on 1 April 2008.

Dr Roy spoke at length about the potential of peptides as chemotherapeutic agent in the drugs and pharmaceutical industry. He said that a lot of work has been done in this area because preparation of different amino acids leading to chemotherapeutic peptides is much easier compared to other options.

Earlier, Dr J.S.Yadav, Director, IICT, who presided over the function, highlighted the significance of the event and the achievements of IICT during

the financial year 2007-08. He explained the genesis of the lecture series started on 1 April 1989 in the name of Dr S.S. Bhatnagar, first Director General of CSIR and a father figure to the 38 laboratory of CSIR, who provided an outstanding leadership and extra-ordinary services to CSIR.

Dr A.C. Kunwar, Director Grade Scientist, introduced the illustrious speaker to the audience right from his Ph.D. from the University of Delaware, USA, to his tenure at the Bose Institute, Kolkata, and the present tenure as Director, IICB.

The programme was attended by academicians, members of the industry and member of the IICT's sister laboratories, in addition to staff members and research fellows of IICT. Mrs C.B.Lakshmi, Head, Research Management, proposed a vote of thanks.



Major events at NEERI

During April-June 2008, the National Environmental Engineering Research Institute (NEERI), Nagpur, celebrated three major events: (i) Its Foundation Day (8 April), (ii) National Technology Day (12 May) and (iii) World Environment Day (5 June). Eminent personalities delivered lectures on these occasions. Highlights:

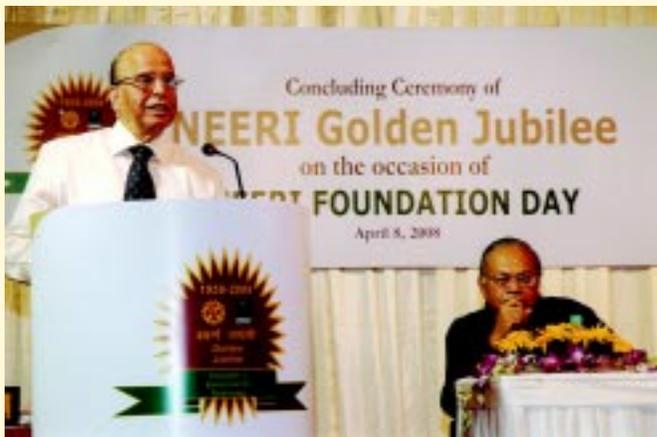
Foundation Day— Concluding ceremony of Golden Jubilee Celebrations

NEERI completed its 50 years of foundation on 8 April 2008. On this occasion, the institute organized a concluding ceremony of NEERI Golden Jubilee celebrations. Dr K. Kasturirangan, Director, National Institute of Advanced Studies (NIAS), Bangaluru and former Chairman of ISRO presided over as the Chief Guest. Dr S. Varadarajan, former Director General, CSIR, was the Guest of Honour.

Delivering a lecture on 'Space and Environment', Dr Kasturirangan said that India spends about Rs 4,000 crore in space research programmes and can afford to spend a few thousand crore more. Health, agriculture and water are some of the areas where ISRO can do much more through various satellite projects. He opined that after making satellites like 'Cartosat', 'Resourcesat', 'Edusat', etc., now we should think of Healthsat, Watersat, Agrisat and even Astrosat.

Commenting on *Chandrayaan-I*, Dr Kasturirangan said that its next step could be to land a robot on the moon, explore it and collect samples. He said that in future, we may use the moon for unmanned missions to Mars, as a mid-step launching pad.

Dr Kasturirangan advocated for collaboration between NEERI and



Dr K. Kasturirangan delivering the lecture on 'Space and Environment'. Seated on the dais is Dr T. Chakrabarti

ISRO to combat the environmental challenges. He said that space systems have become a crucial tool for finding out solutions to climate change. Synoptic coverage, repeated observations, multi-spectral imaging, information on special domain, stereo coverage, etc., are some of the advantages of remote sensing, he added. Dr Kasturirangan informed that the progress made in last four decades pertaining to various space programmes has been instrumental in snow and glacier monitoring, desertification and drought monitoring, land degradation monitoring, coastal monitoring, biodiversity monitoring, environmental impact assessment studies, etc. He said that because of remote sensing satellites, it was possible to note in 2000 that a total of 64 million hectares (Mha) land

degraded in India, and depending on this information, necessary steps were taken, and in 2003 the area of degraded land reduced to 56 Mha. Maharashtra had 4.93 Mha wasteland, which was 16.02% of the total geographical area, he added.

Dr Varadarajan in his address, cautioned against the alarming growth of energy demand. Alternatives to meet the energy demand do not

seem easy and sufficient, he added. In such grim scenario, Dr Varadarajan stated that NEERI can play a significant role in finding out appropriate solutions in the area of energy and environment. He also threw light on several other problems related to the environment and urged the scientists to concentrate on excellence in R&D to find out perfect solutions.

In his welcome address, Dr Tapan Chakrabarti, Acting Director, NEERI, highlighted significant R&D activities carried out in last 50 years at the institute. He also assured that the institute will continue this tradition of excellence in R&D in environmental science and engineering.

On this occasion, Dr Kasturirangan released the 'Commemoration Volume' published by the institute.

On this day, the 'NEERI Golden Jubilee Concluding Conference on

Environment & Sustainable Development' was also organized. The conference was inaugurated by Dr Kasturirangan. Several environment experts, Dr Deepak Kantawala, ex-RC Chairman, NEERI; Mr K.P. Nyati, Principal Advisor, CII; Dr Sam Godfrey, UNICEF, Bhopal; Prof. B.

Pitchumani, Prof. of Chemical Engineering, IIT-Delhi; Dr Asoor Shyam, Environmental Specialist, GMR, Bangaluru; Dr Gurdeep Singh, Professor, Indian School of Mines, Dhanbad and Prof. S.J. Arceivala, ex-Director, CIPHERI delivered lectures on this occasion. Dr Varadarajan

distributed the NEERI Foundation Day Awards to the scientific and non-scientific personnel for their conspicuous contributions at the institute.

Former Directors of NEERI and Chairmen/members of NEERI Research Council were also felicitated on this occasion.

National Technology Day Celebrations

Mr C.V. Khandelwal, Chief of Operations, Indo Rama Synthetics (I) Limited, Nagpur, was the Chief Guest on this occasion, and he delivered a lecture on 'Energy and Environment', Mr Khandelwal said that overlapping issues related to energy and environment are posing serious challenges to both developed and developing countries. Energy and economy are interrelated to each other. We have to take care of the environment too. Mr Khandelwal emphasized on the need to ensure clean affordable energy options for all including the poorest sections of the society. He gave details about GDP growth rates of various countries in

terms of energy economy. Briefing on energy intensity, Mr Khandelwal said that energy intensity is an indicator to see how energy is used efficiently in economy. During industrialization, energy requirement increases for massive growth of GDP, he added. Mr Khandelwal remarked that India's energy intensity is much higher than emerging economies among the Asian countries. He informed that in terms of primary energy consumption, India ranks 5th in the world, accounting for about 3.5% of world commercial energy. Mr Khandelwal informed that India, Canada, France, UK and Brazil account for 13.5% of world's energy consumption, and China, India and

Japan are the largest consumers of energy in Asia due to their large population. He threw light on world's five largest CO₂ emitting countries and informed that India's CO₂ emission is 251 carbon eq. (Million MT). He also drew attention towards climate change and global warming.

Earlier, Dr T. Chakrabarti, Acting Director, NEERI, in his welcome address spoke on the importance of the National Technology Day. Dr S. P. Pande, Scientist and Head, R&D Planning Unit, NEERI, introduced the Chief Guest. Mr Arindam Ghosh, Scientist, NEERI proposed a vote of thanks.

World Environment Day Celebrations

Dr Mohan Dharia, a well-known environmentalist and former Deputy Chairman of the Planning Commission of India, presided over as the Chief Guest.

Delivering his lecture on 'My approach in India to meet the challenge of global warming', Dr Dharia expressed concern over the consequences of global warming. He said that global warming is not a challenge but it is a calamity. We should minimize the adverse impacts of global warming using our natural resources, he added. Dr Dharia remarked that there should be adequate forest cover, enough natural resources and good water availability, so that global warming should not affect us. We should use natural resources very cautiously, he urged. Speaking about natural resources, Dr Dharia informed that we are not harvesting even 10% of total rain water. To conserve every drop of water, there is a



Dr Mohan Dharia delivering the World Environment Day Lecture; Seated on the dais (from right): Mr Arindam Ghosh, Dr T. Chakrabarti and Dr G.V. Mulmuley



need of micro watershed development and proper water management, he added. He said that by saving water, waste or degraded lands can be made arable. Dr Dharia opined that energy resources should be decentralized and emphasis should be given on non-conventional energy resources, particularly solar energy.

Briefing about the consequences of global warming, Dr Dharia said that because of changing climatic conditions, drought is being experienced even by United States and United Kingdom. Increase in temperature is melting icebergs and so sea level is increasing. Dr Dharia cautioned that several islands including Andaman and Nicobar may vanish under the sea and 700 km of sea shore of India would be affected owing to global warming.

Dr Dharia further said that it is not very difficult to bring the people from filthy urban slums back to the green villages, by the judicious use of the available natural resources. Speaking about his Voluntary Organization 'Vanarai' involved in conservation of natural resources, Dr Dharia stated that he has succeeded in involving thousands of people in rural development and making self-reliant villages. In several villages, developed by 'Vanarai', many villagers who had migrated to cities have returned to their villages for better living, he added.

Dr Dharia said that the nature is beautiful enough to satisfy our needs, but we have to come out of greed. He also laid stress on population control. He urged youngsters to work on these issues. On this occasion, Dr Dharia requested his villagers to bury him after his death and not to burn him, and plant a *neem* tree at this place, which would provide shed, medicines and wood to future generations.

Earlier, Dr T. Chakrabarti, Acting Director, NEERI, in his welcome address spoke on the importance of the World Environment Day and this year's theme 'CO₂: Kick the Habit'. Briefing about the green house gases, he explained their role in global warming, and subsequent impacts on the environment.

Earlier, Mr Arindam Ghosh, Scientist and Head, R&D Planning Unit, NEERI, introduced the Chief Guest. Dr G.V. Mulmuley, Scientist, NEERI, proposed a vote of thanks.

Prestigious International Recognition for Dr Utpal Bhadra's Lab at CCMB

Dr Utpal Bhadra's lab at the Centre for Cellular and Molecular Biology (CCMB), Hyderabad, has recently received recognition by two prestigious international bodies, namely, CEFIPRA (*Centre Franco-Indien pour la Promotion de la Recherche Avancee*) - Review Council in France and the *Science* journal.

The work done under the CEFIPRA project on 'Searching link between pairing dependent silencing and cosuppression' sponsored jointly to Dr Bhadra's lab and Dr Giacomo Cavalli has been highly appreciated by the CEFIPRA Review Council and rated 'Excellent'. In his letter of 10 June 2008 to Dr Bhadra, Prof Shiva Prasad, Director, CEFIPRA, has conveyed the offer of travel grant to both investigators for continuation of scientific discussion and interaction. This recognition came for the outstanding publications emanating from the work carried out under the project — eleven publications in top-notch journals, e.g. *Nature*, *Genes & Development*, *Cell*, *Developmental Cell* and *Science* etc.

The paper "Heterochromatic silencing of HPI localization in *Drosophila* are dependent on the RNAi machinery", published in *Science* 303:669-72, 2004 is a milestone paper in RNA interference because it showed novel contribution in RNAi in different pathway of heterochromatin silencing. Therefore, no wonder that it has been included in a ranking of the 'most-cited papers' in a Special Topic on gene silencing over the past three years as measured by Essential Science Indicators (ESI). ESI is a Web-based compilation of science indicators and trend data derived from Thomson Scientific's databases. The supervisor Dr Utpal Bhadra was one of the corresponding authors from CCMB for this publication. ESI has desired to include a feature related to this article, which would be publicly accessible on the Web and later archived on the ESI Website.

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