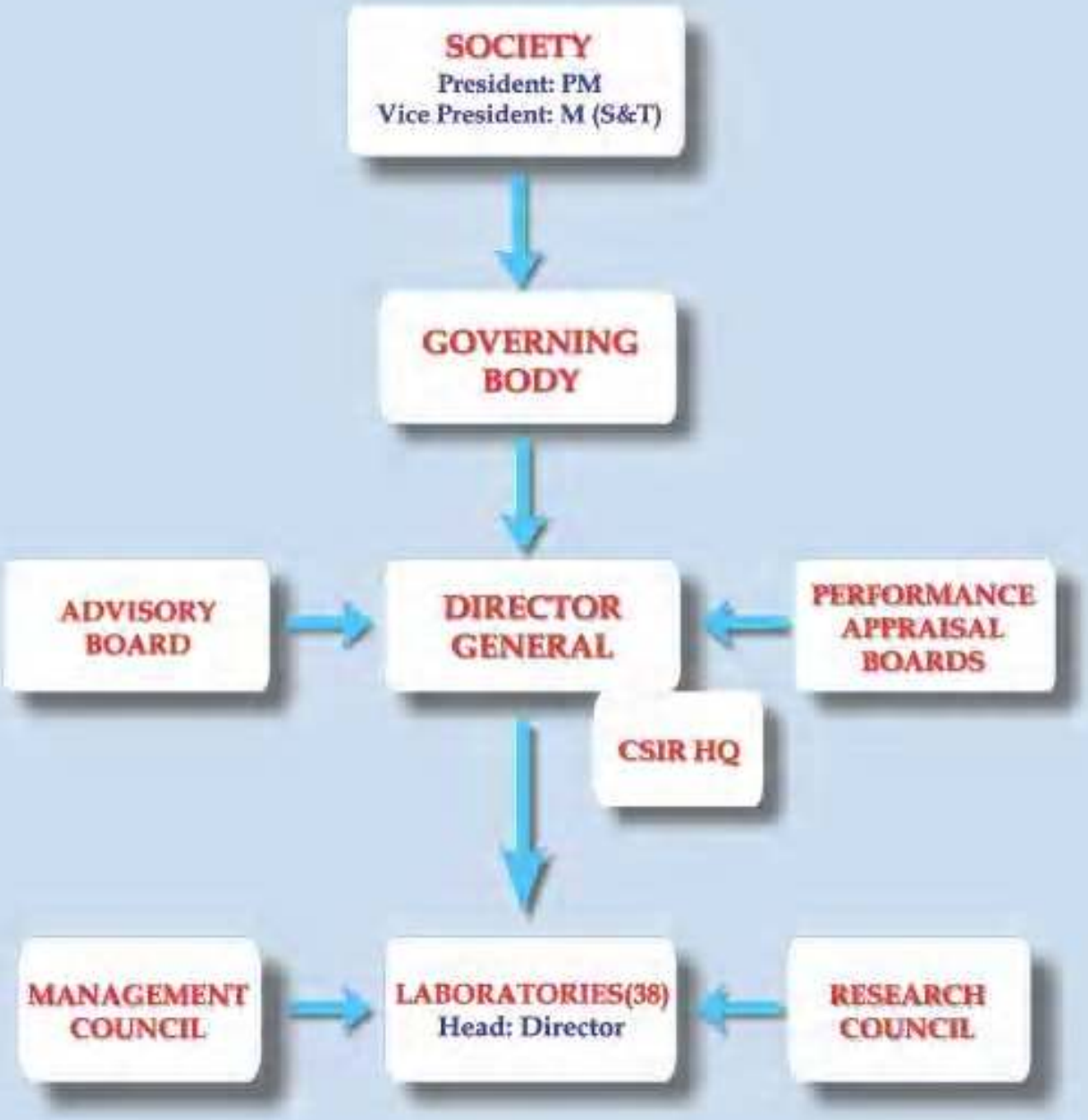
CSIR FLYING HIGHER & FURTHER

CSIR Annual Report 2004-05

Council of Scientific & Industrial Research
New Delhi

CSIR ORGANISATIONAL STRUCTURE



CSIR Annual Report 2004-05

Council of Scientific & Industrial Research
Rafi Marg, New Delhi

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Cover: Top: SARAS takes to sky
Bottom: Succour to Tsunami victims

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3.0 HEADQUARTERS ACTIVITIES

Overview

OVERVIEW

The Annual Report for the year 2004-2005 highlights the salient features of the contributions made by CSIR in a wide spectrum of activities, which span from creation of public goods to private goods to social goods to strategic goods. While maiden flight of SARAS was a landmark in CSIR's contributions to herald the civil aviation industry in the country, the discovery of a new molecule, as a potential drug for cure of deadly disease of tuberculosis, CSIR's instant response to alleviation of hardships of Tsunami's victims were the major contributions in other spheres.

During the period under review, CSIR continued to make strides in scientific achievements as well as management reforms. These reform processes and new modes of operation were in consonance with the new demands on CSIR to respond to the dynamic changes taking place in India.

Under new mode of operation, CSIR continued to consolidate its programme delivery through network projects. A large number of knowledge networks spread across and beyond CSIR laboratories were created. The focus of the programmes thus evolved has been to synergise the vast competencies of CSIR laboratories and others within the country. Special attention has been paid towards monitoring and evaluation of these large network projects.

CSIR pioneered New Millennium Indian Technology Leadership Initiative (NMITLI) scheme, which is considered to be India's largest private public partnership programme. There are 65 private sector companies and 175 institutions involved essentially to capture global technology leadership position and development of technology through consortia of the "best" academic/R&D and industrial partners. A number of NMITLI projects have paid handsome dividends by way of new discoveries. A major initiative was taken during this year to consolidate on the research results from these projects to convert them into major technology missions, e.g. TB Mission with a view to develop the first TB drug from India.

CSIR has been an open and learning system with periodic reviews undertaken through internal and external committees. The ongoing reform process within CSIR owes itself largely to the recommendations of Kelkar Committee Report submitted last year. The committee revitalized the thought process for change management within the CSIR, which has been appreciated widely and emerged as a model for other institutions in India and abroad to emulate.

The process of change within CSIR has also drawn our attention to focus on issues associated with human resource development. The 'Human Resource Development

Center' (HRDC) established during the year 2002 has taken an initiative for setting up of Human Resource Groups (HRGs) in all the CSIR laboratories. The HRDC shall be looking at the human resource development issues centrally at CSIR level; the Groups shall be responsible for meeting the specific HR needs of the laboratories.

More specifically, it presents CSIR's S&T contributions in the sectors such as Aerospace Science & Technology, Biology & Biotechnology, Chemical Science & Technology, Earth Resources & Natural Hazards Assessment, Ecology & Environment, Energy, Food & Food Processing, Health Care, Drugs & Pharmaceuticals, Housing & Construction, Information Dissemination & Products, Leather, Material, Minerals, Metals & Manufacturing and Metrology. Various activities related to Central Management and Headquarters are also detailed in the Report. The section on 'Dateline CSIR' lists the significant events that took place at various CSIR constituent laboratories during the year.

Some of the notable features of the Report are provided below:

SARAS TAKES TO SKIES

SARAS, India's first indigenously developed, multi-role civilian aircraft took its inaugural flight to skies at 8.20 am on Sunday, 22nd August, 2004. SARAS will serve as a multi-role aircraft with feeder airline and air taxi operations as its primary roles. It would also be used as executive transport and light cargo carrier, in remote sensing, as aerial research vehicle, coast guard, border patrol, air ambulance and other services. It can take off and land from short semi-prepared runways and is therefore ideally suited for operations in difficult terrains and would help in providing connectivity, especially in the North East India. With potential for such multiple roles, it is expected that SARAS will usher in a vibrant civil aircraft industry in the country in the coming years.

A NEW TB VACCINE

Tuberculosis (TB) is the leading infectious killer of youth and adults. One third of the world's population is currently infected with the causative organism, *Mycobacterium tuberculosis*, a Gram-positive bacterium. A candidate vaccine has successfully been evaluated in the form of live *Mycobacterium habana* in animals. *M. habana* is an atypical mycobacteria reported non pathogenic in mice, guinea pig and monkey. There is no report of its association with any human disease. The antigens of *M.habana* cross-react strongly to the antigens of *M. tuberculosis*, which means that the two mycobacterial strains share antigenic homology.

TB MOLECULE BREAKTHROUGH

As a result of private-public partnership programme, launched by New Millennium Indian Technology Leadership Initiative (NMITLI), a new molecule, 'sudoterb' for the treatment of TB has been developed, for which clinical trial has been started. This is the first new molecular strain discovered after Rifampicin in 1963. The molecule, which may help reduce the treatment time from eight months to two months, is especially well suited for the poor.

A BIOMARKER FOR THE DIAGNOSIS OF VISCERAL LEISHMANIASIS

IICB identified the increased presence of disease specific biomarker(glycotype) on erythrocytes of patients with visceral leishmaniasis (VL). The over expression of this biomarker has helped in the development of erythrocyte binding assay to monitor the clinical status of visceral leishmaniasis patients, which can detect VL even under field conditions. Only a drop of blood is required for this assay. The assay is cheap, non-invasive and above all is rapid and can be carried out in field conditions. The assay has greater sensitivity and minimal cross reactivity with malaria and tuberculosis. The potential of this discovery has been quickly identified by World Health Organisation (WHO) for its global application and the technology has recently been transferred to an Indian company (Zephyr Biomedical, Goa).

VAXIPRED- COMPUTER AIDED VACCINE DESIGN

VaxiPred, an innovative immuno-informatics tool enabled computer aided vaccine design has been released. This research tool contains components, which synergistically and seamlessly combine the best of research in immunology and immuno-informatics, the offshoot of information technology. VaxiPred is primarily the result of premier research in vaccinology at IMTECH, which has been adequately backed and supported by use of state-of-the-art in information technology by BioMantra. VaxiPred changes the very percept, outlook and approach of vaccinology and immunology. Release of this state-of-the art technology for use amongst the research community has the potential to bring Indian vaccinology at par with world-class research.

ISFET (ION-SENSITIVE FIELD-EFFECT TRANSISTOR)- BASED GLUCOSE BIOSENSOR

CEERI has developed ISFET based glucose biosensor. This biosensor comprises an ion-sensitive field-effect transistor (ISFET), which is a metal-oxide-semiconductor field-effect transistor (MOSFET) with the metal gate replaced by a chemical membrane (SiO_2-Si_3N_4) responsive to hydrogen ions, producing a solid-state pH-micro-sensor. This has the advantage over conventional biosensor in terms of smaller size, robustness, easy cleaning, minimal need for maintenance, and fast response.

OPTICAL FIBRE AMPLIFIER

For the first time in India, an optical amplifier for light wave telecommunication network has been developed by CGCRI using erbium-doped optical fibre (EDF) and power semiconductor pump laser source. This device has the potential for use in the propagation of "Fibre to Home" technology in the country.

TRADITIONAL KNOWLEDGE PROTECTION

Two NISCAIR journals, *Indian Journal of Traditional Knowledge (IJTK)* and *Medicinal and Aromatic Plant Abstracts (MAPA)*, have become part of Non Patent Literature (NPL) of the PCT Minimum Documentation. For the first time journals from a developing country have been included in the coveted list of 'prior art search journals'. Inclusion of IJTK in the list is yet another feat towards achieving the basic objective of Traditional Knowledge Digital Library (TKDL) for prevention of grant of wrong patents through misappropriation of our traditional knowledge. With this, India has joined the select list of thirteen nations. It shares the seventh position with France & Switzerland. TKDL is serving as a role model for protection of traditional knowledge for various countries like South Africa, African Regional Industrial Property Organization (representing 16 member nations), Singapore, Japan etc.

COMPUTER-AIDED MICROSCOPIC INSPECTION SYSTEM FOR MEDICINAL PLANTS

A computer-aided microscopic inspection system, which avoids some of the shortcomings of the conventional microscopic inspection methods, has been developed. The system, HERBAS (Herbs Authentication System) consists of a computer, microscope, digital camera, printer and custom-developed application software. The application software running on the computer allows the user to capture the microscopic images through the digital camera and utilizes them appropriately.

CSIR'S SCIENTIFIC BREAKTHROUGHS

The year saw several of CSIR'S significant breakthroughs picked up by prestigious international research publications to be highlighted on their cover pages. Some of these are

From CCMB

"Role of *cycline E* in cell fate determination in the central nervous system of *Drosophila melanogaster*" on the cover page of 'Nature Cell Biology', January 2005. The study has led to understanding the mechanism of critical role of c*ycline E* in the nerve cell fate determination which will help in gene therapy for neural disorders.

"Changes in cell shape induced by membrane cholesterol" on the cover page of 'Experimental Cell Research', October 2004.

"Microbes from cold habitats: Biodiversity, Biotechnology & Cold Adaptation" on the cover page of 'Cellular & Molecular Biology', July 2004. It would open up avenues for developing strategies for improving resistance of crop plants to low temperatures and also yield biomolecules of biotechnological potential such as enzymes.

From IICB

"Micronuclei as Biomarkers of Carcinogen exposure in populations exposed to arsenic through drinking water in West Bengal, India: A comparative study in three cell types" on the cover page of American Association for Cancer Research, May 2004.

From ITRC

"Modulation of P-glycoprotein-mediated multidrug resistance in K562 leukemic cells by indole-3-carbinol" on the cover page of 'Toxicology and Applied Pharmacology', February 2005.

CSIR PROVIDES RELIEF IN TSUNAMI HIT AREAS

The devastating tsunami that hit the coastal areas of South-East Asia on 26th December 2004 left behind in its wake a wide swath of death and destruction. With a death toll of 300,000 across Asia, of which around 11,000 reported from the eastern coast of South India and the Andaman & Nicobar Islands, the sea-based earthquake has come to hold the dubious distinction of being one of the largest disasters ever in recent history. It is estimated that as many as 2 million people in India have been rendered homeless, foodless and clothless owing to this fury.

A number of CSIR laboratories rose to the occasion to offer their scientific & technical skills and other resources to mitigate the sufferings of those who survived this unprecedented calamity and also to initiate programmes that could help the country to deal with such natural catastrophic events. These offers and initiatives included shelter, food, drinking water and numerous studies that could improve our knowledge and skills to deal with such disasters and their after effects in times to come.

FOOD

CFTRI took the mission of providing food for the needy people in the tsunami hit areas. It undertook the largest production of instant food by an R&D laboratory, providing 55 tonnes of food equivalent to nearly 1,80,000 meals. This includes ready to eat meals (upma mix, sambar rice with pickles), high-energy food, baby milk powder, rice, sugar, oil, suji and atta.

DRINKING WATER

CSMCRI has installed Reverse Osmosis (RO) and Electrodialysis (ED) plants in different Tsunami hit areas:

- Nagapattinam - RO Plant (1,500-2,000 litres per hour) installed at Akkaraipettai that is supplying nearly 20,000 litres of water per day. Around 12,000 people benefited.
- Andaman & Nicobar Islands – Two RO Units (each of 800-1,200 litres per hour capacity) were installed in Port Blair.
- Ayyampettai – The first Electrodialysis Desalination (ED) Unit of 500 litres per hour capacity installed at Ayyampettai (1500 population) is operating smoothly and producing potable water of 500 litres per hour. It is connected to the distribution pipeline and people are getting water in their taps. The second unit was installed at Rajapettai village with a population of around 2000.

SHELTER

CBRI provided backup support in rehabilitation of the devastated areas by providing pragmatic solutions to the repair and retrofit of the existing infrastructure and buildings.

Even though the washed away shelters of most fishermen were non-engineered or semi-engineered, SERC, commissioned a team of scientists to survey the entire coastal stretch from the Chennai to Nagapattinam and prepared a report on structural damage and its assessment.

AFTERSHOCKS

NGRI continuously recorded and monitored the aftershocks of the tsunami. The data was provided to the concerned authorities in Andhra Pradesh on possible effects of such shocks on sea so that appropriate steps could be taken to avoid further loss of life.

EXCELLING IN SCIENTIFIC & INDUSTRIAL RESEARCH OUTPUT

CSIR's basic research contributions scored an all time high. As a result of researches carried out in the national laboratories over 2660 research papers have been published in internationally peer reviewed journals with average impact factor per paper of nearly 1.90. CSIR was granted 272 patents abroad, again an all time high. 60% share in the total US Patents granted to Indians excluding NRIs and foreign assignees belongs to CSIR.

RESOURCE BASE

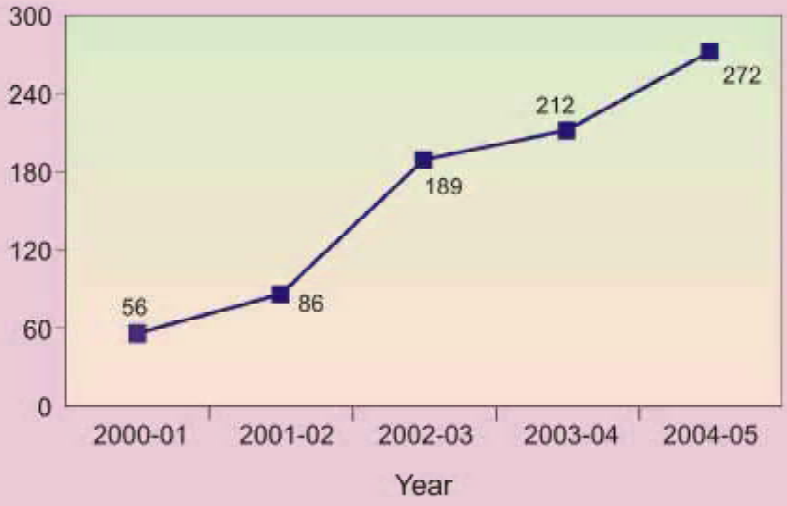
1.	**Infrastructural**	**Number**
	• Laboratories/Institutes	38
	• Outreach Centers	39
2.	**Human**	
	• Total Staff	18251
	■ Total S & T staff	13338
	■ Scientists (Group IV)	4682
	■ Technical (Group III)	2957
	■ Technical (Group II+I)	5699
	• Total Administrative& non-technical (includes isolated staff strength)	4913
3.	**Financial**	**Rs. crore**
	• Government budgetary support	1266.47
	■ Government plan allocation	580.77
	■ Government non-plan allocation	685.70
	• Extra budgetary resource generation	
	■ From contract R & D and consultancy	258.75
	■ Miscellaneous receipts (non R & D)	55.747
	■ Laboratory reserves	88.967

PERFORMANCE

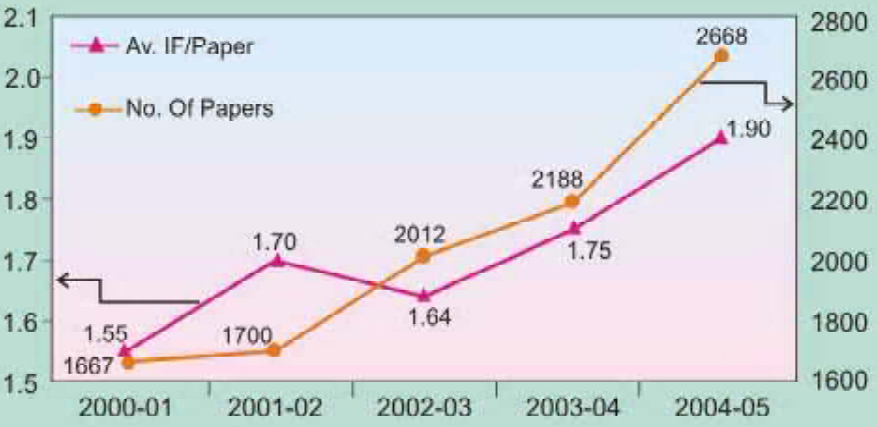
1. Science Output	Numbers	
• Papers contributed		
■ Number	2668	(2188)
■ Average Impact Factor Per Paper	1.899	(1.749)
• Patents		
■ Filed in India	418	(406)
■ Filed abroad	500	(495)
■ In force in India	1240	(1083)
■ In force abroad	990	(727)
2. National S & T Human Resource Developement		
■ Research Fellows/Associates Supported	7640	(6755)
■ Emeritus Scientists in position	119	(137)
■ Pool Scientists (SRAs) in position	186	(206)
■ Research Schemes supported	760	(728)

Figures in parenthesis correspond to the previous year 2003-04

FOREIGN PATENTS GRANTED



PAPERS CONTRIBUTED
AVERAGE IMPACT FACTOR/PAPER



CHAPTER-1

S&T Contributions

S&T CONTRIBUTIONS

The Council of Scientific and Industrial Research has established a network of national laboratories/institutes in various parts of the country to undertake research in diverse fields of science and technology and with emphasis on applied research and utilization of research results. There are at present 38 research establishments in different parts of the country, including five regional research laboratories. Some of the establishments have set up experimental, survey or field stations to further their research activities and 39 such stations attached to 16 laboratories are functioning at present.

Some of the CSIR laboratories are engaged in research, which contribute to the advancement of Indian industry whereas other laboratories deal with general needs of the Society such as food, fuel, buildings, roads, etc. A few of these are concerned with problems of interest to specific industries, like biotechnology, chemicals, drugs & pharmaceuticals, electronics, glass and ceramics, leather, minerals and metals, marine chemicals and scientific instruments. There are some laboratories concerned with research in mechanical engineering, aerospace science and engineering, electrochemistry, geophysics, oceanography, experimental medicine and toxicology. The regional research laboratories deal with problems of industrial development specific to their respective geographical areas.

In general, all the laboratories are equipped for applied research, including development work. They undertake surveys of industrial raw materials and research on their beneficiation, testing and standardization. Many problems of industry, and even of pure science, are multi-disciplinary in character, and require for their solutions the knowledge and techniques of more than one branch of science and call for teamwork. CSIR laboratories provide facilities for such teamwork. Research in CSIR laboratories also covers basic research aimed at exploring new frontiers of science.

CSIR has several programmes relating to water, energy, environment and health care and the new job creation/saving jobs, essentially to provide S&T base solutions

to economic development. In the following, results of a few of the more significant, both basic and applied researches, carried out by the national laboratories are presented sectorally.

1.1 AEROSPACE SCIENCE & TECHNOLOGY

NAL is a major player in India's aerospace programmes. It has developed a world class capacity for design, development and fabrication of large components of advanced composites for civilian and combat aircraft, structural testing and analysis, aerospace electronics and systems, innovative capabilities in surface engineering etc. The activities are focused on design, development, fabrication and airworthiness testing of small civilian aircraft and on creating, maintaining and providing high class expertise and world class test and certification facilities.

1.1.1 Progress made under Network projects

Some of the significant achievements project-wise are:

I. CATERING TO SPECIALISED AEROSPACE MATERIALS

The objective of the project is to formulate and execute a structured programme on development and characterization of different specialized aerospace materials and to provide materials related technological services to aerospace organizations.

PROGRESS:

NAL has developed some variants of the pressure sensitive paints and two of the paints developed have withstood 50 blow downs in the NAL high-speed wind tunnel without any performance deterioration.

II. HIGH SCIENCE & TECHNOLOGY FOR NATIONAL AEROSPACE PROGRAMMES

The main objectives of this programme are enhancing the capabilities for generating crucial design and certification data for aerospace systems; enhancing the knowledge base through R & D activity for increased self-reliance and freedom; building up new and critical facilities in the area to minimize dependence on foreign test facilities.

PROGRESS:

Application of pressure sensitive paints as a diagnostic tool for complex and 3D separated flows at high speeds has been found to be very satisfactory. Numerical techniques have been developed for modeling multiple damages in smart composites, addressing issues related to actuator / sensor debonding and substrate delamination. Fabrication techniques for manufacture of glass epoxy composites (flat and cylindrical) using combination of braiding and resin injection has been developed and demonstrated. Algorithms for on-line flight data/path reconstruction and parameter estimation, multi sensor and multi target tracking and fusion have been developed. Air Traffic Models have been simulated for Airports like Bangalore International Airport and Cochin International Airport.

III. SPEARHEADING SMALL CIVILIAN AIRCRAFT DESIGN, DEVELOPMENT & MANUFACTURE

The objectives of the project are to design and development of stretched HANSA; Civil Aircraft R&D, Civil Aviation Policy Research & Market Analysis; Indigenous development of critical LRUs with particular relevance to small aircraft; and Weight optimization and other improvements of SARAS to production standards; various versions of SARAS.

PROGRESS:

Configuration of the 4-seater aircraft (HANSA Streched version) finalized. Configuration design for the HT & VT and pressure bulkhead completed. Configuration for EICAS and autopilot finalized. Design and drawings completed for landing gear actuater and parts are under fabrication. Wing root rib weight optimisation SARAS structured completed. Composite empennage layout design and composite pressure bulkhead design of SARAS completed. Design of assembly jigs for weight optimised structure for SARAS completed.

1.1.2 Scientific Achievements under non-network programmes

COMPUTATIONAL FLUID DYNAMICS (CFD)

NAL, using Computational Fluid Dynamics (CFD) approach, analysed practical flow situations like flow on HANSA-3, SARAS aircraft and missile configurations. Some packages were also enhanced to compute real life flow situation like separated flows, flow over wings at large incidence, computation of unsteady flow over a helicopter rotor blade in hover and RANS simulation of flow past bow mounted sonar dome of a warship. A model approach has been used to study the liquid

sloshing in spherical tanks and successfully applied to calculate slosh frequencies in spherical tanks for different fill volume and Bond number conditions. The method was also extended to sloshing in satellite fuel tanks due to prescribed spacecraft rotational maneuvers.

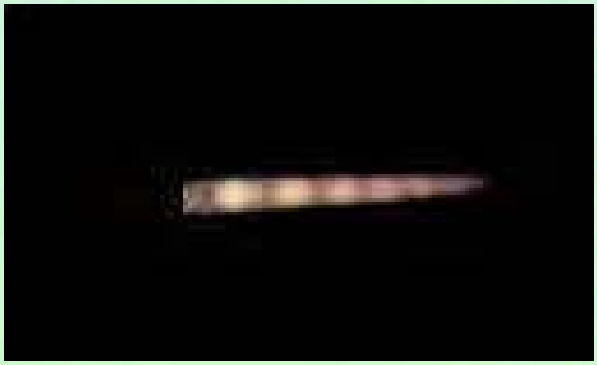
CO-CURED CO-BONDED COMPOSITE FABRICATION TECHNOLOGY

NAL has developed co-cured, co-bonded technology for fabrication of composite aircraft structures. The impact of this technology on national aircraft programmes is substantial as it reduces the space inventory, reduces down time during maintenance and ensures a higher degree of reliability. This is a national first in a field held closely by international players. The figure shows the fabrication of Trouser duct for TEJAS by this technique.

Trouser Duct for TEJAS

SUPERSONIC COMBUSTOR / SCRAMJET

NAL has successfully demonstrated combustion in supersonic flow regimes using both hydrogen and kerosene. Successful combustion has been achieved in the dual mode i.e. subsonic as well as supersonic flows and thus has fulfilled a major requirement for futuristic launch vehicles. The technology is very useful for futuristic propulsion systems.



Demonstration of supersonic combustion

SMART MATERIALS

NAL has been working on a number of aspects relating to smart materials and their application to aerospace systems. Technology for embedding fibre optic sensors in composite aircraft structures has been developed and demonstrated. Simultaneously, methodologies for sensor characterisation and interpretation of data provided by these sensors for detection of damage has been developed. This is a major contribution for *in-situ* structural health monitoring of aircraft components in flight. Successful use of shape memory alloys for deploying and retracting the mousche (a control surface) for the naval version of a fighter aircraft has been demonstrated on a prototype scale. This is a vital input in operating the aircraft from aircraft carrier. Another notable advance has been the application of smart materials for active vibration control using Lead Zirconate Titanate (PZT) technology. A "V-stack" actuator has been developed to enhance the flutter characteristics of a control *surface*

piezo actuator stack

AERO-INDIA 2005

During the Aero India 2005, as a part of showcasing NAL expertise and capabilities in aerospace area, SARAS Aircraft took to sky in the flying display while HANSA aircraft took part in both the static and flying display every day. These aircrafts received a high degree of appreciation from the aerospace community.

NAL stall, Aero India 2005

1.1.3 Human Resource Development

- A special ISO 9001-2000 Auditors Course for Internal Auditors was held.
- CSIR Programme on Youth for Leadership in Science (CPYLS) was held. 45 top ranking students from Karnataka State participated and were certified.

1.1.4 Recognition & Awards

Technology Shield	NAL
H. K. Firodia Award	Dr. T. S. Prahlad, NAL
National Aeronautical Prize for 2004 of the Aeronautical Society of India	Dr. K. Y. Narayan, NAL
Distinguished Alumnus of IIT-Chennai for 2004	Dr. P.R. Pai, NAL
Raman Research Fellowship	Dr. P.K. Panda, NAL
Mechanical Engineering Design Award 2004 of the Institution of Engineers	Dr. D.B. Venkatasubramanyam, NAL

1.2 BIOLOGY & BIOTECHNOLOGY

CSIR continues to make wide ranging contributions in the areas of genomics, control of gene expressions, recombinant DNA products, molecular & cellular biology, tissue culture, agro-biotechnology and fermentation. The work in these areas is not only getting published in high impact factor journal (Nature-Cell Biology, Science, Langumir etc. for example) but it is gratifying to note about its getting highlighted on the cover pages of different issues of journals as well. Work on multi locus, BKm derived probe for DNA fingerprinting has placed India among the first few nations, which has its own DNA finger printing probe. CSIR has done pioneering work on leishmania, cholera cataract formation in the eye, apoptosis, and antibacterial activity of plant sources. It has also developed several PCR based marker and diagnostic systems. CSIR has to its credit development of many new and improved strains for several medicinal, aromatic and flowering plants.

1.2.1 Progress made under Network projects

Some of the significant achievements project-wise are:

I. EXPLORATION AND EXPLOITATION OF MICROBIAL WEALTH OF INDIA FOR NOVEL COMPOUNDS AND BIOTRANSFORMATION PROCESS

The project envisages to exploit microbial diversity of the country for commercial exploitation through both culture dependent and culture independent methods, with ultimate goal of exploiting it as a major source of biotechnological products and processes.

PROGRESS:

***Molecular analysis of bacterial diversity by culture independent method*:**

- **ETP samples:** To understand the microbial diversity of ETP samples metagenomic DNA obtained was used for amplification of 16S RNA genes. The Eubacterial PCR products obtained from metagenomic DNA of Merind and Gharda ETP samples were cloned. More than 1000 recombinant colonies were obtained for each sample.
- **Hot spring microbial mat:** About 20 clones from a 16S gene library from metagenomic mat DNA were sequenced to obtain more than 500 bp sequence of the 16S gene. Sequence analysis by BLAST revealed that mat sample is dominated (58% clones) by bacteria related to Halothiobacillus sp. (89%-90% identity). Clones related to Desulfocaldus terraneus (2 clones, 94% identity), Cyanobacteria (2 clones, 91% and 95% identity), Thiomonas sp. (1 clone, 95% identity), Tistrella mobilis (1 clone 88 % identity), Betaproteobacteria (1 clone, 96% identity) and an uncultured bacterium (1 clone 95% identity) were obtained. The results indicate that hot spring mat microbial community possesses unique uncharacterized bacteria.

The fungus *Eupenicillium parvum*, isolated and recorded for the first time from tea rhizosphere, was studied for solubilization of phosphate substrates. The fungus shows high efficiency in the solubilization of tricalcium phosphate, aluminium phosphate and ferric phosphate, and North Carolina and Mussoorie rock phosphates. Twenty one bacterial isolates with high efficiency for phosphate solubilization were screened for their stress tolerance against desiccation. Nine isolates showed high tolerance to desiccation.

Thirty eight pseudomonades were screened for their antifungal activity against *Fusarium* spp., infecting gladiolus and carnation to assess the role of siderophores

in fungal antagonism. The results indicate the production of antifungal metabolites along with siderophores by 5 isolates.

Twenty-two *Trichoderma* isolates antagonistic to *Fusarium* spp. infecting gladiolus and carnation were characterized for their diversity for RAPD markers. Significant genetic variability was observed and the similarity coefficient values ranged from 0.05 to 0.60 amongst the isolates. The groups that emerged from cluster analysis represented two different species, with group I representing *T. harzianum* and group II representing *T. viride.*

II. MOLECULAR BIOLOGY OF SELECTED PATHOGENS FOR DEVELOPING DRUG TARGETS

Molecular biology description of a given pathogen plays major role in the development of a new drug for the given disease. The project envisages in depth study of molecular biology of a few pathogens for developing drug targets, namely for *Mycobacterium tuberculosis, Plasmodium falciparum, Leishmania Donovani, Fungal pathogens (C. albicans and A. fumigatus), Enteric pathogens (V. cholerae, S. dysenteriae and H. pylori).*

PROGRESS:

glnE (Glutamine Synthetase) as a novel drug target in M. tuberculosis: BLAST2 analysis of sequences of the predicted N-terminal and C-terminal domains of *GlnE* (Glutamine Synthetase), full-length ATase was concluded to contain two duplicated homologous domains. Protein secondary structure prediction using PHD server for the predicted N-terminal and C-terminal domains showed similar prediction of the helices and ß-sheets. Sequence alignment of *GlnE* from 59 bacterial organisms was analysed using *ClustalW*. It was found that the residues responsible for forming the phosphate binding loop and the metal binding residues in *E. coli* were conserved in *Mtb* as well. The phylogenetic trees for the conserved regions of *GlnE* and its substrate *GlnA1* have been generated to study the co-evolutionary pattern. Meanwhile, glnE (2985bp) has been successfully cloned in *pBlueScript* (SK+), which has been confirmed by PCR amplification of *glnE* from the recombinant clone and by restriction digestion with *NotI*.

III. DEVELOPING CELL & TISSUE ENGINEERING

The project targets to develop commercially sustainable and viable products in the field of Cell & Tissue engineering with applications in modern medicine, agriculture and basic sciences. It will come through new technologies and methodologies for maintaining and growing cells *in vitro*, developing new types of cells and tissues for transplantation into new hosts including humans, methods

for preparing commercially important compounds in cells and tissues of plant or animal origin etc.

PROGRESS:

***Studies on the basic properties and applications of stem cells in regenerative medicine*:** Significant progress has been made in the characterization of stem cells from different rodent and human tissues such as skeletal muscle bone marrow, fetal liver cells, limbal cells, etc. A technique has been standardized to isolate highly potent stem cells (SP cells) from the bone marrow using a simple staining technique and fluorescence activated cell sorting. Improved diagnostic methodology has been established for characterizing different categories of childhood acute lymphocytic leukemias and their management. A technology has been standardized for the isolation and *in vitro* growth of human melanocytes in serum free defined media for their use to treat of vitiligo patients. A new therapeutic protocol has been established for the treatment of Leishmaniasis in mouse models and its potential is being tested to develop this protocol for human application. A facility for breeding and maintenance of SCID/Hu mice has been established for carrying out transplantation of human tissues to do pre-clinical studies and develop new cell based therapies of human diseases. A new cell culture system has been developed for the maintenance of cybrid cells to develop new therapies for neurodegenerative diseases.

Isolation, characterization, production and application of special products from plants: A tissue culture based free cell-system for the controlled production of shikonin-based colors has been established. Some new components of the gene expression pathways involved in the production of commercially important colors from Arnebia euchroma have been identified. Preliminary identification and chemical characterization of specific molecules responsible for the unique flavour of alphanso mangoes has been done. A database using DNA markers to understand the diversity of alphanso mango trees has been developed. A transfection and expression system of the rabies virus glycoprotein has been established in the tobacco plant cells and the large-scale production of tobacco plants expressing this glycoprotein has been established. This strategy would be used for vaccination against rabies. Large-scale tissue culture and bioreactor based methods for production of biomass *Swertia chirata* and *Rauwolfia serpentina* have been established.

IV. TOXICOGENOMICS OF POLYMORPHISM IN INDIAN POPULATION TO INDUSTRIAL CHEMICALS FOR DEVELOPMENT OF BIOMARKERS

The project aims to understand the molecular basis of the toxic response, identify the biomarkers for toxic exposure, and screen the individuals in the population that are genetically predisposed for differential toxic response. It will help to design

suitable strategies for reducing the risk of the chemicals, mitigation and treatment of the toxic response, and adoption of preventive methods for the susceptible individuals.

PROGRESS:

Assessing natural variations in gene expression in humans by comparing with monozygotic twins using microarrays: Gene expression profiling in blood leukocytes with thirteen individuals (including five pairs of monozygotic twins) on 10,000 genes using HG U95Av2 oligonucleotide microarrays was done. The proportion of differentially expressed genes between monozygotic twins was low (0-1.76%). Variation in expression of genes between monozygotic twins can be classified as 'random variations'. Genes exhibiting random variations did not show clear preference to any functional class, although 'signaling and communication' and 'immune and related functions' generally topped the list. The extent of variation in gene expression increased in comparisons between unrelated individuals (0.37%-14.13%). Most of the genes (89%) exhibiting random variations in twins also varied in expression in unrelated individuals. As with twins, 'signaling and communication' topped the list and substantial variations were observed in all three categories: least variable, moderately variable and most variable. A striking outcome of this study was that the housekeeping genes were nearly insensitive to random variations but appeared to be more susceptible to genetic differences.

ArrayD: A general purpose software for microarray design: Software called 'ArrayD' is developed that offers various alternative design solutions for an array given a set of user requirements. The user feeds the following inputs: type of source plates to be used, number of gene probes to be printed, number of replicates and number of pins to be used for printing. The solutions are stored in a text file. The choice of a design solution to be used will be governed by the spotting chemistry to be used and the accuracy of the robot. ArrayD is a software for standard cartesian robots. The software aids users in preparing a judicious and elegant design, universally applicable and is available at http://www.igib.res.in/scientists/arrayd/arrayd.html.

V. DESIGNING ANIMALS AND PLANTS AS BIO-REACTORS FOR PROTEINS & OTHER PRODUCTS

The project envisages designing of transgenic plant, animal, and yeast bioreactors, to develop genetic transformation technology in novel hyper expression systems, to cell exploit bioreactors for production of high value biopharmaceuticals and to construct Gtases library for biotransformation (glucosylation) of natural products.

PROGRESS:

Designing of transgenic plants, animals and yeast bioreactors for therapeutic protein production:

Genes: The therapeutic gene "AAT" was synthesized with codon usage optimization. The gene was sequenced, characterized and confirmed. Similarly the native gene "Cecropin" from *Drossophila melanogaster* was cloned and characterized. Cloning of PPO and catalase has been achieved. Primers were designed for cloning SOD, which was cloned in expression vector. The glycoprotein G gene of rabies virus is already in hand.

Transformation protocol: The transformation and regeneration protocols for *Hyoscyamus* and *Cicer* being developed. Cloning and expression analysis of AAT and cecropin gene in yeast *Pischia* is in progress.

Down-stream processing: AAT purification protocol both from the native tissue matrix as well as from the plant admixture has been developed. Purified AAT has been characterized with respect to active site residues and structural attributes. PPO purification has been achieved and its properties characterized with respect to immobilization for TF production.

Development of genetic transformation technology in novel hyper expression bioreactor system: Three chloroplast transformation vectors have been designed. One chloroplast transformation vector has been developed for homologous recombination and biolistic mediated transformation carried out. Several putative chloroplastic transformants are now being screened. Cloning and reconstitution of second chloroplast vector for homologous recombination is at advanced stage. This system is being developed for novel hyper expression bioreactor system.

Cell exploit bioreactors for production of high value biopharmaceuticals: *In vitro* ergot associative system is being developed through cultured ovaries harboring *Claviceps* mycelia as a simulation of natural system. Sclerotia of selected lines have been analyzed for ergot alkaloid metabolites and quantitative isolation of the metabolites and intermediates is in progress. *Panax* callus cultures have been analyzed with respect to quantitative and qualitative ginsenosides through TLC and LC-MS. Ginseng cultures are being up-scaled to 10-20 litre scale using airlift and membrane bioreactor systems. A collection of 95 sponges from Mandapam coast has been made and these have been taxonomically identified. In the collected sponges, total content of protein and carbohydrates were estimated (mg/gm dry weight). Spicules and collagen network from the individual sponges have been isolated and light microscopy and scanning electron microscopy studies have been completed. Collagen (in small amounts) from the sponges *Iricinia fusca* and *Petrosia nigricans* has been isolated and hydroxy proline content (marker amino acid for collagen) from the isolated collagen has been estimated.

Construction of Gtase/Gdases library for biotransformation of natural products: A set of five Gdases of unique physico-kinetic characteristics has been identified. The set includes usual gluconolactone inhibition sensitive enzymes, gluconolactone inhibition insensitive, alpha-link specific, beta-link specific, conjugated gluco-specific and conjugated galacto-specific. Two GDases have been purified. A high temperature active GDase has been isolated and patent has been filed. Radiochemical assay screening (primary) has been carried out for progress towards the Gtases using artificial and natural substrates. 4-NP glycosylating GTases have been detected in several medicinal plants. GTases for geraniol, andrographolide, oleonolioc acid and some putative endogenouis substrate specific Gtases have been detected.

VI. MEDICINAL PLANT CHEMOTYPES FOR ENHANCED MARKER AND VALUE ADDED COMPOUNDS

The project envisages to enhance the production of around 20 commercially important high value drug molecules present in medicinal plants viz. Artemisia annua, Acorus calamus, Bicopa monnieri, cathranthus roseus, Picorrhiza kurroa etc.

PROGRESS:

***Artemisia annua*:** The first chemotype tagged through marker assisted breeding of this network programme (named CIM-AROGYA) was released and licensed to M/s Themis, India and M/s Vital Health Care for commercial exploitation. The chemovar has distinct DNA fingerprints, unique globular canopy, high biomass yield (553.0 q/ha fresh herb; 48.89 q/ha dry leaf and I.0% artemisinin against 438.4 q/ha fresh herb, 42.30 q/ha dry leaf and 0.5% artmisinin in best variety Jeevan Raksha). CIM-Arogya has now being multiplied for seed production for targeting 25,000 ha area of its plantation to make India a major global supplier of this anti-malarial molecule.

***Andrographis paniculata*:** Based on breeding and agronomic trials of the selected chemovars at two locations, the genotype AP-3 named as "CIM-MEGHA" has now been released as an improved cultivar (variety) for commercial cultivation in the country. The chemovar is characterised by open canopy type with a branch angle of 60^0 from the main stem, early maturing, tolerant to iron deficiency, 32-40 q/ha herb yield with 2.33-3.18 % andrographolide (against 1.79% in Check) and 0.76-1.32% neo –andrographolide content. One-step chemical conversion of andrographolide into Isoandrographolide with 90% recovery has been developed. A new diterpene named as "COR-002" has been identified as a novel marker in this plant. The new molecule is an isomer of andrographolide. Also, two new flavonoids named as 5,7-dihydroxy-8,2'- dimethoxy-flavone and 5-hydroxy-7,8-Di- methoxy flavone (andrographosides) have been isolated that show potent anti-neoplastic activity against mouse myeloid leukemia cells.

***Catharanthus roseus*:** A method for inducing direct shoot bud regeneration from leaf discs has been developed for the first time in *C. roseus*. This technological breakthrough will remove the biggest bottleneck of development of transgenic plants in this herb.

***Podophyllum hexandrum*:** New mechanical and hormonal treatments to break strong seed dormancy in this herb have been devised, enabling up to 93% germination. Method for detecting marker molecule podophyllotoxin in 2.0 mg plant tissue standardised. In addition to podophyllotoxin, 6 new markers namely deoxypodophyllotoxin, 4'-demethyl deoxypodophyllo-toxin, picropodophyllotoxin, iso- picropodophyllo-toxin, and 4-demethyl deoxypodophyllo-toxin glucoside have also been isolated for chemovar selection.

***Acorus calamus*:** Chemical modification of â-asarone (the predominant but undesirable component of the oil) into a novel neolignan with 65% recovery using double bond activation reaction followed by C_6-C_3 dimerisation has been achieved. Also, a method for converting â-asarone into 2,4,5 trimethoxybenzeldehyde, which is widely used in flavor and cosmetic industry, has been achieved.

***Chlorophytum borivilianum*:** One of the Chemovar, named as "CIM-OJ", has now been released as India's first genetically stable and uniform variety of Musli for distribution to farmers. The variety yields 83.4 q/Ha tubers, has moderate harvestable roots and is tolerant to leaf blight disease. Area covered by the variety so far is about 500 Ha. Agrotechnology package for commercial cultivation with concrete recommendations on optimal planting time, sowing rates, crucial in put requiring growth phase, harvesting schedule, spacing, intercroping with rainy and winter season crops for maximum returns has been developed and published in the form of Farm Bulletin for farmers. New polysaccharides based immunomodulatory and health promoting Marker has been isolated from gel forming aqueous extract of the roots. This is named as "Musli Glucomannan (MGM)".

***Picrorrhiza kurroa*:** Three chemovars rich in Picroside I or II (4.5 and 3.9 %, respectively) and with 200-250 g/plant root yield are in hand and are being multiplied at 3 locations in Kashir including a few farmers' field. A population of about 50000 plants of these chemovrs is being maintained. Methods for microanalytical quantification of markers from 10 mg plant material with 90% recovery have been standardized. Four new markers namely apocynin, androsin, 6-O-feruloylcatapol and PK-3 have been isolated for chemoprofiling. Picroside-I has been biotransformed into catapol, which is a laxative and diuretic drug in demand. Three genes involved in the Irridoid pathway namely, Thiamine biosynthesis, HMG-CoA and HMG-CoA reductase have been sequenced for pathway.

***Swertia chirayita*:** The eight accessions showed 0.01-0.59% of the target marker amarogentin from *Swertia chirayita*. A new marker compound mangiferin in *Swertia chirayita* is also isolated. An efficient micropropagation technique has been developed and patented. Four to ten weeks old *in vitro*-raised shoot cultures were analysed for marker molecules and were found positive. The content of these markers in 8 weeks old tissue culture varied from 0.07-0.085, 0.03-0.06 and 0.10-0.70, respectively.

***Bicopa monnieri*:** The fresh weight as well as dry weight (dry matter accumulation) at both 90 DAP and 120 DAP were significantly affected by FYM levels as well as plant spacing. Significantly higher yields were obtained with the application of 40 t FYM as compared to 20 t/ha. Also the plant material collected from Joginder Nagar gave higher yield than the material collected from Toru. Amongst the different plant spacing closer spacing of 20x20 cm gave significantly higher yields.

VII. DEVELOPMENT AND COMMERCILISATION OF NEW BIOACTIVES AND TRADITIONAL PREPARATION

The objectives of the project are to discover new single molecules as drugs and take them to the IND stage for diseases of interest to India and to the international community; Discover and develop herbals which function through different, mechanisms including metabolic activation and which are based on synergism; Introduce combination drugs including the use of bioenhancers which themselves are not drugs but increase the effectiveness of the drug; Introduce formulations and novel delivery systems which may be target specific; and Discover and develop new herbal pest management agents which influence the pests in the desired fashion but are safe for humans.

PROGRESS:

Around 12000 samples were bio-evaluated against various diseases and disorders [viz., malaria (4600), tuberculosis (3000), filaria (3600), hypertension (600), anxiety (85), depression (70) and dementia (110). Samples found active are at various stages of confirmation and reconfirmation.

1.2.2 Scientific Achievements under non-network programmes

Apart from network projects CSIR is making S&T progress in non-network mode also. Some of the significant achievements during the year are highlighted below:

CYLIN E IN CELL FATE DETERMINATION OF DROSOPHILA MELANOGASTER

CCMB has examined the process by which cell diversity is generated in neuroblast (NB) lineages in the central nervous system of *Drosophia melanogaster.* It has been

shown that the NB6-4t lineage represents the ground state, which does not require the input of any homeotic gene, whereas NB6-4a lineage is specified by the homeotic genes A*bd-A* and *Abd-B*. NB6-4a lineage is specified by down regulating levels of the G1 *cycline DmCycE (CycE). CycE,* which is asymmetrically expressed after the first division of NB6-4t, functions upstream of *pros* and *gcm* to specify the neuronal sublineage. Loss of *CycE* function causes homeotic transformation of NB6-4t to NB6-4a, whereas ectopic CycE induces reverse transformations. However, other components of the cell cycle seem to have minor role in this process, suggesting a critical role for CycE in regulating cell fate in segment-specific neural lineages.

DROSOPHILA MELANOGASTER FOR GENOTOXICITY ASSESSMENT

ITRC has conducted a study to validate the model, a modified Comet assay in *Drosophila melanogaster (*Oregon R^+), for evaluating somatic cell genotoxicity. Alkylating agents *i.e.*, ethyl methanesulfonate (EMS), methyl methanesulfonate (MMS), *N*-ethyl-*N*-nitrosourea (ENU) and cyclophosphamide (CP) which is recognized carcinogens were used. Briefly, third instar larvae (74 ± 2h) of *D. melanogaster* were fed different concentrations of EMS, MMS, ENU and CP (0.05, 0.5 and 1.0mM) for 24h. At 98 ± 2h, anterior mid gut from control and treated larvae were dissected out, single cell suspensions were prepared and Comet assay was performed. Results showed a dose dependent increase in DNA damage with all the four alkylating agents, in comparison to control.

CHAPERONE-LIKE ACTIVITY OF A LENS PROTEIN

CCMB has generated two chimeric proteins, alpha ANBC and alpha BNAC, in which the N-terminals of alpha A and alpha B crystallins have been swapped. Swapping the N-terminal domain between human alpha A and alpha B crystallins makes a more effective chaperone in the case of alpha BNAC chimera, whereas alpha ANBC chimera loses its protective abilities completely. This study provides a promising protein engineering approach to enhance the chaperone-like activity of alpha - crystallin, which may give useful leads to design strategies to tackle chaperone-diseases such as cataract.

GENE DELIVERY AND DRUG DELIVERY SYSTEMS

CCMB has developed several cationic lipid formulations for efficient gene delivery. Further, new lipids with several hydroxyl moieties in the head group were synthesized. These molecules were as efficient as the dihydroxy analogue in all the cell lines tested. At lower charge ratios the cationic lipids enhance the transcription of DNA. A mutant lipase has also been isolated, which is 6 times more active than the wild type at 55° C.

"CIM-GROW"- A HIGHLY EFFECTIVE PLANT GROWTH PROMOTER

CIMAP has selected a superior bacterial strain (*Bacillus* sp CIMAP B1) on the basis of its influence on the enhanced growth of several medicinal and aromatic plants and unique antagonistic behavior against wide range of fungal pathogens known to infect medicinal and aromatic plants. The strain was exploited for the development of the product, designated as 'Cim-Grow' using semi-synthetic medium for growth and multiplication on the simple carrier medium (vermicompost) in polyethylene bags. It is considered to be a safe and effective product due to rapid multiplication in the carrier medium and formation of resistant spores. 'Cim-Grow' was tested alone and in different combinations to test their effectiveness on the plant growth and productivity of geranium. It produced 298.5 g / pot herb yield when treated alone. The increase was recorded to be 95% over untreated control (153.1g/plant). The combination of 'Cim-Grow' with *G. aggregatum* increased herb yield by 102.9% over control. In combinations of other bio-inoculants, viz. *G. aggregatum* + *Streptomyces* sp., it produced 346 g/pot herb yield which was recorded to be 126.2% more than that with untreated control.

SWEET SMELLING PEPPERMINT GENOTYPE 'CIM-MADHURAS'

CIMAP has developed a method to allow open pollination in the available parent cv Kukrail followed by single seed progeny selection through chemoprofile and aroma matching the best available commercial samples of oil. A sweet smelling chemotype 'CIM-Madhuras' is produced as a result. `CIM-Madhuras' were produced 51 kg herbage per 25 m^2 plot, which was highest compared to all the control varieties. The herb contained about 0.65% oil.

"CALLITERPENONE" A NATURAL PLANT GROWTH PROMOTER FROM *CALLICARPA MACROPHYLLA*

CIMAP has isolated Phyllocladane diterpenoids from *Callicarpa macrophylla,* which shows remarkable plant growth promoting activities in various pot, tissue culture and field experiments. Among Calliterpenone and its four derivatives valuated for plant growth promoting activities, calliterpenone was found to be the best, for seed germination, root growth, and overall growth of the plant, even better than GA_3 and IBA the commonly used plant growth promoters. A bench scale process for isolation of calliterpenone has been developed (0.4-0.9% yield).

"CIM-LIV"- A HIGH SILYMARIN YIELDING CULTIVAR OF MILK THISTLE

Milk thistle, *Slibum marianum* is an important medicinal plant and has considerable market potential and is used in various drugs for liver protection. CIMAP developed a high yielding cultivar "CIM-LIV" of *Slibum marianum,* which possesses 2.8%

yield of silymarin. The plant of this cultivar is tall with erect growth habit and yields 12-14 q seeds per hectare. The silymarin yield content is 35 kg/ha. The process for the hepatoprotective agent silymarin from the plant *Silbum marianum* was also developed on bench scale (100 gms seed per batch). The process is now being scaled up to pilot plant level (40 kg seeds / batch). Some of the processes involved are already scaled to pilot level.

"CIM-CHANDNI"- HIGH YIELDING NEW VARIETY OF CLARYSAGE (*SALVIA SCLAREA*)

Clraysage (*Salvia sclarea*), an important aromatic perennial temperate plant of family *Lamiaceae,* is cultivated for production of essential oil- a source of fragrance due to its refreshing and long lasting note and also possesses medicinal properties. CIMAP developed the white flower variety named as "CIM-Chandni" whose per hectare yield is 20 kg against 14 kg of control. The major oil constituents linalool and linalyl acetate in "CIM-Chandni" are about 26.2% and 52.4%, respectively.

ONE POT PROCESS FOR ANTIMALARIAL DRUG ARTELINIC ACID

The water-soluble derivative, sodium artesunate, prepared from artemisinin is useful in the treatment of cerebral malaria but its utility is impaired by its poor stability in aqueous solution and extremely short plasma half-life. Sodium artelinate, another water-soluble derivative of *artemisinin* possesses comparable antimalarial activity *in vitro* as well as *vivo* to *artemether* and *arteether*. It is currently under preclinical testing and has been considered as the best candidate among the available water-soluble derivatives of artemisinin. Basically *artelinate* is being prepared in three steps (reduction, alkylation and hydrolysis) in three different pots. CIMAP has developed a one-pot process, which does not require isolation of intermediate products, dihydroartemisinin (DHA). Methyl artelinate produces artelinic acid with higher yield, 85-88% in 10-12 hours as compared to prior art three pot processes with yield between 43.5 to 53% in 4 to 5 days.

IN VITRO SOMATIC EMBRYOGENESIS FROM KAPPAPHYCUS ALVAREZII (DOTY)

CSMCRI has successfully demonstrated i*n vitro* somatic embryogenesis and regeneration of somatic embryos to whole plants through micro-propagules from pigmented uniseriate filamentous callus of *Kappaphycus alvarezii* (Doty) in axenic cultures. More than 80% of the explants cultured on 1.5% (w/v) agar solidified Provasoli enriched seawater (PES) medium showed callus development. The callus induction rate was consistently higher for laboratory-adapted plants. Transfer of embryogenic callus along with tiny somatic embryos to liquid medium and swirling on orbital shaker facilitated rapid growth and morph genesis of somatic embryos

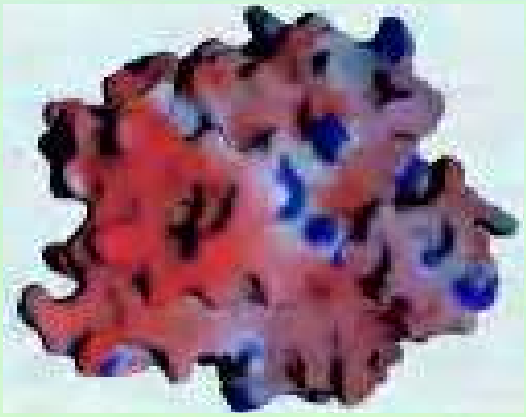
into micropropagules that grew into whole plants in subsequent cultivation in the sea. The daily growth rate of one tissue cultured plant was monitored for seven generations in field and found to be as high as 105-1.8 times over farmed plants.

INHIBITION OF BCR-ABL TYROSINE KINASE BY CHLOROGENIC ACID

IICB has found that chlorogenic acid (Chl) induces apoptosis of several Bcr-Abl–positive chronic myelogenous leukemia (CML) cell lines and primary cells from CML patients *in vitro* and destroys Bcr-Abl–positive K562 cells in vivo. In contrast, this compound has no effect on the growth and viability of Bcr-Abl–negative lymphocytic and myeloid cell lines and primary CML cells. Sodium chlorogenate (NaChl) exhibits 2-fold higher efficiency in killing K562 cells compared with Chl. The results indicate that inhibition of Bcr-Abl kinase leading to activation of p38 mitogen-activated protein (MAP) kinase may play an important role in the anti-CML activity of chlorogenic acid.

POLYKETIDE SYNTHASES

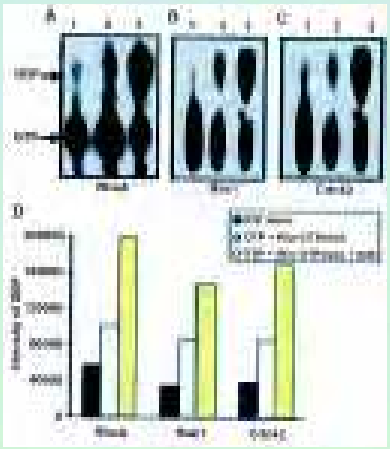
CCMB studies show that the superfamily of plant and bacterial type III polyketide synthases (PKSs) produces diverse metabolites with distinct biological functions. PKS18, a type III PKS from *Mycobacterium tuberculosis*, displays an unusual broad specificity for aliphatic long-chain acyl-coenzyme A (CoA) starter units (C_6 to C_{20}) to produce tri- and tetra-ketide pyrones. The crystal structure of PKS18 at 2.25 Å resolution reveals a remarkable 20 Å substrate-binding tunnel, hitherto unidentified in this superfamily of enzymes. This remarkable cavity, extending from the active site to the surface of the protein, is primarily generated by subtle changes of backbone dihedral angles in the core of the protein. Mutational and functional analysis of this cavity emphasizes its significance in substrate specificity and also offers new insights into the product release mechanism. This first bacterial type III PKS structure underlines a fascinating example of how delicate changes in protein architecture can generate metabolite diversity in nature.



A surface representation of PKS 18 shown with the novel substrate binding tunnel perpendicular to the plane of the paper.

NUCLEOSIDE DIPHOSPHATE KINASE OF MYCOBACTERIUM TUBERCULOSIS

IGIB has identified for the first time Nucleoside diphosphate kinase (Ndk), to be present in supernatant of M. tuberculosis H(37)Rv that stimulates the conversion of GTP-bound Rho-GTPases to the GDP-bound form. This culture supernatant protein that stimulated *in vitro* GTP hydrolysis by members of Rho-GTPases. The histidine-117 mutant of Ndk, which was impaired for autophosphorylation and nucleotide-binding activities, showed GAP activity. These results suggest that Ndk of M. tuberculosis functions as a Rho-GAP to downregulate Rho-GTPases, and this activity may aid in pathogenesis of the bacteria. GAP activity of Ndk with Rho-GTPases loaded with [a-^{32}P]GTP. GSH–Sepharose beads bound GST-Rho/Rac/Cdc42 proteins (1 mg each) were incubated with 3 mCi of [a-^{32}P]GTP at 25°C for 5 min, beads were washed thrice and incubated with or without Ndk (0.5 mg) in separate reaction mixtures at 25°C for 5 min. Beads were washed twice and bound nucleotides were eluted, resolved on PEITLC plates and visualized by an autoradiogram. (A–C) Lane 1, [a-^{32}P]GTP alone; Lane 2, [a-^{32}P]GTP plus Rho-GTPases (RhoA, RacI and Cdc42) and Lane 3, [a-^{32}P]GTP plus Rho-GTPases and Ndk. (D) Intensity of GDP formed was quantified by densitometer. The intensity of GDP formed when [a-^{32}P]GTP was loaded either with Rho-GTPases alone or in combination with Ndk is as shown below:



STRUCTURAL BIOLOGY OF PROTEINS AND ENZYMES

IMT explains the biochemical nature and the essential aminoacids responsible for the reaction mechanism of Nucleotide diphosphate kinase (NdK) of *Mycobacterium tuberculosis* on the basis of the structure. Likewise the structural analysis of similarly looking SH3-like fold proteins showed that they all have similar binding sites specific to a variety of ligands, in spite of a large sequence variation. The structure of D-hydantoinase showed how mercury inhibits the function of hydantoinase enzyme. The structure of D-hydantoinase will be very helpful in designing novel hydantoinase mutants, which can be used to produce desired aminoacid derivatives.

A RAPID METHOD OF SEQUENCING LONG SYNTHETIC PEPTIDE

IGIB has developed a very simple and efficient method of sequencing of long peptides, using long polyglutamine stretches with and without interruptions, as model peptides, using MALDI-ToF in a linear mode. The method does not require any enzymatic or proteolytic digestions, and very long synthetic polyglutamine sequences can be sequenced efficiently, just by incremental variation of laser power. This method provides an alternative tool for validating long polyglutamine stretches, which are very often used as models for studying the structure and conformation of proteins associated with a number of neurodegenerative disorders.

SPAAN: A SOFTWARE FOR PREDICTION OF ADHESINS AND ADHESIN-LIKE PROTEINS USING NEURAL NETWORKS

The adhesion of microbial pathogens to host cells is mediated by adhesins. IGIB has employed 105 compositional properties and ANN to develop SPAAN, which predicts the probability of a protein being an adhesin (Pad). SPAAN had optimal sensitivity of 89% and specificity of 100% on a defined test set and could identify 97.4% of known adhesins at high Pad value from a wide range of bacteria. Further, SPAAN guided in improved annotation of several proteins as adhesins. Novel adhesins were identified in 17 pathogenic organisms causing diseases in humans and plants. In the Severe Acute Respiratory Syndrome (SARS) associated human corona virus, the spike glycoprotein and nsp's (nsp1, nsp5, nsp6 and nsp7) were identified with adhesin-like characteristics. These results offer new leads for rapid experimental testing.

LANGMUIR–BLODGETT FILM BASED BIOSENSOR

IGIB has developed a mono-enzyme amperometric biosensor for the estimation of galactose in milk and milk products. Galactose oxidase was immobilized with poly(3-hexyl thiophene)/stearic acid (P3HT/SA) on to indium tin-oxide (ITO) coated glass plates using Langmuir–Blodgett (LB) film deposition technique. This P3HT/SA/GaO LB film on ITO-coated glass plate was used as working electrode with platinum as reference electrode for development of galactose biosensor. The biosensor shows the linearity 1–4 g/dl galactose. The electrode was found stable upto 45 °C and has a shelf life of more than 90 days.

GENES OF ASPERGILLUS FUMIGATUS

IGIB has generated 125 expressed sequence tags (ESTs) from 200 phage clones of a non-normalized cDNA library to identify genes of *aspergillus fumigatus*, a fungal pathogen, causes a spectrum of allergic and invasive disorders. Out of a novel 68 ESTs, 45 were assigned putative functions based on the sequence similarity. The

identities of some of these genes suggest that they may be involved in pathogenesis or autoimmune reactions. Additional genes were identified that are possible targets for the development of antifungal drugs or that may be of use in diagnosing fungal infections.

PLANT VIRAL GENOME ORGANIZATION

IHBT completed the nucleotide sequencing of an Indian isolate of *Carnation mottle virus* (CarMV). It was determined to be 4005 bp in length, 2 bp longer than previous reports. Coat protein (CP) and movement protein (MP) genes from annual and perennial carnations were amplified by RT-PCR. Primers were designed for the amplification of all the genes encoded by the *Carnation etched ring virus* (CERV) genome viz. Movement Protein, Aphid Transmission Factor, DNA Binding, Coat Protein, Poly protein, Inclusion Binding matrix genes and for complete genome amplification. The genome of CERV was sequenced by amplifying the complete genome of CERV using primers from 5′ and 3′ end and with internal primers that amplify individual genes and parts of the genes, which were subsequently cloned and sequenced.

VAXIPRED: A SUITE OF PROGRAMS FOR COMPUTER-AIDED VACCINE DESIGN

In the last 5 years, a large number of computer aided prediction and design methods have been developed by IMTECH. These allow a user to predict B or T cell epitopes with high accuracy. Though these methods are available to the public in the form of web servers and are heavily used by the scientific community, they were not considered as user-friendly as commercially available programs. A large number of computer programs have been integrated in a single software, where users can input their sequences only once and thereafter use all the programs through a single command. The value addition through integration makes this software package very attractive for the rapid prediction of potential vaccine candidates in an antigen.

DELIVERY OF ANTIGEN IN ALLOGENEIC CELLS

IMTECH has examined the possibility of evoking antigen-specific T cell immune response by using allogeneic cells as a source of adjuvant and also as a vehicle to deliver antigen. The mice were immunized with antigen-pulsed allogeneic cells. It was observed that this immunization strategy chiefly elicited antigen specific $CD4^+$ Th1 cell response. This study therefore provides a rational approach for skewing immune response to evoke cell-mediated immunity especially since cell-mediated immunity is cardinal in defending against TB, AIDS, malaria, etc. It has also been demonstrated that a 150-kDa protein associated with the surface of macrophages is responsible chiefly for the activation of Th1 cells and is constitutively expressed

on peritoneal but not splenic macrophages isolated from mice of different genetic backgrounds: Balb/c, C57BL/6 and C3He. However, it was expressed not only on peritoneal but also on splenic macrophages of non-obese diabetic (NOD) mice. Expression on splenic macrophages was significantly induced by culture with lipopolysaccharide (LPS), interferon (IFN)-gamma and granulocyte-macrophage colony stimulating factor (GM-CSF) and cross-linking of B7-2, CD40 and ICAM-1. In contrast, the expression was inhibited by interleukin (IL)-10.

AGNI

NBRI has developed an excellent hybrid from a cross between cultivar 'Charm' and cultivar 'Pink Pearl'. This hybrid produces 1-2 scapes (50.0 cm tall) bearing 2-4 horizontal flowers during March-April and lasts for a week. The flowers are large in size (19.0 cm across), flat faced, fully open, showy and attractive red (47A/F-1) colour and no streaks present on ground colour of the petal. The throat is yellowish green in colour (150 C/F-3). The petal texture and bloom quality are very good. The plant is evergreen and produces dark green foliage. This hybrid does not produce seeds but it can be used freely as a male parent.

'Agni' - A new hybrid of Hippeastrum

SAINT BERNARD'S LILY

NBRI has introduced *Chlorophytum bichetii* (Karrer) Backer popularly known as 'Saint Bernard's Lily' belonging to family Liliaceae with handsome foliage. The plant is native to Gabon (Tropical West Africa) and has been performing well at Lucknow under sub-tropical climatic conditions. It is a dwarf herbaceous plant with fleshy roots growing to 20 cm high forming bushy tufts of linear-lanceolate leaves 10-20 cm long and 0.85-1.66 cm wide, thin-leathery, fresh-green with yellowish white stripes particularly along margin, distinctly petioled. The flower stalks, distinctly shorter than the foliage, are slender, lax and usually branchless, flowers white rather larger than those of other *Chlorophytum* under cultivation, pedicels jointed below middle.

Chlorophytum bichetii (Karrer) Backer

DEVELOPMENT OF PLANT GROWTH PROMOTING *TRICHODERMA* TECHNOLOGY

NBRI has developed a technology for mass production of *Trichoderma* based biopesticide by using solid state fermentation. The *Trichoderma*-based bio-pesticides have been found to control soil borne diseases of economically important crops viz. betel vine, chickpea maize, sunflower, mustard, gladiolus etc. Novel plant growth promoting microorganism (*Pseudomonas* and *Bacillus* and *Trichoderma* strains) based products, were also developed which have the ability to control phyto-pathogenic fungi, promote plant growth, tolerance for abiotic stresses, and solubilize phosphate even under abiotic stress conditions. The products are useful as plant growth enhancer and bio-fungicide for seed, soil, and foliar applications.

BAMBOO MICROPROPAGATION

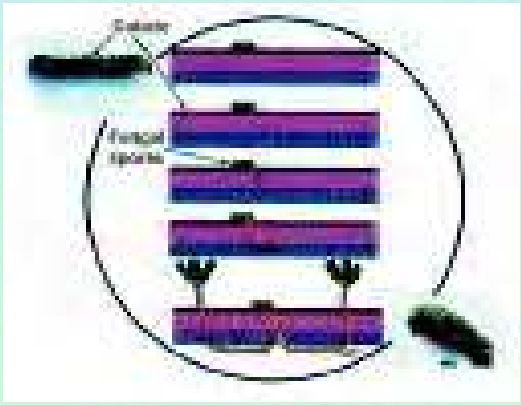
IHBT has standardized protocol for somatic embryo genesis from mature explants of *Dendrocalamus hamiltonii*, tracing morphogenetic events using histological techniques and biochemical analysis of amylase secretion during somatic embryo genesis. Prior selection of the seedlings in the field grown plants of *D. hamiltonii* was ensured before attempting mass propagation both through nodal explants *in vivo* as well as through tissue culture. The selections were based on the growth performance of the seedlings in the field conditions and the propagation from mature plants of known physiological age ensured better performance in the field.

EXTRACT OF *RHODODENDRON ARBOREUM*

IHBT has developed a simple and convenient process to extract and enrich colour by removing highly hygroscopic, non colouring water soluble portion from *R. arboreum* flowers using polymeric resin to obtain brick-red colour free flowing non-hygroscopic solid (yield 3% in the raw material). It is readily soluble in alcohol/ water. The solid is rich in phenolics stable colour. It was stable up to 150^0C, under sunlight for 4 hr. and to acidic medium.

SOFTENING INSECT CELL WALLS FOR KILLER FUNGI

NCL have uncovered the role of certain enzymes in "softening" the cell wall of pests. These enzymes could greatly enhance the effectiveness of a certain class of pesticides called myco-pesticides. Myco-pesticides use fungi to kill pests. The mechanism by which fungal pesticides (or myco-pesticides) act is: the fungi produce dry spores that stick to the body of the insect. After attachment, the fungal spores produce filaments called hyphae that penetrate the body of the insect. These filaments then multiply and poison the pest. Typically, the fungal filaments enter the insect body via wounds or through joints between segments of the insect body or via its sense organs. The main barrier in the penetration process is the hard skin (cuticle) of the insect that is composed of a hard polymer called chitin. Therefore, if the insect cuticle can be softened, the pest can be killed faster by fungal filaments. It has been demonstrated that certain enzymes in conjunction with these fungi can form a highly effective integrated formulation to kill pests. For example, in lab tests, use of the enzyme with *Metarhizium anisopliae*, a fungus used against a pest called the gram pod borer (*Helicoverpa armigera*) took less than three days to eliminate the pest.

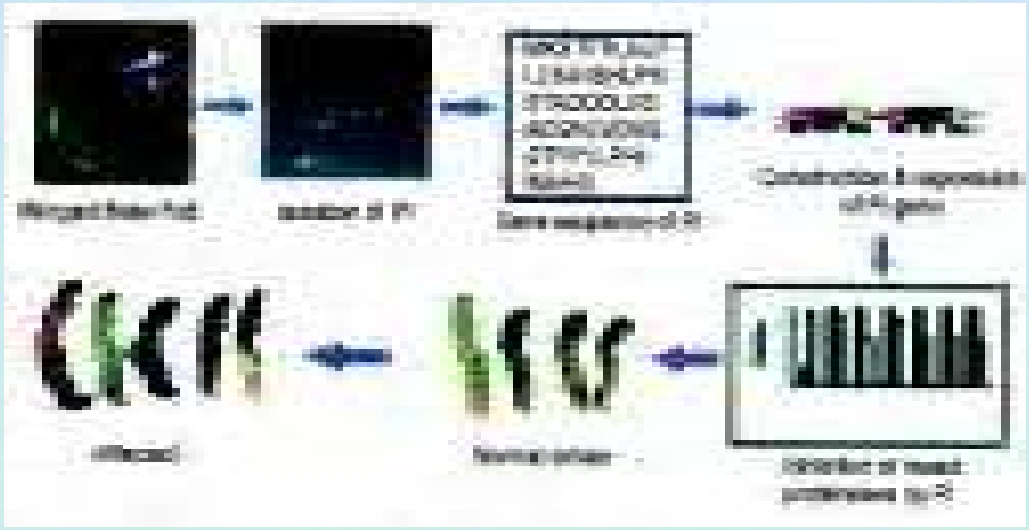


Schematic of softening of insect wall 1

PEST RESISTANT PLANTS

NCL has demonstrated the effectiveness of a novel approach to thwart pests by developing pest-resistant variety of chickpea. To defend themselves against insect attack, plants synthesize a wide range of molecules. Of these, the Proteinase Inhibitors (PI) block digestive capabilities of the insect and, are detrimental to the growth, development and reproductive potential of insects. These molecules are part of the plant's natural defense system. The proteinase inhibitor synthesized by a plant might not be effective against all insects. NCL has found that the Gram Pod borer disarms the host plant's natural defense mechanism by inactivating proteinase inhibitors and, then feeds on them. Several other plants were screened, which were resistant to the Pod borer and identified their Pls. The study revealed that when Pls from winged bean, bitter gourd, capsicum, potato and groundnut were fed to the Pod borer, its growth and, egg-laying/hatching abilities were

dramatically retarded. The genes responsible for these PIs have been isolated and successfully transferred to bacteria and yeast. The PIs synthesized by these organisms show effective activity against the Pod borer.



XYLANASES FROM MARINE FUNGI FOR POTENTIAL USE IN BIOBLEACHING OF PAPER PULP

NIO has screened obligate and facultative marine fungi for xylanase activity. Several fungal isolates were obtained from marine habitats showed alkaline xylanase activity. The crude enzyme from NIOCC isolate 3 (*Aspergillus niger*), with high xylanase activity, effluents-free and unique properties containing 580 U l sup(-1) xylanase, could bring about bleaching of sugarcane bagasse pulp by a 60 min treatment at 55°C, resulting in a decrease of ten kappa numbers and a 30% reduction in consumption of chlorine during bleaching. The culture filtrate showed peaks of xylanase activity at pH 3.5 and pH 8.5. When assayed at pH 3.5, optimum activity was detected at 50°C, with a second peak of activity at 90 °C. The crude culture filtrate also showed moderate activities of beta-xylosidase and alpha-L-arabinofuranosidase, which could act synergistically with xylanase in attacking xylan. This is the first report showing the potential application of crude culture filtrate of a marine fungal isolate possessing thermostable, effluents-free alkaline xylanase activity in biobleaching of paper pulp.

BIOTRANSFORMATION OF NICOTINIC ACID TO 6-HYDROXYNICOTINIC ACID

RRL-Jorhat has developed a process to produce high concentration of 6-hydroxynicotinic acid under mild reaction conditions with a yield of 90-95%. The process uses an indigenous bacterial strain *Pseudomonas* sp. RLJ12N for producing

100-120g/l of 6-hydroxynicotinic acid by reacting nicotinic acid with resting cells of the organism in aqueous medium at pH 6.5 - 8.5 and at 25-350C over a reaction period of 17-24 h. The product yield is high (90-95%) due to high specificity of the nicotinic acid hydrolyase present in the strain RLJ12N.

1.2.3 Human Resource Development

CCMB

- Hands on training course on "Chromosomal & Molecular Diagnostics"
- A Three-day Symposium on "Molecular medicine and health"
- An International Conference on Translational Research (B2B-2K5) for "Cancer and Other diseases"
- Hands on training course on "Advanced Microscopy and Image Analyses"
- International EMBO workshop on "Cell Interactions in Development and Diseases"
- International workshop on "Bioinformatics"
- Summer training: CCMB conducts summer training programme for M.Sc. students every year in the month of May-June. During the year, 28 M.Sc. students were chosen on a national basis for hands on research training

IGIB

- An innovative course-work program in integrative biology for Ph.D. students has been launched. The program is specially designed to encourage young minds to thinking vacuum and come up with integrative methods of approaching contemporary challenging problems in biology. The broad areas that would be covered in this course are biological information flow, time and space in biological systems, system biology approach to biomaterials and organ systems, host-pathogen interactions, microbial community structure and dynamics and bio-tools theory and practice.

IHBT

- Training on: Medicinal and aromatic plants; Bioresource awareness; Production of disease free planting material; IPR
- CSIR Programme on Youth for Leadership in Science: Thirty three participants attended the programme. The students were exposed to R&D activities and research facilities of the Institute.

IMTECH

- Summer & Winter Training Programme for M.Sc. (Biotechnology) students
- A two week short-term training course on "Trends in Fermentation, Recovery and Purification of Biomolecules"
- National Workshop on "Docking and Molecular Simulations of Proteins"

NBRI

- Six two-day training programmes on dehydration of flowers and floral crafts were organised at various places.
- Training has also been imparted about home gardening and sustainable use of kitchen wastes.

RRL-JORHAT

- The laboratory is conducting the Govt. of India Trade Apprenticeship Training and Graduate Apprenticeship Training Schemes.
- Year of Scientific Awareness (YSA-2004) was organized by the laboratory. Various programmes like open house on a series of topics of agriculture practices, general health, science and superstition, child health care, biodiversity, chemistry, hazard mitigation etc. have been organized.
- CSIR Programme on Youth for Leadership in Science (CPYLS): 57 toppers from various schools took part in the programme.
- Science Motivation Programme: A 5-day Science Motivation Programme was held for school students of Assam and Manipur during 12-16 July, 2004. Thirty nine participants comprising students, teachers and officials from Manipur Science and Technology Council (MASTEC) and Tripura State Science and Technology Council participated in the programme.
- Training on cultivation technologies of Medicinal & Aromatic Plants and Mushroom to various sections of society viz. farmers, men and women, Bank Manager and Govt. officials.

1.2.4 Recognition & Awards

"The Great Son of the Soil" award by All India Conference of Intellectuals (AICOI) Honorary D.Sc. from Banaras Hindu University	Dr. Lalji Singh, CCMB
INSA Medal for Young Scientist	Ms. Pallavi Kshetrapal CCMB
Fellow of Indian Academy of Sciences, Bangalore	Dr. D.P. Kasbekar, CCMB
Shanti Swarup Bhatnagar Prize in Biological Sciences- 2004	Dr. R. V. Sonti, CCMB
Fellow of Indian National Science Academy	Prof. S. Roy, IICB
Fellow of Indian National Science Academy	Prof. A. Dutta, IICB
Chairman of West Bengal Science & Technology Council	Dr. H.K. Majumdar, IICB
Elected as Council Member of Human Genome Organization (HUGO) for a period of 3 years.	Prof. S. K. Brahmachari, IGIB
CSIR Young Scientist Award in Biological Sciences 2004	Dr. D. Dash, IGIB
"Ranbaxy Award" for the year 2003	Dr. G. Sahni, IMTECH
Scientific Advisory Committee of M/s Nagarjuna Fertilizers & Chemicals, Ltd. Hyderabad	Dr. Amit Ghosh, IMTECH
Fellow of Indian National Science Academy	Drs. G.P.S. Raghava & J.N. Agrewala, IMTECH
Guha Research Conference	Drs. P. Guptasarma & Jagmohan Singh, IMTECH
B.P. Poddar Memorial Award (2003-04) for environmental improvement / awareness	Dr. N. Saika, RRL-Jorhat
AMI Louis Pasteur Award for the year 2004 for outstanding research contribution	Dr. T. C. Bora, RRL-Jorhat

Expert, Advisory Board for Formation of Vedic Medicine Initiative (VMI) Centre at SGPGIMA, Lucknow Member, Reconstituted Task Force on 'Biotechnology based for SC/ST and Rural Population', DBT	Dr. P. Pushpangadan, NBRI
Govt. of India Fellowship Award-2004 of National Environmental Science Academy	Dr. P. Pushpangadan, NBRI
Biotech Product, Process, Development and Commercialization Award 2004 Fellow of the National Academy of Agricultural Sciences (FNAAS)	Dr. C.S. Nautiyal, NBRI

1.3 CHEMICAL SCIENCE & TECHNOLOGY

CSIR has come to enjoy high credibility with the chemical industry especially in the areas of agrochemicals, catalysts, and chemical intermediates-subsectors characterized by high level of innovativeness. Some of the significant achievements in network and non-network projects are presented below:

1.3.1 Progress made under Network Projects

I. DEVELOPMENT OF CATALYSIS AND CATALYSTS

The project envisages development of novel mesoporous materials that includes Nano tubes and Nano particles and evaluation in catalytic oxidations.

PROGRESS:

***Mesoporous materials/ Supported Materials & Organic functionalizations*:** The synthesis protocols for stable MCM-41, MCM-48 and SBA-15 type mesoporous materials, were developed. Carbon based mesoporous materials were synthesized using silica based mesoporous materials as template. These materials are being tested for volatile organic carbon (VOC) removal.

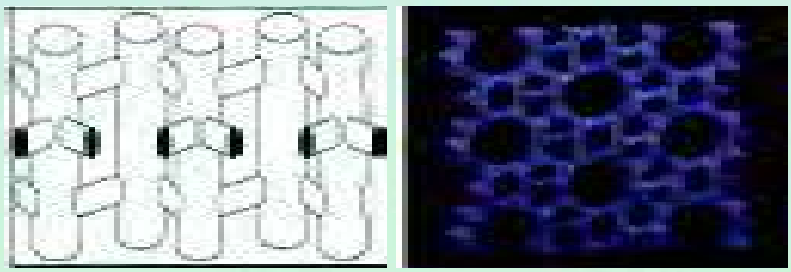
Fine specialty chemicals:

CO_2 utilization- A process for synthesis of dimethyl carbonates by transesterification of the cyclic carbonates with aliphatic alcohols was carried out with high yield using a variety of solid catalysts including alkali doped alkaline

earth metal oxides like MgO, various tungsten oxides, nitrogen containing ligand anchored on mesoporous materials.

Chiral auxiliaries and chiral catalysis: Ruthenium-based homogeneous catalyst was combined with the solid silicate supports such as mesoporous MCM-41 and MCM-48 materials, to produce a new and efficient heterogeneous asymmetric hydrogenation catalyst. NCL has demonstrated that the heterogeneous catalyst exhibits high conversion (>90%) and high selectivity (up to 99%) towards a particular enantiomer in the hydrogenation of a variety of prochiral ketones to chiral alcohols. The efficiency of the new catalyst in terms of activity and enantioselectivity is very high compared to previously reported catalysts in the literature. The stability and reusability of the heterogeneous catalyst make it a potential candidate for utilization in industrial asymmetric hydrogenation reactions.

DeNOx Catalyst: Various rhenium-oxide entrapped zeolite catalysts were prepared by pre and post synthesis modifications of zeolites to achieve better support metal interactions to enhance the stability of metal active sites at reaction conditions employed. Synthesis of zeolites was performed in stainless steel autoclave covered with Teflon and the structure of the material was confirmed by XRD. Among the various zeolites, H-ZSM-5 exhibits suitable pore geometry with pore diameter of around 5.5 A for the formation of rhenium oxide nano-clusters that are anchored to zeolite walls by long range and short range chemical bonds.



ZSM - 5 pore channels and across sectional view

II. DEVELOPING GREEN TECHNOLOGIES FOR ORGANIC CHEMICALS

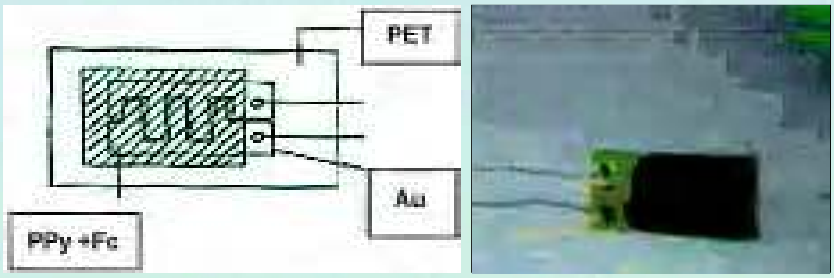
The project targets to develop Green processes for bioactives from medicinal plants value-added organic chemicals from biomass and agro industrial wastes, alkylation and oxidation of aromatic compounds, fluoroorganics by chemical/electrochemical methods and novel mesoporous nanomaterials.

PROGRESS:

Isopropylation of benzene to 1,3-diisopropylbenzene using alkylhalide under solvent free conditions: Synthesis, characterization and catalytic screening of different catalysts with different zeolite structures for the isopropylation of benzene

under low temperature liquid phase and solvent free conditions using isopropyl chloride and isopropyl bromide as alkylating agent was achieved. Based on detailed screening, Fe and Ga were identified as most suitable ion-exchangeable cations amongst Fe, Ga, Al, Zn, Cu and Ce.

***Conducting polymers based MEMS for sensors*:** Conducting polymers have been suitably modified with ferrocene and iron based organo-metallic complexes so as to increase their sensitivity for carbon monoxide gas. Polypyrole (PPY) was used mainly as the main conducting polymer in which the iron based organic complexes were doped. These were characterized by various techniques to confirm the modification. These polymers when coated on gold coated flexible polyester film (PET) substrates with interdigited pattern and tested for sensitivity to CO gas (300 ppm obtained as standard calibration ampoule) showed tremendous sensitivity at room temperature. Typical sensor geometry is indicated below



Such sensors can replace the electrochemical-based sensors, which have limited working life and require complicated electronic circuitry for detection. These can also be integrated with MEM based devices very easily.

III. GLOBALLY COMPETITIVE CHEMICALS PROCESSES AND PRODUCTS

It is envisaged to develop new generation technologies for high demand chemicals and strategically important for the country e.g novel bioactives, alternative fuels, and new natural functional dyes etc.

PROGRESS:

A rapid HPLC analytical procedure was developed for VCR and VLB analysis. Isolated Purified sample of *artemisinin* from *A.annua* .

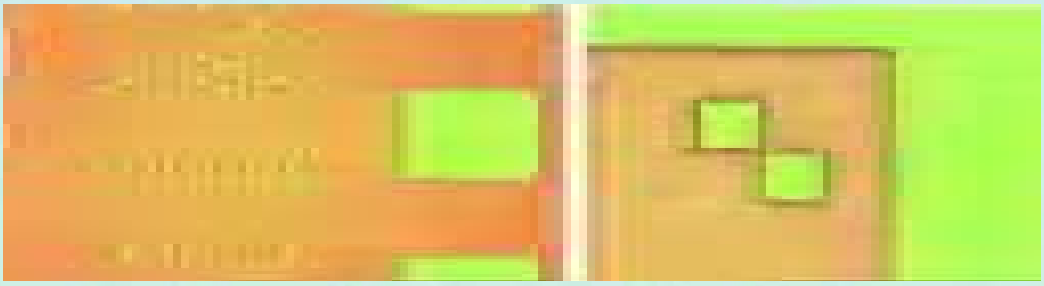
IV. DEVELOPMENT OF NOVEL POLYMERIC MATERIALS

The project aims to use sustainable raw materials for the preparation of specialty polymers such as Organic-Inorganic hybrids and nanocomposites, UV/E-beam curable coatings and adhesives, functional polymers for chiral separations,

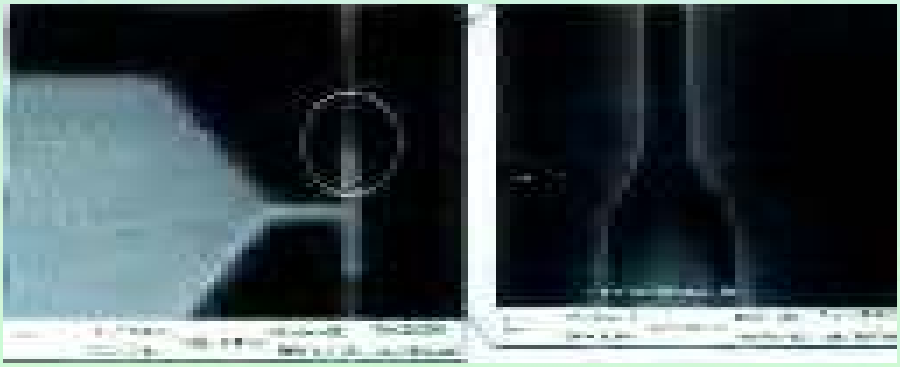
Specialty Polymers for petroleum industry, and Specialty polymers from renewable resources.

PROGRESS:

***UV/E beam curable coating: Development of G & I line photoresist*:** NCL has standardised a process for facile synthesis of terpolymer of poly(hydroxy styrene). Formulation based on this base resin was tested which could resolve 1 micron geometry. The material has potential for I line and deep UV. Photoresist of 1.4 mm thickness with good sensitivity and reproducibility was established. It is also demonstrated that `high *ortho*' novolac copolymers with optimum *m*- and *p*-cresol content and optimum base solubility has yielded a well-defined line latitudes and excellent performance against conventional lithographic steps like etching, lift-off and others. The photoresist is currently under test at semi commercial level at SSPL, New Delhi.



(Poly hydroxy styrene) based novel terpolymer photoresist: Opening of 1 - micron geometry

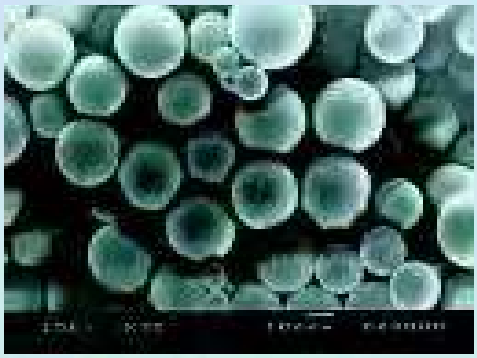


Barrier of 0.5 micron geometry was crossed by ortho novolacs resin based photoresist formulation

UNCTIONAL POLYMERS FOR CHIRAL SEPARATIONS:

Tailored beaded hydrophobic polymer matrices for the immobilisation have been developed as polymeric supports. Macroporous functionalized copolymer networked with pendent epoxy groups were synthesized with relatively high

concentration of divinyl monomers to have a permanent macroporous (macroreticular) structure, essential to trap and to covalently anchor large sized enzyme molecules. The porous structure was modified by incorporating inert diluents (porogens). In addition, for lipase immobilization the micro-environment was further altered by the covalent incorporation of hydrophobic tails, unsaturated oils to serve as affinity ligands.



Spherical porous epoxy polymer beads synthesized for immobilization of PGA and lipases

ELECTROACTIVE/ CONDUCTING POLYMERS FOR APPLICATIONS IN ELECTRONICS INDUSTRY

A new route for synthesis of polyaniline by non-acidic method has been achieved which gives non-corrosive, environmentally friendly method for large-scale synthesis of this material. Also, the processability of the conducting polyaniline has been achieved by introducing a dispersing agent, which also acts as a processing aid. These compositions can be injection moulded, extruded or compression moulded into various shapes.

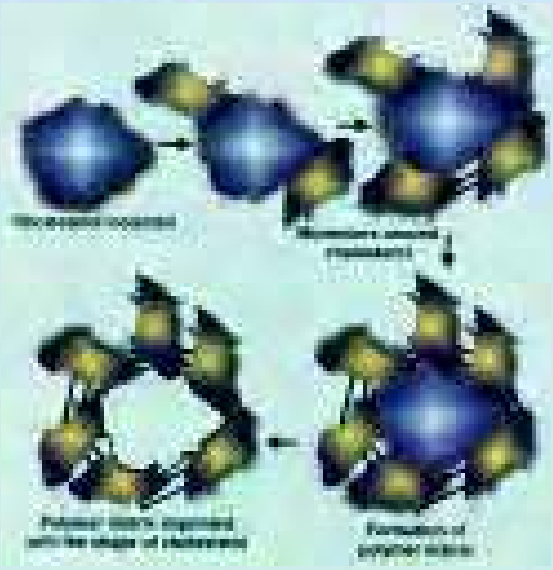
1.3.2 Scientific achievements under non-network programmes

Apart from network projects CSIR laboratories are working in non-network mode also. Some of the significant achievements are:

POLYMERS TO REMOVE CHOLESTEROL

NCL has designed polymers that remove cholesterol very effectively - these polymers can hold 45 mg of cholesterol per gram of the molecule surpassing the previously reported best of 17 mg cholesterol. The special polymers were prepared by "molecular imprinting" technique, which involves creation of polymers imprinted with the exact shape of cholesterol. Cholesterol is used as a "template" and is surrounded by molecules (called monomers) that are linked up to form the molecularly imprinted polymer. Thus, the polymer is fixed into the shape of the cholesterol and the monomers are precisely arranged so as to recognize cholesterol. When this molecularly imprinted polymer is mixed with body fluid containing

cholesterol, the cholesterol "docks" perfectly into the cavity in the polymer and is removed along with the polymer.



ULTRA PURE SALT

CSMCRI has developed a cost effective, innovative method for the production of high quality industrial grade solar salt with improved whiteness. The process is based on changing the salt-crystal morphology by clarification of the feed brine using physico-chemical methods. Microscopic studies have confirmed that the salt crystals are compact with less defects and minimum entrapped impurities. The salt crystals are larger in dimension as compared to salt harvested by conventional methods. The final product has specifications as Ca=0.07-0.11%; Mg=0.05-0.07% and SO_4=0.15-0.2%. The whiteness index of the harvested salt is measured as 86-88 against 78-83 for the normal salt produced through the conventional method. The process is simple and can be implemented in any salt works.

NaCl TOLERANCE IN CALLUS CULTURES OF *SUAEDA NUDIFLORA Moq*

CSMCRI has studied salt tolerance in the cultures of *Suaeda nudiflora* Moq. A dicotyledonous succulent halophyte. Growth was significantly inhibited at 50, 100, 150 and 200 mM NaCl. Inorganic ions and proline accumulated in response to salinity. Ion accumulation pattern reflected the utilization of Na^+ as an osmoticum. Na^+/K^+ ratio rose steadily as a function of external NaCl concentration. Salt stress enhanced the activity of peroxides, whereas it decreased activities of super oxide dismutase and catalase. This would help in identification of genes involved in salt tolerance and improvements of plants species for salt resistance.

ECO-FRIENDLY HAIR DYE

NBRI has developed a method for preparing a range of safe herbal hair dyes with shining ebony black to brown and pinkish red. The mixture of dyes derived can be used in coloring hair black. The method of obtaining the dyes from plant materials is perfectly safe and eco-friendly. The dye thus developed is non-itching, non-toxic, non-allergenic, anti-fungal, and non-sticky to skin. The dye enhances, the texture and luster of hair. Pharmacological study also revealed that the dye has powerful antioxidant activity.

THERMALLY STABLE CATION- EXCHANGE MEMBRANE FOR FUEL CELL

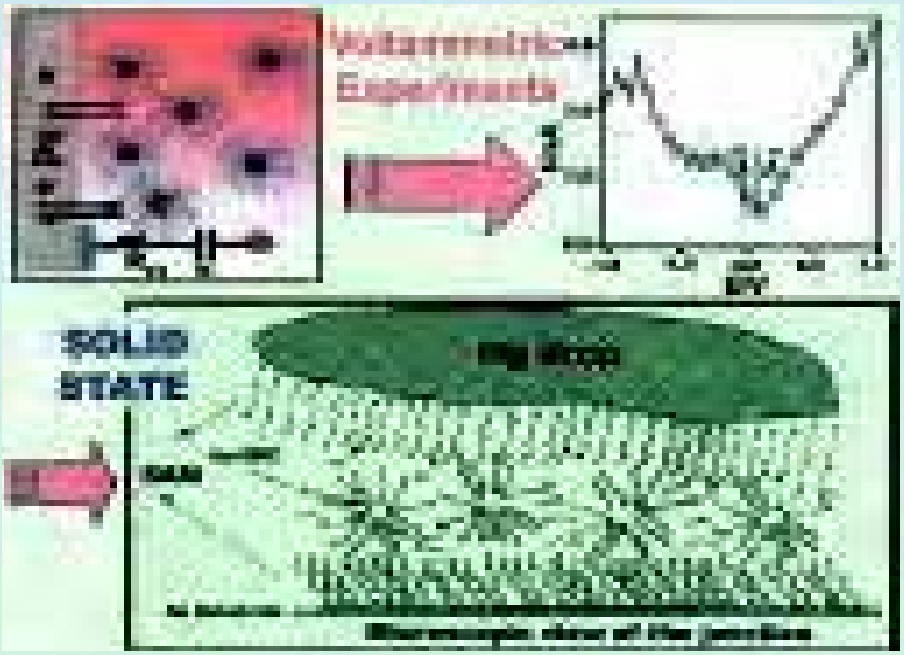
CSMCRI has developed a novel method for the preparation of thermal stable and chemical resistant ion exchange or proton-exchange membranes by eco-friendly route in aqueous medium. Organic-inorganic hybrid membranes were prepared based on polyvinyl alcohol/SiO_2, under acidic and basic conditions, in which sulfonic acid groups were introduced at the inorganic segment. These membranes were extensively characterized for their morphology, intermolecular interactions, thermal and mechanical stability, and physicochemical properties. It is concluded that a definite compromise between the silica content and membrane ion-exchange properties is required in order to have organic-inorganic hybrid cation exchange membrane. Furthermore, physicochemical and electrochemical properties of these membranes were comparable with Nafion membrane, which suggest that they are suitable for fuel cell and chlor-alkali applications as a substitute for the Nafion membrane.

NEW PROCESSES FOR FUEL CELL MEMBRANE

NCL has developed two new processes to obtain high-purity diaminobenzide (DAB) the monomer that is used to prepare polybenzamidazole (PBI) membranes for fuel. It has been recognized that PBI membranes are especially suitable for Proton exchange membrane (PEM) applications as they do not degrade or lose their mechanical strength at high temperatures. However, the monomer DAB that is used to prepare PBI is not commercially available in large quantities. The first process uses a non-carcinogenic raw material (nitro-bromoacetamide or NBA) and a novel, highly efficient catalyst. The second method (from dichlorobenzidine or DCB) involves a three-step process with a novel catalyst called titanium superoxide. Both the processes yield highly pure DAB (100 per cent purity) with no by-products. The processes use novel catalysts that make it possible to carry out the reactions under milder, safer conditions. These processes represent a significant advance that will enable the production of PBI membranes for fuel cell applications.

TUNABLE SINGLE ELECTRON TRANSPORT IN NANOPARTICLE ASSEMBLY

An easy method has been developed to organize gold-MPCs at a fixed distance on SAM modified gold substrate, where the distance could be controlled by changing the length of the SAM forming molecule. The I-V measurements have done in air at room temperature by using aforesaid mercury based junction. These results help to understand the electronic behavior of nanoparticles based molecular circuits especially useful for constructing future electronic devices.



MONOLAYER CATHODES FOR LITHIUM BATTERIES

NCL has demonstrated that a cathode prepared from a single layer of molecules can be used for high-energy rechargeable lithium batteries. It could reduce the weight of the battery drastically. For the first time a self-assembled monolayer of an organic molecule (a disulphide) has been used to prepare cathodes. Self-assembled monolayers (SAMs) are closely packed arrays of organic molecules, can be easily prepared and are very stable. SAM is prepared on a metal using a disulphide, an organic molecule with sticky sulphur atoms attached on each end. Disulphide is stuck on gold to create a single well-ordered monolayer and this forms the cathode. The disulphide molecule allows lithium ions in solution to effectively hook-up with the cathode and establishes a flow of current through the external circuit. The SAM coated gold was used along with a lithium electrode to prepare a lithium battery that gave an open circuit voltage of 2.9 V.

NON-EDIBLE VEGETABLE OIL BASED 2-STROKE ENGINE OILS

IIP has developed biodegradable non-edible vegetable oil based 2-stroke Engine oil that offers better or at least same performance as petroleum or synthetic oil based products. This agricultural-based 2-stroke engine oil is less expensive than petroleum or synthetic oils and offers significant benefits to environment and to end-users. Use of vegetable oil based 2-stroke lubricants is going to reduce dependence on petroleum, be almost completely biodegradable, less volatile than petroleum and synthetics, produce lower emissions of Volatile Organic Compound (VOC) and particulates and offer new employment avenues in rural sector. Further the new products, due to its improved lubricity, will reduce engine operating temperatures and engine wear.

OXIDATIVE DESULPHURIZATION OF DIESEL

IIP has developed oxidative desulphurization method for the removal of 4-methyldibenzothiophene (4-MDBT) and 4,6-dimethyldibenzothiophne (4,6-DMDBT). In this process the sulphur compounds present in diesel are first oxidized to sulphones to increase their polarity and subsequently removed by extraction with polar solvent or adsorption. The process is advantageous in the sense that the refractory sulphur compounds like 4,6-dimethyldibezothiophene and its alkylated derivatives, which are extremely difficult to hydrodesulphurize in deep hydrodesulphurization (HDS), can be easily oxidized to sulphones and removed by extraction / adsorption thereby yielding ultra low sulphur diesel with sulphur content below 10 ppm. Therefore, oxidative desulphurization has great potential to be a complementary process to traditional HDS for producing ultra low sulphur diesel (ULSD).

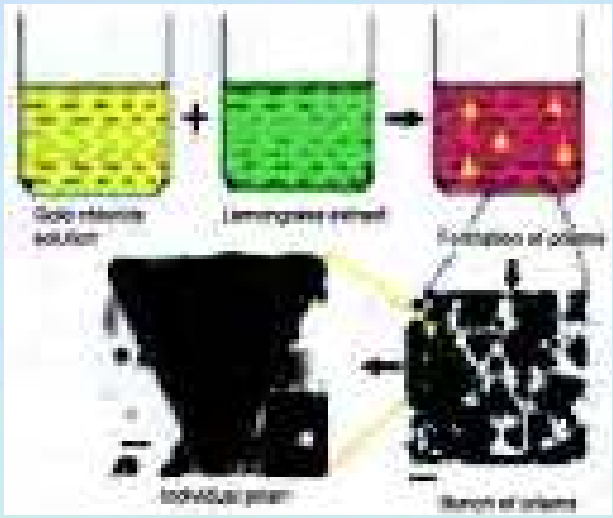
IMPROVED SOAKER VISBREAKING TECHNOLOGY

IIP has developed an indigenous technology on soaker visbreaker with internals. The main advantages of the improved soaker includes better temperature profile, increased conversions or reduction in beater duties for same conversion level, increased fuel oil stability as a result of uniformity in process temperature and feed distribution and enhanced run lengths due to prevention of undesirable side reactions leading to coke formation. The developed internals are easy to de-coke and require less effort to clean during shut down operation. The incorporation of internals can be performed through the revamping of the existing soaker.

Soaker Reactor With Internals

BIOSYNTHESIS OF GOLD NANOPRISMS FROM LEMONGRASS

NCL has demonstrated biological synthesis of triangular gold nanoprisms. The size and shape-dependent properties of metal nanoparticles are known to have important applications in catalysis (conversion of carbon monoxide to carbon dioxide), biosensing (novel labels for DNA diagnostics), and high-density recording media. Despite its importance, controlling the shape has so far yielded only limited success. Specific chemicals such as polypeptides secreted by the bacteria (*Escherichia coli*) have been shown to induce the growth of flat, triangular gold nanocrystals at 4% yield relative to the total nanoparticle formation. Large amounts of triangular gold nanoprisms by a single-step, room-temperature reduction of gold salt solution has been synthesized biologically by the extract of the plant, lemongrass (*Cymbopogon flexuosus*). The percentage of gold nanotriangles in the reaction medium has also enhanced up to 95% of the nanoparticle population by repeated centrifugation.



Gold nanoprisms from lemongrass

NEW CORROSION CONTROL BELTS FOR REINFORCED CONCRETE BRIDGES AND STRUCTURES

For corrosion control in salt damaged reinforced concrete bridges and structures, the only foolproof technique, till now, is cathodic protection. However, this technique is not only expensive but also quite laborious. CECRI has developed a new, simple and cost effective sacrificial protection system based on a novel proton conductive polymer back (PCPS) fill which is first of this kind in India. This back fill is capable of effectively distributing the current from a strip anode across the high resistance concrete medium and ensuring the minimum potential shift on embedded steel reinforcements needed for satisfactory cathodic protection. Maintenance free reference electrodes embedded at critical locations enable easier monitoring of the system. Sacrificial anodes in strip form along with the proton conductive polymer backfill are just strapped on to the concrete surface. Long-term performance of this innovative technology has been evaluated on a prototype model structure erected for this purpose.

POLYMER AMINES AS CORROSION INHIBITORS FOR IRON IN ACID MEDIA

CECRI has employed corrosion inhibitors such as monomer amines like aniline and substituted anilines for control of corrosion of iron in acid media. Water-soluble polymeramines like polyaniline, poly aminophenol, polyphenylene diamine have been synthesized and evaluated for their effectiveness as corrosion inhibitor for iron in 1M HCl. It has been found that the polymer amines of less than 10ppm concentration have offered the inhibition effectiveness of more than 90% whereas the concentration required by monomer is about 1000 ppm.

ELECTRO-REFINING OF ALUMINIUM METAL

A new novel two-layer electro refining process has been developed by CECRI where the alloying of the impure metal with copper is completely avoided. The anode and cathode metals are separated by a thin refractory partition. The anode metal (impure aluminium metal) and the cathode metal (super pure aluminium metal) are allowed to float over the surface of the electrolyte containing $BaCl_2$, AlF_3 and NaF. Two layer electro refining cells up to 1000 A° capacity were operated and various operating parameters have been optimised.

POLYSACCHARIDE BASED SOFT CAPSULES

CSMCRI has developed a method for preparation of polysaccharide based soft capsules from inexpensive kappa carrageenan as a seaweed polysaccharide in preparation of tough, biodegradable films. The films can be recycled and reprocessed if required. Incorporating polyvinyl alcohol that lends toughness and clarity can enhance the performance of the films. It is possible to store solvents and oils in the pouches, made of polysaccharide.

NOVEL CLASS OF PYRIDOSTEROIDS

A solid phase base catalyzed condensation of steroidal ß-formyl enamides with nitromethane under microwave irradiation led RRL-Jorhat to develop a new strategy for the one-pot preparation of a novel class of pyridosteroids via Henry reaction. The hitherto known applications of Henry reaction have been developed using sonication, high pressure reaction, heterogeneous catalyst and polymer support. This reaction has attracted enormous attention as one of the valuable fundamental synthetic strategies for construction of carbon-carbon bonds.

1.3.3 Human Resource Development

CECRI

- CECRI conducted various training programmes related to corrosion of steel, Recovery of silver from photographic solution, Paints for corrosion protection, "Industrial Metal Finishing and demonstration, Plating of precious metals, Trouble shooting in Electroplating and metal finishing, Surface coating by PVD, CVD and Surface analysis etc.

CSMCRI

- CSMRI conducted regular training programs for the benefit of marginal salt producers of the country and provide technical assistance for good quality salt

manufacture in their own salt works. The institute imparted training also to technical personnel and executive officials from various salt & marine chemical industries.

NCL

- NCL conducted a training programme of 12 days duration on micropropagation. The aim of the programme was to encourage the educated people to take up tissue culture as a viable enterprise and to train manpower for tissue culture industry.

1.3.4 Recognition & Awards

Honorary Doctorates in Science & Engineering: ■ Guru Nanak Dev University, Amritsar (2005); ■ Maharishi Dayanand University, Rohtak (2005); ■ Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (2004); ■ Narendra Dev University of Agriculture & Technology, Faizabad (2004); ■ University of Kalyani, Kalyani (WB) (2004) **Election to Prestigious Academies and Scientific Bodies (India and Abroad)** ■ Foreign Associate, US National Academy of Sciences, USA (2005); ■ Fellow, Indian Association for the Cultivation of Science, Kolkata (2005); ■ President, Indian National Science Academy (2005); ■ President, Materials Research Society of India (2004); Baroda Sun Award (2005) by Bank of Baroda for leadership	Dr. R.A. Mashelkar, FRS, Director General, CSIR

Star of Asia Award (2005) of Business Week (USA) Maharashtra Bhushan Award (2005) by Govt. of Maharashtra for contributions to Science & Technology Honorary Professor, Banaras Hindu University (2005)	
NACE meritorious contribution award	Dr. N. Palaniswamy, CECRI
Mascot National Award (Awarded by the Electrochemical Society of India, Bangalore)	Dr.G. Venkatachari, CECRI
CSIR Technology Award 2004 in "Chemical Technology" for Development of High Flux Thin Film Composite Reverse Osmosis Membranes Technology and its Applications for Water Desalination and Purification"	S/shri V.J.Shah; (Ms) S.V.Joshi; J.J. Trivedi; C.V. Devmurari; A. P. Rao; N. Pathak; P.A. Patel; A.A. Patel; N.K. Waghani; T.B. Gohil; K.J. Anjara; K. Eswaran and P.K. Ghosh, CSMCRI
CSIR Young Scientist award 2004 in Chemical Sciences	Dr. P. Ghosh, CSMCRI
Goyal Prize, Kurukshetra University	Dr. J.S. Yadav, IICT
President of Catalysis Society of India (2005-07)	Dr. S. Narayanan, IICT
Best Scientist Award by Federation of A.P. Chambers of Commerce & Industry, Hyderabad Dr. S.D. Thirumala Rao Memorial Award by OTAI	Dr. R.B.N. Prasad, IICT
Indian Paint Association Award	Dr. K.V.S.N. Raju, IICT
Prof. B.N. Ghosh Oration Award by Indian Pharmacological Society, New Delhi	Dr. P.V. Diwan, IICT
O.P. Narula Young Scientist Award for excellence in reaserch in the field of Lipid & Allied Products.	Smt. M.S.L. Karuna, IICT
AVRA Young Scientist Award (2004)	Dr. S. Chandrasekhar, IICT

Dr. (Mrs) Jagadiswari Rao Award (2004) by Applied Zoologists Research Association. India	Dr. P. Usha Rani, IICT
Andhra Pradesh Scientist Award 2005	Dr. T.K. Chakraborty, IICT
Shanti Swarup Bhatnagar prize in Engineering Sciences (2004)	Dr. V. V. Ranade, NCL
VASVIK Award 2002	Dr. R. A. Joshi, NCL
B. M. Birla Science Prize in Chemistry (2002)	Dr. V. R. Pedireddi, NCL
CRSI Silver Medal	Dr. K. N. Ganesh, NCL
MRSI Medal (2005)	Dr. S. Radhakrishnan, NCL
Fellow of Indian National Academy of Engineering	Dr. M. G. Kulkarni, Dr. V. V. Ranade, Dr. R. V. Chaudhari, NCL
Fellow of Indian National Science Academy; S.K. Bhattacharya Eminent Scientist Award of Catalysis Society of India (2005)	Dr. R. V. Chaudhari, NCL
LABDHI-RDE Award	Dr. A.A. Natu, NCL
Rajiv Goyal Prize for Young Scientists (Chemistry- 2003)	Dr. M. Sastry, NCL
Prof. Sukumar Maiti Polymer Foundation Award (2004)	Dr. P. P. Wadgaonkar, NCL
INSA Medal for Young Scientist (2004) in Chemical Sciences	Dr. R. A. Fernandes, NCL
Young Scientist Prize, Council of the International Association of Catalysis Societies	Mr. B. R. Sarkar, NCL
Rajiv Gandhi Sadbhawana Award (2004), Rajiv Gandhi Youth Forum, Orissa Alkyl Amines – UICT Foundation Day Young Scientist Award (2004)	Dr. D. K. Mohapatra, NCL

Fellow of Indian Institute of Chemical Engineers	Dr. S. Devotta, NEERI
Elected fellow of Indian Institute of Chemical Engineering	Dr. P.G. Rao, RRL-Jorhat
CRSI Bronze Medal for the year 2004 in recognition of the research contribution in chemistry	Dr. R. C. Boruah, RRL-Jorhat

1.4 EARTH RESOURCES & NATURAL HAZARDS ASSESSMENT

Two CSIR laboratories NGRI and NIO are exclusively devoted to R&D for earth resources. R&D programmes, both through Network and Non-network projects, were taken up for new hydrocarbon resource location, estimation of recharge of ground water systems, mineral explorations and seismic studies.

1.4.1 Progress under Network Projects

I. STUDY OF MESOZOIC SEDIMENTS FOR HYDROCARBON EXPLORATION

The objectives of the project are application of new strategies of integrated geophysical studies of seismic refraction, gravity, magnetotellurics and deep resistivity sounding for the delineation of Mesozoics basins in areas covered by Deccan Traps which are likely to contain oil and gas; Investigation of unexplored areas for hidden Mesozoic sediments for oil and gas; Location of prospective hydrocarbon potential structures in the study area.

PROGRESS:

Gravity observations at 2050 stations completed and data has been processed. Data acquisition for deep resistivity sounding of 31 stations in the eastern part completed of which data processing for 20 stations has been carried out.

II. DEVELOPMENT OF TECHNIQUES AND METHODOLOGIES FOR EXPLORATION, ASSESSMENT AND MANAGEMENT OF GROUND WATER

The project aims at development of techniques and methodologies, and integration of the available advanced geophysical and hydrogeochemical data to thoroughly

investigate various aquifer systems in hard rocks, dilineation and characterization of the fractured and Island aquifer systems to understand the recharge mechanism as well as geochemical contamination and simulation of flow and mass transport and development of techniques to simulate the process of artificial recharge and test their effectiveness for a value added groundwater management in hard rocks.

PROGRESS:

- Natural recharge studies have been carried out in Wailapalli watershed (granite) and Ghatiya watershed (basalt) using injected tritium technique. In order to collate the recharge results with hydrogeological responses, investigations such as permeability, infiltration and geophysical responses, investigations such as permeability, infiltration and geophysical changes were also carried out.
- Characterization of the samples for fluoride and uranium in Wailapalli watershed has been completed. The studies reveal very high concentration of fluoride in soil and rocks. This high concentration of fluoride will percolate down and contaminate groundwater. High concentrations of uranium and thorium are observed in some selected pockets of Wailapally in rocks as well as soil samples.
- Rainwater harvesting and artificial recharge studies were carried out in Wailapalli watershed in Nalgonda district. A groundwater source with fluoride concentration of less than 0.7 ppm was created through large diameter open well.
- Post tsunami effect on aquifer system on Neil Island, Andaman & Nicobar Islands has been studied to assess the change in the groundwater regime on the island. The data on groundwater has been collected in the Neil Island. Three-dimensional modeling has been designed for the centralized database.

Check dam with capture well

Resource well with groundwater

III. TECTONIC AND OCEANIC PROCESSES ALONG INDIAN RIDGE SYSTEM AND BACK ARC BASINS

The project proposes to concentrate on Carlsberg ridge (CR)- Central Indian ridge (CIR) and Andaman backarc spreading system to understand the tectonic and oceanic processes that are occurring at these dynamic plate boundaries.

PROGRESS:

Multi-disciplinary investigations have been conducted along the Carlsberg and Central Indian Ridge segments in the Indian Ocean by undertaking two cruises on board ORV Sagar Kanya. During these oceanographic expeditions of SK-201 and SK-207, about 11,176 km swath bathymetry, seabed sampling at 14 locations, and water column data at 55 locations has been acquired. Extraction of Helium from water samples and analysis for 3HefHe ratio were attempted for the first time on especially collected samples. New insights into the tectonic evolution of the Andaman basin have been provided based on the integrated analysis and interpretation of multibeam bathymetry, magnetics, and seismological data. These results brought out, for the first time, information about the topographic fabric and the tectonic configuration of the backarc spreading center. Younger age of opening to the backarc basin than the previously proposed ages was suggested.

1.4.2 Scientific Achievements under non-network programmes

GRAVITY ANOMALIES OF A 2.5D FAULTED BED

An inversion technique coupled with the relevant computer code based on the Marquardt algorithm is developed by NGRI to interpret the gravity anomalies of a

2.5D faulted bed in which the density contrast varies with depth. The inversion is capable of estimating shape parameters of a 2.5D-faulted bed in addition to regional gravity background. Two gravity profiles, one bisects the strike length and the other runs at an offset distance from the origin, of a 2.5D faulted bed are interpreted with and without regional background using both parabolic and constant density-depth profiles, and found that the results obtained with the parabolic density-depth profile are more accurate in comparison with the constant density-depth profile. For the first time it is shown that the interpretations performed using parabolic density-depth profile are independent of the strike length of a fault structure, as long as the profile passes through the origin of the fault plane. The parabolic density-depth profile yields geologically plausible model rather than the constant density-depth profile.

DETERMINATION OF DEPTHS TO THE BOTTOM OF A 2.5-D SEDIMENTARY BASIN

NGRI has developed an algorithm and a code GRA2P5MOD to determine the depths to the bottom of a 2.5-D sedimentary basin in which the density contrast varies parabolically with depth. This algorithm estimates initial depths of a sedimentary basin automatically and modifies thereafter appropriately within the permissible limits. The applicability of the method is exemplified with the derived density-depth model of the Godavari sub-basin to interpret the gravity anomalies due to the basin. Interpretations based on parabolic density profile are more consistent with existing geological information rather than with those obtained with constant density profile.

SUDDEN CHANGES IN DESERT WATER-LEVEL FOR EARTHQUAKE PREDICTION

Significant changes in water levels of shallow and deep borewells before and after earthquake events were observed in the Thar Desert of India and reported for the first time by NGRI. Rise in water level of the deep well (165-m depth) was of the order of 5 to 50 cm and was observed prior to earthquake events having epicenters at distances ranging between 100-800 km. Analysis show the water level changes directly proportional to the magnitude distance ratio (magnitude/epicentral distance) and inversely proportional to the epicentral distance. The fall in water levels was associated with global events in some cases and signifies the sensitivity of the site in arid conditions for earthquake precursory studies. The plot of epicenters is found to be falling in two major trends of N-S and NE-SW directions, which are transverse to the Himalayan arc and sub-parallel to the Aravalli Range respectively. These preliminary observations signify the favourable conditions of the desert environment to be a good sensor for earthquake hazard management of densely populated northern continent of India.

BURIED IN TIME: CULTURABLE FUNGI IN A DEEP-SEA SEDIMENT CORE FROM THE CHAGOS TRENCH, INDIAN OCEAN

NIO has obtained paleobes, for the first time, from a deep-sea sediment core from a depth of 5904 m from the Chagos trench in the Indian Ocean. Culturable fungi, direct counts of bacteria, age of the sediments based on the radiolarian assemblage, total organic carbon, Eh and $CaCO_3$ were determined in these sediments. Culturable fungi were obtained from subsections up to 370 cm depth. The age of the sediments from which fungi were isolated was estimated to range from greater than 0.18 to 0.43 million years (Ma), being the oldest recorded age for recovery of culturable fungi. Colony forming units of fungi ranged from 69 to 2493 g^{-1} dry weight sediment with a maximum abundance recorded at 160 cm depth of the core, corresponding to approx. 0.18 Ma. Bacterial numbers in the core showed oscillations corresponding to cycles of approximately 100 ka (kilo years). The fungi comprised non-sporulating forms and a sporulating form identified to be *Aspergillus sydowii*. Germination of spores of *A. sydowii* at 100, 300 and 500 bar hydrostatic pressures at 5°C confirmed its barotolerance and its nativity to deep-sea sediments. It is proposed that deep-sea sediments are a source of paleobes, which could be useful in studies on palaeoclimate, long-term microbial survival and biotechnology.

ENVIRONMENTAL INFLUENCES ON THE SPECIES DIVERSITY OF SOFT BOTTOM FAUNA IN EASTUARINE OF GOA

A total of 58 species were recorded belonging to polychaetes, effluent, crustaceans and other minor groups in order of species abundance. Eighteen species are new to the local fauna that were not reported earlier. The maximum mean species diversity index (Shannon-Wiener), total biomass (wet) and total population density recorded were 2.3 (Z1), 6.7 g/m^2 (M1) and 703 no./m^2 (M2) respectively. Significantly higher species diversity was observed at high salinity, fine sand and high sedimentary biochemical parameters of total organic carbon (TOC), total organic nitrogen (TON) and carbon of biopolymeric fraction (C-BPF) sites. The best multiple linear regression model revealed that all the 13 parameters studied were significant influencing parameters on species diversity, biomass and population density with exception of temperature. The combination of significant influencing environmental parameters, percent variation and Mallows' Cp values varied from sites to biotic parameters. This explained 32-72% of the total variance. The regression model derived from this data helps in detection of these biotic parameters and detection of pollution-induced effects.

1.4.3 Human Resource Development

NGRI

- UNESCO training workshop on Dynamic of hard rock aquifers was organised; 18 Indian and Foreigners participated.

NIO

- Summer Training Course in Microbiology and Biotechnology from different Colleges of Goa (20 students);
- Training/Project work on (i) Growth of marine microorganisms– influence on mild steel corrosion, (ii) Marine pollution and ecotoxicology, (iii) Hydrocarbon pollution in coastal sediments, and (iv) Controlling corrosion of metal (4 students);
- Training on Educational Linkage programme from St. Xavier's College, Mapusa (150 students);
- Training on Industrial Offshore Survey – A Long Hydrography effluents course for officers of Indian Navy and Royal Malaysian Navy. Field-work, onboard Coastal Research Vessel *Sagar Sukti* , carried in order to provide practical training to the participants;
- Training on Marine Biology, Environment and Techniques from Govt. Science College, Jabalpur (22 students+ 2 teachers);
- Training on Management of Coastal Eco-system from Ministry of Environment and Forests (Govt. of India) (21 Indian Forest Service Officers);
- Training/Project work on Plankton and nutrient analysis for National Aquatic Resources Research & Development Agency (NARA), Sri Lanka;
- 125 top ranked SSC (2004) students invited under CPYLS.

1.4.4 Recognition & Awards

CSIR Young Scientist Award (2004) in Earth, Atmosphere, Ocean and Planetary Sciences. M.S. Krishnan Gold Medal (2004) by Indian Geophysical Union.	Dr. U. C. Kulshreshtha, IICT
Fellow of National Academy of Sciences, Allahabad	Dr. V.P. Dimri, NGRI
National Mineral Award, 2003 of Ministry of Coal & Mines, Govt. of India	Dr. M. S. Prasad, NIO & Dr. G. Parthasarthy, NGRI
National Mineral Award, 2003 (Geophysics) of Ministry of Coal & Mines, Govt. of India	Dr. R.K. Chadha, NGRI
Krishnan Gold Medal of IGU-2004	Dr. Ajay Manglik, NGRI
IETE Hari Ramji Toshiniwal Gold Medal-2004	Shri S. Narayana, NGRI
Vigyan Ratna, 2003-04	Dr. S.W.A. Naqvi, NIO
Fellow of the Indian Science Academy (INSA)	Dr. M. Dileep Kumar, NIO

1.5 ECOLOGY & ENVIRONMENT

CSIR has been a major contributor in providing S&T inputs to evolve national policies and to ameliorate environmental problems. CSIR, has developed expertise in air, water and soil quality management, effluents onshore, offshore & atmospheric environment, near space environment, ionospheric chemistry, stratosphere – mesosphere coupling, 'toxic & hazardous' waste management etc. CSIR is achieving these goals both through network and non-network programmes. Significant scientific achievements are outlined below.

1.5.1 Network Projects

I. POLLUTION MONITORING, MITIGATION SYSTEMS AND DEVICES WITH APPLICATIONS TO ENVIRONMENTAL ASSIMILATIVE CAPACITY IN SELECT REGIONS

The project envisages developing innovative sensors, indicators and instruments

for pollution monitoring and study of assimilative capacity of environmental media for pollution mitigation.

PROGRESS:

A Biosensor for beverage industry has been optimized taking into consideration the variations in the BOD load at various periods of time.

II. INDUSTRIAL WASTE MINIMIZATION AND CLEAN UP

It is proposed to dematerializing the resource intensive activities of industries into more appropriate environmental technological solutions aimed at waste minimization, cleanup and remediation. It is also envisaged development of futuristic, niche and cost-effective technological interventions for at least ten highly polluting categories of industries.

PROGRESS:

Various steps towards minimization of effluents in a nickel-plating plant like, no. of rinses, volume ratio of plating to rinse tank etc. have been standardized. A suitable drug-out set-up for a nickel-plating plant has been formulated. Chemical precipitation procedures were standardized to separate copper from copper drug-out solution with more than 95% recovery.

III. IMPACT OF ANTHROPOGENIC PERTURBATIONS ON OCEANOGRAPHIC - ATMOSPHERIC PROCESSES IN AND - AROUND INDIA IN THE CONTEXT OF GLOBAL CHANGE

The major objective of this project is to improve our understanding of natural variability (from Diurnal to decadal) and to develop the capability to differentiate anthropogenic influence through long-term time series measurements.

PROGRESS:

Time-series measurements showed consistent occurrence of hypoxia along the Goa coast following the southwest monsoon. Occurrence of plankton blooms associated with higher concentrations of climatically important gases are found. Several samples collected from Indo-Gangetic plain, Deccan Plateau and other areas revealed accumulation of nitrate and nitrous oxide in ground waters. Both nitrification and denitrification are found to be responsible, through stable isotope measurements, for the formation of nitrous oxide, which is a greenhouse gas.

1.5.2. Scientific Achievements under non-network programmes

ARSENIC AND IRON REMOVAL FROM GROUND WATER BY CERAMIC MICROFILTRATION MEMBRANE

CGCRI has developed microfiltration system, which is a novel approach for decontamination of arsenic and iron from groundwater and to cater to the need of safe drinking water for community use. The basic components of this hybrid system are i) absorption of arsenic by the colloidal media particles suspended in water and ii) application of membrane based separation technique for solid liquid separation using ceramic microfiltration membrane module. The salient features of the technology are simultaneous removal of arsenic and iron from highly contaminated groundwater below the limits recommended by WHO; Modular design with flexible production capacity; and Semi-automatic user friendly operating procedure, can be operated by female community members. This technology has been transferred to many Small Scale Industries for mass production.

Ceramic Membrane module for removal of Arsenic fron ground water

LOW COST ADSORBENTS FOR REMOVAL OF ARSENIC FROM CONTAMINATED DRINKING WATER

ITRC has developed iron-coated sand for decontamination of water spiked with 50 ppb Arsenic. This material was reused for five consecutive days. The efficiency of Arsenic removal on day one was maximum (90-95%) which declined to 80% on day three and 60 % on day five. The technique can be utilized for water decontamination upto 50 ppb Arsenic level. The materials required are not very costly. Iron coated sand once prepared can be used for three days.

ASSESSMENT AND MANAGEMENT OF GROUNDWATER IN ALLUVIAL REGION OF THE GANGETIC PLAINS IN NORTH INDIA

ITRC performed 'Multivariate statistical modeling' to analyze the groundwater quality of the alluvial region (Unnao) with a view to investigate the groundwater composition, its spatial variation, and the processes/factors influencing it. The data set comprised physico-chemical parameters and heavy metals in groundwater samples collected from alluvial region covering an area of about 2150 km^2 and spread over the recent and ancient alluvial deposits. The principal component analysis helped in identification of major natural and anthropogenic factors responsible for groundwater composition and contamination in the region. Discriminant analysis identified the discriminating variables (hardness, alkalinity, chemical oxygen demand, chloride, phosphate, iron) between surface and groundwater and also between different type of water sources (dug well and hand pump). Partial least squares (PLS) modeling revealed that the groundwater samples are dominated by variables (F, Ca, Cu, Mg, Zn, Cd, SO_4) having both natural and anthropogenic sources in the region.

PHOTOCATALYTIC MATERIALS FOR ENVIRONMENTAL APPLICATIONS

NEERI has developed new photocatalytic materials by doping TiO_2 with nitrogen, fluorine and transition metal compounds and also by incorporating other chemical species to achieve the visible and ultraviolet (UV) photocatalytic activity and better photocatalytic properties with respect to delayed photogenerated electron recombinations and their stability. Tailoring of zeolite materials by incorporating TiO_2, heteropolyacids and suitable transition metals for facilitating photocatalytic water splitting and CO_2 reduction have been used to synthesize the materials, which result in improved photocatalytic properties. Zeolite based hybrid photocatalytic materials consisting of combination of electron donor, charge transfer complex viz, heteropoly acid, semiconductor and transition metal have also been synthesized. These materials show better photocatalytic activity as compared to conventional photocatalysts in the presence of UV and visible light. The photocatalytic materials synthesized are stable in aqueous conditions.

CATALYTIC METHANE COMBUSTION FOR CLEANER ENERGY PRODUCTION

Catalytic methane combustion is a relatively cleaner route to produce energy, since it allows efficient and complete fuel burning at temperatures lower than those in flame combustion. This results in lower emissions of unburned hydrocarbons, CO, Nox and particulate. In the context of CO_2 emissions, catalytic methane combustion is being proposed as a cleaner energy route with relatively less CO_2 generation while producing the same amount of energy. In addition, catalytic combusition

can be carried outt in a wider range of air-to-fuel ratio. One of the common otential applications of the catalytic combustion is in the area of natural gas fueled burners for gas turbine power generation.

SIMULTANEOUS DETOXIFICATION AND DECOLOURIZATION OF MOLASSES SPENT WASH (MSW)

The wastewaters of molasses-based alcohol distilleries contain brown colored melanoidin pigments that are one of the major pollutants. NIO has successfully decolorized an intensely brown colored molasses spent wash (MSW) by *Flavodon flavus*, a white-rot basidiomycete fungus isolated from a marine habitat. Polyurethane foam-immobilized-fungus decolorized 10% diluted MSW by 60 and 73% in days 5 and 7, respectively. The immobilized fungus could be effectively used for a minimum of three cycles repeatedly to decolorize MSW. Besides decolourization, the fungus also removed the toxicity of MSW. Toxicity bioassay of the fungus-treated molasses spent wash using an estuarine fish *Oreochromis mossambicus* showed no liver damage in contrast to untreated effluent, which showed moderate liver damage. Benzo(a)pyrene, a polycyclic aromatic hydrocarbon (PAH) in the MSW is detected and this appears to be one of the causes of toxicity of the MSW. The concentration of PAH in the MSW decreased by 68% by day 5 on treatment with the fungus. This is the first report where decolourization of MSW is accompanied by simultaneous detoxification and decrease in PAH content of the MSW. A comparison of gel filtration chromatography of MSW, before and after treatment with the immobilized *F. flavus* showed disappearance of the most of the colored fractions in the fungus-treated MSW. A possible mechanism of decolourization of MSW is via the action of glucose oxidase accompanied by production of hydrogen peroxide that may ultimately act as a bleaching agent.

REMOVAL OF CHROMIUM AND CADMIUM FROM INDUSTRIAL EFFLUENTS

Though the presence of the oxides of Mn, Fe, Si and Al are responsible for the adsorption characteristics of industrial wastes but in case of sea nodule residues from two different places, NML has observed that the residue generated at one place is cationic in nature hence could effectively remove cations, another is anionic in nature therefore was found very effective for anions removal. Cr(VI) Sea nodule residue was found to be most effective for the removal of cadmium and Cr(IV) in a concentration range upto 200ppm of Cd and 75ppm of Cr(VI) from waste waters. Red mud was found effective for cadmium and chromate ions upto 25ppm and thus these solid wastes especially sea nodule residue can be used as an effective and economic adsorbent which can also replace carbon- a commonly used adsorbent which is a widely used ones.

EXTRACTION OF NICKEL FROM A MALAYSIAN SPENT CATALYST

Nickel recovery from spent nickel catalyst is very important from the view of environmental protection and resource recycling. It is also one of the rich sources of nickel and considered as industrial waste, disposal of which is controlled under strict environmental protection law. NML has developed a process, which under the moderate conditions has achieved very high nickel recovery in presence of a very little quantity of a promoter. More than 98% nickel recovery is achieved with overall recovery of above 96% of nickel.

ASSESSMENT AND MANAGEMENT OF ACID MINE DRAINAGE FROM NORTHEASTERN COALFIELDS

RRL-Jorhat studied the mechanism of pyrite oxidation and consequences thereof, based on the aqueous leaching of the coals from various collieries. The study shows the formation of highly acidic water with low pH and its relationship with conductivity, Total Dissolved Solids (TDS), and sulphate ions. The study has also confirmed acid generating potential of the coal samples from the active and abandoned mines, possible build-up of heavy metal contamination in surface and ground water systems. The physico-chemical characteristics of the mine water samples discharged with seasonal variations to the nearby river systems are evaluated. The characteristics of soil, effluent water samples and sediments from the point and non-point sources have shown similarities with those of simulated acidic drainage from coals and mine rejects. The processes have been developed in the laboratory and scaled up levels to manage the acidic drainage, simulated from high sulphur weathered coals and coal fines.

WEALTH FROM WASTE: BUILDING BRICKS FROM OIL FIELD EFFLUENT TREATMENT PLANT (ETP) SLUDGE

The ETP of Lakwa oil field generates about 12m^3 sludge per day. The sludge often contains 7-10% hydrocarbon (permissible limit is 3% for safe disposal by land filling) and is environmentally hazardous. RRL-Jorhat has developed a process for preparing value-added product like common masonry building bricks utilizing the hazardous wastes. The process has been employed for brick production under field condition in brick fields. Bricks prepared, replacing about 30% of the raw materials by the sludge conform to Indian standard specification for common burnt clay building bricks. In the process, the water in the sludge serve as the process water, the hydrocarbons burn and provide partial fuel requirement and the inorganic materials are fixed as constituents of the bricks. The Toxicity Control Leaching Protocol (TCLP) tests show that the bricks meet the Environmental Protection Agency (EPA) requirement for trace metal leaching. Standard size bricks prepared using the sludge and firing in

a commercial coal fired kiln show high compressive strength and low water absorption capacity. This development helps the sludge disposal problem.

1.5.3 Human Resource Development

ITRC

ITRC conducted the following workshops in the year: Training Workshop on Scientific Communication; Workshop on Research Methodologies and Statistical Methods in Biomedical Research; Workshop on Current Techniques in Genetic Toxicology; Environmental awareness programme in school children.

NEERI

- Biodiversity training programme sponsored by Ministry of Environment & Forest was conducted for IFS Officers
- Environmental training programme sponsored by Ministry of Environment & Forest was conducted for IFS Officers
- Management; Environmental Impact Assessment: Training programme sponsored by Ministry of Environment & Forest was conducted for IFS Officers
- Water and Wastewater Management training programme sponsored by Ministry of Environment & Forest was conducted for IFS Officers.
- Food Processing Industries training programme sponsored by Ministry of Environment & Forest was conducted for IFS Officers.

1.5.4 Recognition & Awards

Fellow of Indian Academy of Neurosciences, 2004 AEB Honours Award-2004 by the Academy of Environmental Biologist Gujral-Bhargava Oration of Indian Pharmacological Society - 2004	Prof. Y.K.Gupta, ITRC
Fellow, Academy of Environmental Biology	Dr. R.K. Upreti, ITRC
Fellow of the Society of Toxicology (India), 2004	Dr. A. Dhawan, ITRC

Honorary Fellow of the Society for Nature Conservator (India).	Dr. K. P. Singh, ITRC
Pitambar Pant Award	Dr. A. A. Juwarkar, NEERI

1.6 ELECTRONICS & INSTRUMENTATION

CSIR laboratories have helped in the development of professional electronics industry in the country through development of specialized products, such as Ion-sensitive field effect transister (ISFETs), Optical Fibre Amplifier etc. CSIR is the repository of high-tech knowledge in microwave & traveling wave tubes and klystrons & magnetrons. Its capabilities in semiconductors have provided tailor-made hybrid microcircuits for the Indian space programme and other applications. CSIR's achievements are highlighted in following subsections.

1.6.1 Network Projects

I. SPECIAL ELECTRON TUBE TECHNOLOGIES FOR LARGE SCALE APPLICATIONS

The project aims at technology development for fabrication and characterization of High power electron tubes, their components like RF windows, Multistage depressed collectors, High current density cathodes and other components, Plasma devices and integrated pulse power systems.

PROGRESS:

Beam stick of micro-TWT for microwave power modules (MPM): CEERI has designed electron gun and input and output couplers for a broadband Micro-TWT for the MPM using available computer software E-Gun and HFSS. Design of Periodical Permanent Magnet (PPM) system has also been completed using in-house developed software package MGFLD. Electron beam transmission has been simulated for the full length of the tube. In-house developed software was validated with the experimental value and the accuracy was within 5%. To verify and optimize the PPM system to achieve maximum beam transmission, Beam Stick of the Micro-TWT has been integrated, processed and tested. Beam transmission of the order of 99% has been achieved.

II. DEVELOPMENT OF KEY TECHNOLOGIES FOR PHOTONICS AND OPTO ELECTRONICS

It is proposed to develop indigenous technology and packaged products for a number of key components and devices, which play vital role in future communication technology and have enormous market potential such as Optical amplifiers, In-fibre Bragg grating, Arrayed planar waveguide components and Organic light emitting diodes (OLED).

PROGRESS:

Optical fibre amplifier: For the first time in India an Optical amplifier for light wave telecommunication network has been developed particularly using erbium-doped optical fibre (EDF) and power semiconductor pump laser source. The amplifier gain block with all necessary logic control and computer interface commensurate with CATV and Telecom standards has been designed and developed with an industrial partner, NeST, Cochin. This device is very much helpful in the propagation of "Fibre to Home" technology in the country.

Optical fibre amplifier

III. DEVELOPING CAPABILITIES AND FACILITIES FOR MICRO-ELECTROMECHANICAL SYSTEMS (MEMS) AND SENSORS

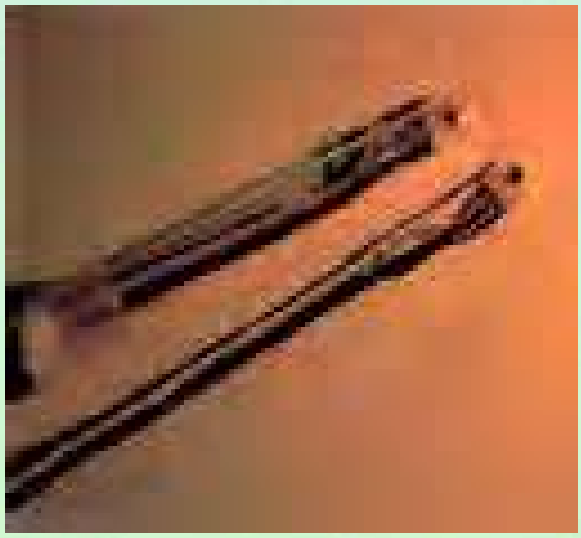
The development of MEMS based Chemical and Bio sensors, microstructures for Lab-on-a-chip type application in different chemical and biological fields, and micro-cantilever bean array biosensors is envisaged. Ultimately these developments are to be transferred to industry for commercial exploitation.

ISFET based glucose biosensor: This biosensor comprises an ion-sensitive field-effect transistor (ISFET), which is a metal-oxide-semiconductor field-effect transistor

(MOSFET) with the metal gate replaced by a chemical membrane (SiO_2-Si_3N_4) responsive to hydrogen ions, producing a solid-state pH-micro-sensor. The ISFET is an N-channel enhancement mode device fabricated by the n-well metal oxide semiconductor (NMOS) process. It has a high aspect ratio (channel length/ channel width) - 400 provided by an interdigitated source-drain geometry. Glucose oxidase (GOD) enzyme was immobilized over the silicon dioxide-silicon nitride dual-dielectric gate. The 3 mm X 3 mm biosensor chips were mounted on ceramic substrates with wire bonds. The ISFET-based biosensor combines the advantages of specificity of biological systems with those offered by solid-state technology such as low cost, minimal sample preparation, high input impedance and low output impedance, and inexpensive mass production using IC technology.

ISFET pH sensor: The N-channel ion-sensitive field-effect transistor with silicon nitride sensing layer developed. This solid-state device has many advantages over the conventional glass electrode pH sensor such as microsize, robustness, easy cleaning, minimal need for maintenance, and fast response. The device has been operated in the active mode by applying a gate-source voltage through Ag/AgCl reference electrode with appropriate biasing conditions. Its pH response has been determined by three-point calibration in standard pH = 4, 7 and 10 buffer solutions. The test conditions were as follows: drain-source voltage V_{DS} = 2 V, drain-source current I_{DS} = 10 mA in pH=10 solution. The drain-source current was maintained at the above value by varying the gate-source voltage V_{GS} in pH=7 and 4 solutions; the accompanying changes in gate-source voltages (DV_{GS}) giving the interfacial potentials were measured. Based on these experiments, the pH sensitivity was estimated to be ³ 50 mV per decade of pH.

The typical pH sensitivity of silicon nitride gate ISFETs is 53-55 mV/pH.



The packaged ISFET device with and without its protective cover

IV. ELECTRONICS FOR SOCIETAL PURPOSES

The project aims to develop electro-optic systems for sorting, grading packaging & storage of agricultural products, prosthetic instrumentation and medical instruments calibration and natural hazards mitigation.

PROGRESS:

It is proposed to develop electronics based systems especially for the sectors of Agriculture, Health and Natural Hazards Mitigation.

Electro-optical system for sorting, grading and packaging of apples: The opto-mechanical assembly of the chamber has been developed. Experiments have been conducted on spectral characteristics for different external defects like bruises and cuts in apples.

Intelligent Prosthetic Devices for Rehabilitation of Physically Challenged:

Artificial Knee: Hydraulically operated artificial knee joint with rotary vane system, damping system and hydraulic chamber has been developed.

Functional Electrical Stimulation System: The prototype of programmable functional electrical stimulation system has been developed. Preliminary clinical trials have been conducted on a paraplegic patient at Government Medical College & Hospital (GMCH), Chandigarh.

Seismic Alert System to Avert Colossal Losses during the Occurrence of Major Earthquakes: Algorithm and software for estimation of magnitude of earthquake has been developed. Testing is in progress with real seismic event. Lab testing of engineering model of Weak Motion Recorder has been completed.

Instrumentation for Monitoring, Detection and Early Warning of Landslides: Data Acquisition System has been developed for acquiring/logging data of various geotechnical sensors required for monitoring the landslide. Necessary communication link (Optical fibre link) for transmission of acquired data from data acquisition system to local controlling station has been completed. For data analysis & interpretation (at local control station), necessary software modules for the sensors have been developed.

1.6.2 Scientific Achievements under non-network programmes

NON-INDUCTIVE TYPE LOW VALUE POWER RESISTORS

Low value non-inductive type power resistors 25 mohm, suitable for MOSFET, IGBT, SMPS, Small motor drive was designed and developed. 10 prototype samples of low value non-inductive type power resistors were fabricated. The process involves mask and screen preparation, printing, drying and firing of resistor film and conductor for attachment on metal header, scribing, lead attachment, mounting of resistor on header using solder reflow technique and high temperature epoxy protection. The size of the substrate is 6 x 6 mm^2 with specifications: Value: 25 mohm, Power: 4 watt, Package: T-220.

"VOICE CHIP" FOR TEXT-TO-SPEECH SYNTHESIS OF HINDI LANGUAGE

CEERI has developed a 'Voice Chip', which is an Application Specific Instruction-set Processor (ASIP) based on Klatt's parametric formant algorithm for Hindi text-to-speech synthesis. It has the potential for use in embedded systems and appliances for visually challenged and speech-challenged persons. The 'Voice Chip" supports 45 instructions and has several dedicated floating-point and integer arithmetic units, sine-cosine unit, exponential function unit, and a random-number based noise generation unit.

DIGITAL MOISTURE PROBE

CSIO has developed a system for moisture measurement, which is based on variations in conductivity. This increases with increasing moisture. It has sensing system, microcontroller and display unit. The sensing system consists of two special metallic sensors embedded in a probe, electrically insulated, except at contact point near the tip where moisture of the oil seeds and grains is registered. It is simple to use, accurate, versatile with minimum controls to determine moisture content. Automatic temperature compensation has been provided to ensure optimal accuracy.

Digital Moisture Probe

COEFFICIENT OF HAZE AND DUST MASS MONITOR

CSIO has developed Microcontroller based coefficient of haze and dust mass monitor, which determines the instantaneous and average level of black dust mass concentration alongwith Coefficient of Haze (CoH) at ground level. A pump draws air at a predetermined constant flow rate through a sampling head and the dust particles are allowed to deposit on a filter for a fixed time. A dust spot is, therefore, formed on the filter paper proportional to the dust load in the ambient air. Before the sampling of dust, the microcontroller (8051) reads the intensity of transmitted light through blank filter paper (I_0) and latches this data in the memory. At the end of sampling time, the spot on the tape is moved in front of photodetector very precisely with the help of a stepper motor. The motion of the stepper motor is controlled by microcontroller.

Microcontroller based COH and Dust Mass Monitor

SMART CARD OPERATED PRE-PAID ENERGY METER

CMERI has developed a working prototype of a single-phase card operated energy meter using the latest technology using a popular microcontroller, smart card, ASIC based energy measurement unit and latching relay for load disconnection. The meter consists of a energy measurement unit , a card programmer / vending machine, a card reader, microcontroller based control logic, alarms and displays and a load controller. The Energy Measurement Unit basically consists of voltage and current sensors, signal conditioning circuits and energy processing unit. The energy processing ASIC directly gives the average real power information in the form of low frequency outputs. The Card Vending Machine is interfaced to a PC via RS232C interface. This is used to program the card using a user-friendly and simple software. Smart card technology has been used for transaction of electricity. Microprocessor smart cards have high memory capacity and a microprocessor, enabling them not only to store information but also to carry out local processing on the data. They have a high guarantee of security with respect to users. An intelligent card reader is used to read the card and is provided with an RS 232C interface. These are engineered to perform at least 50,000 operations. The reader

erases the card as soon as the data is read. The meter is designed using a microcontroller which reads the card, computes the net credit energy, updates the LCD display, activates the various alarms like 25% net credit and load-off indications, controls the relay on-off for load connection/disconnection. The control logic computes the net energy credit and updates the LCD display. It indicates 25% net credit alarm after 75% energy is consumed. It also gives a load-off indication after the net credit is zero.

1.6.3 Human Resource Development

CEERI

- Under the DIT-sponsored project "Special Manpower Development for VLSI Design and Related Software", four learning material (LM) modules have been prepared on High-level VLSI Design; VLSI Architectures and Systems; Laboratory on VLSI Subsystem Design; Laboratory on Verilog-based Digital Design;
- Two topics each of these LMs have been provided to IITs and other reputed Engineering Colleges.
- Training to 14 M.Tech. students from IIT, Delhi from 24.5.2004 to 3.6.2004 on "IC Technology".
- Technical visit of 40 students from DST, Bikaner from 25.5.2004 to 26.5.2004.
- Training provided to final year BE/B.Tech. MCA/ME/M.Tech/M.Sc./B.Sc. (Hons) students from various academic institutions.

CGCRI

- Short term training programme related to the field of ceramic, chemical and material engineering organized (28 participants were trained)
- Six HRD programmes organized by Khurja Centre in the field of high tension (HT) and low tension insulator, bone china novelty ware, stoneware crockery and glass bead making (50 participants attended the prorgramme)
- Two training-cum-demonstraiton programme organized by Naroda Centre on (i) energy conservation in ceramic industry (58 participants attended) and (ii) Chemical analysis of ceramic and allied materials.

CSIO

- 12th Management Development Programme on Operation, Maintenance and Repair of Biomedical Equipment
- 5th Management Development Programme on Operation, Maintenance and repair of analytical equipment.
- Training Programmes on Repair & Maintenance of Bio-Medical Instruments for Hospital Technicians/Doctors
- Courses Conducted by Indo-Swiss Training Centre (ISTC) of CSIO
  - Diploma in Instrument Technology
  - Advanced Diploma in Mechatronics & Industrial Automation
  - Advanced Diploma in Die & Mould Making

1.6.4 Recognition & Awards

Punjab Ratan Award	Dr. R.P. Bajpai, CSIO
K. Suryanarain Rau Memorial Award for Smart Technology Development for the Year 2004	Shri N. S. Mehla, Shri S. C. Jain, Dr. A. K. Aggarwal, and Dr. R P Bajpai, CSIO
Fellow of the Indian National Academy of Engineers, New Delhi	Dr. H.S. Maiti, CGCRI
President of West Bengal Academy of Science and Technology, Kolkata	Dr. H.S. Maiti, CGCRI
MRSI Medal, Materials Research Society of India	Dr. Goutam De, CGCRI
Hindustan Dorr-Oliver Award – 2004, Indian Institute of Chemical Engineers	Dr. Sibdas Bandyopadhyay, CGCRI
Certificate of Merit, Govt. of Tripura	Iron Removal Plant of CGCRI
Chartered Scientist – The Institute of Materials, Minerals and Mining, UK	Dr. K.N. Maiti, Scientist-in-charge, Naroda, CGCRI

1.7 ENERGY

In the early years CSIR played a major role in the establishment of the coal washeries in the country. It has been working on developing new approaches to coal fines beneficiation and recovery from the washeries, design of mini flotation plants etc. It has assisted the steel industry to decide on coke blends; the power industry in evolving washing strategies and the myriad of small and medium sized beehive coke units in the coal belt of India to efficiently produce coke with minimum pollution from inferior coals. It has been a pioneer in the developmental efforts in coal gasification and conversion of coal to liquid fuels. CSIR is synergising its strengths existing in different laboratories by networking to develop technologies/ products required by the Indian industry. Some of the achievements are outlined below:

1.7.1 Achievements through Network Projects

I. DEVELOPING NEW GENERATION FUEL AND LUBRICANTS

It is targeted to develop liquid fuels and ethanol production from biomass, biodegradable lubricants from vegetable oils & sugars and to set up emissions norms.

PROGRESS:

Several catalysts for synthesis of FT fuels and DME synthesis were prepared, evaluated, screened characterized and compared on high pressure fixed bed reactor system.

Process was developed for ethanol production at 45°C by a thermophilic strain IIPE-453 giving ethanol yield 45% on glucose. Conversion of rice, wheat flour to fermentable sugars using commercial thermostable enzyme and its further conversion to ethanol was achieved using selected yeast strains at 10L scale.

Different UDA based alkanol amines, UDA based TMP and PE esters, tri hydroxy stearic acid esters and ricinoleic acid estolide (dimer) and its acetate prepared on lab scale pilot plant level to be used as biodegradable lubricants. Laboratory scale processes were developed for Enrichment of erucic acid containing acyl glycerols from mustard oil; Trimethylolpropane and pentaerythritol esters of undecenoic acids and Ricinoleic acid estolide (dimer) methyl ester & its acetylated derivative.

II. COAL CHARACTERIZATION & RESOURCE QUALITY ASSESSMENT FOR SPECIFIC END-USERS

The project aims for detailed studies with respect to petrographic characterization and coking behavior of coal, gainful utilization/value addition of North East (NE) coal directly or after suitably blending, developing appropriate technology for carbonization/combustion and/or after sulphur cleaning by suitable process and also the recovery of precious and rare metals from pyritic wastes, if possible, Mathematical modeling for prediction of composition of gas as a function of operating parameters and properties of coal for gasification reactions.

PROGRESS:

Testing of coals at different carbonization conditions were conducted in a laboratory scale furnace. Desulphurization ratio in the range 17-19% has observed in the lower temperature range below 1000°C. A nano particle-based material has been developed and characterized for carbon dioxide absorption. Kinetic studies on reactivity measurements as well as active and reactive surface area has been determined on seven low rank coals. Methodology for determining true density of coal using nitrogen has been developed. This will change the current methodology of determination of true density by helium.

III. QUALITY ENHANCEMENT OF COAL FOR ITS EFFICIENT UTILISATION

The project envisages to identify the optimum beneficiation strategy of non coking coals to meet the needs of different end users; To assess the effect of blending of coals, (indigenous & imported) on efficiency of power generation and evolving strategies of blending of dissimilar coals. Use of Computational Fluid Dynamics (CFD) as a modeling tool of the different sub-processes like Spiral, Cyclone and flotation for improving the design and performance of existing systems. Application of different physical processes for treating non coking coal fines.

PROGRESS:

A no. of samples from different coalfields were collected for detailed characterization studies. Detailed washability investigations suggest similar washing characteristics of both Hingula and Belpahar coals of Mahanadi coalfields. Yields at 34% ash level are predicted taking help of Computer simulation studies. Blending of Belpahar (MCL) & Sonepur (ECL) coal was studied. Combustion characteristics of the above blended coal samples are studied in the Drop Tube Furnace. From the combustion characteristics of blended coal it is found that high ash Belpahar coal can be blended with the low ash Sonepur coal. Two samples

Satabadi OCP and Muraidih OCP of Bharat Coking Coal Limited were collected. Detailed crushing studies at sizes 75 mm. 25 mm, 13 mm and 6 mm followed by washability studies was carried out on both the samples to assess the liberation potential. No significant liberation was observed, when the coals were crushed even to 6 mm. The characterization studies on the coal fines collected from Patherdih washery is completed. Focus of the study was to improve the yield of cleans from coal fines using conventional physico-chemical processes and other advanced techniques like column, Jameson, Spiral, Knelson concentrator. Preliminary investigation on Patherdih coal fines indicates 50-60% yield at 17% ash level, with conventional and Jameson cell. Whereas column flotation was found more promising with 76% yield at 18% ash level.

1.7.2 Scientific Achievements under Non non-network programmes

FLYASH BASED MINE SUPPORT

CMRI has developed a flyash based mine support as a suitable substitute for timber prop. Other constituents of this prop are a resin and a fibre, which have been used as binding material and reinforcing material respectively. It is highly useful for the mining industry as this prop is light in weight, cost-effective and bears good compressive as well as tensile strength. Talcher flyash has emerged as the most suitable for making prop. It contains maximum CaO (1.82%), very little combustible material (2.5%) and good percentage of S_i0_2 (56.63%). Its bulk density is the lowest (0.74). While less content of the combustible material reduces the fire risk of the prop, low bulk density makes it light in weight. Good percentage of silica ensures good compressive and tensile strengths. The behaviour of the props in actual field conditions were also investigated by installing them at New Pit and Horladih coal mines. No physical and mechanical changes were observed in the *in situ* mine environment during a period of two months of experimentations. The props were found to withstand the load of 8 tonnes.

DIRECT SOURCING OF COAL FOR VALUE ADDED CHEMICALS

CFRI has studied solubilization of two low rank bituminous coals in aqueous organic solvents. The nitro group was introduced in the organic matrix of coal by oxidative nitration using dilute nitric acid. The solubility of raw coals and the coals in which nitro group was introduced, were determined in aqueous acetone and aqueous tetrahydrofuran. The experimental results reveal that introduction of nitro group substantially enhanced the solubilization of coal in aqueous organic solvents. Heat treatment of the oxy-nitrated coal at 150±10^{0}C in air caused elimination of NO_2 and lowering of solubility in potent mixed solvents from 49.5% to 25%, and from 56.2% to 29.3% in aqueous acetone and aqueous tetrahydrofuran respectively. The study reveals that nitro groups present in oxy-nitrated coals

played an important role in solubilizing it in aqueous organic solvents. The decrease in nitro group was detected by the FTIR difference spectra and was confirmed by material balance data. A hypothetical route of nitro group elimination and a possible mechanism for reduction of solubility of oxy-nitrated coal consequent upon its thermal treatment in presence of air have been put forward for the first time which is substantiated by FTIR spectra.

1.7.3 Human Resource Development

CFRI

- Training course on coal carbonisation/ coke ovens for staff of coke oven plants, Durgapur Projects Ltd.;
- CPYLS Programme: Twenty three, class XI students from various schools of CBSE and ICSE Boards within Bihar and Jharkhand State, participated in the programme;
- Vocational training/summer training programme for the students of various colleges, Universities/ technical institutions.

IIP

- XI Training programme on 'Advances in Petroleum Refining Technology and related aspects' for senior executives of different refineries was organized during April 28-30, 2004.
- Four-week training programme on 'Petroleum refining technology was organized for Chemical Engineers during September, 2004.
- Various training programmes on 'Petroleum refining technology' was organized for fresh Chemical Engineers during October & November, 2004.
- Workshop-cum-training programmes on 'Vehicular pollution' were organized during October & December 2004.

1.7.4 Recognition & Awards

CCAI-2004 Award by Coal Consumers Association of India	Dr. K. Sen, CFRI
Subrata Ghose Memorial Coal Petrology Award" for the year 2003-04 by The Mining Geological Metallurgical Institute of India	Mrs. N. Choudhury, CFRI
'Uttraanchal Ratan' Award in 'Indian Petroleum Category' All India Conference of Intellectuals Technocrats Excellencies Award in field Petroleum Research.	Dr. M.O. Garg, IIP
Technocrats Excellency Award in the field of Chemical Envineering	Dr. Jasvinder Singh, IIP

1.8 FOOD & FOOD PROCESSING

In the area of food and food processing, CSIR is contributing several novel cost-effective and easy-to-operate techniques and processes for food grains storage, conservation and processing, and has developed various technologies for low cost-nutritious foods, and food preservation, 'convenience foods', non-conventional foods, spice products, fruit & vegetable preservation, packaging & transportation, besides appropriate and improved designs for a range of machinery for processing, milling etc. Three network programmes are also being implemented in this area.

1.8.1 Progress under Network projects

I. POSITIONING INDIAN NUTRACEUTICALS AND NUTRIGENOMICS IN A GLOBAL PLATFORM

The project envisages repositioning India's leadership in the area of nutraceuticals and nutrigenomics through study of molecular basis of bioactives for the preventive, curative and management of several systematic and chronic ailments. The focus is on the health benefits from a variety of plant resources and their ingredients, which may ultimately pave way for this approach called nutrigenomics.

PROGRESS:

AVP (Ala-Val-Pro), a tripeptide, was synthesized by solid phase FMOC-chemistry using rink amide MBTH resin. The peptide was cleaved from the matrix using 100% TFA containing ethane dithiol. The purity of the peptide was evaluated by

RP-HPLC using the TFA/CH3CN solvent system and found to be >99% pure. The sequence of the peptide was verified by amino-terminal sequence analysis and amino acid composition. The ACE inhibitory activity was evaluated using porcine kidney and lung ACE. The IC_{50} value for ACE inhibition was 36.5µg. This IC_{50} value is several fold higher than the pentapeptide VLIVP and therefore less effective.

II. NATURE, NATURE-IDENTICAL OR SIMILAR BIOMOLECULES

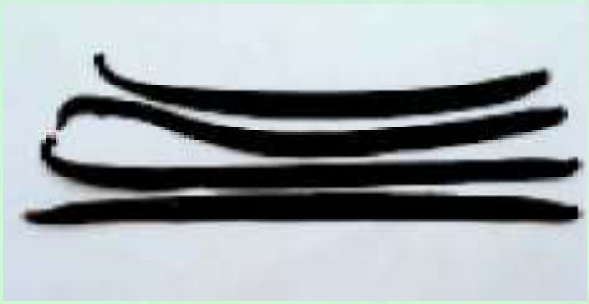
India is the country with rich biodiversity and also with tradition in use of biomolecules from ancient times for health, nutrition and horde of other useful purposes. Inspite of huge demand for such biomolecules throughout the world, their availability is limited and the country even depends on import of a number of biomolecules. The project targets to develop commercially exploitable biomolecules.

PROGRESS:

VANILLA

Mature fruits were found to possess a very high level (nearly 2000 units/g of fresh weight) of peroxidase (POD) (pH 6.0), which could play an important role in the formation of vanillin flavour from various intermediary phenylpropanoid compounds.

Vanilla flavour resulting from various techniques namely, direct extraction of vanilla beans with solvent mixture, liquid liquid extraction, flavor preparation employing Likens Nickerson apparatus and extraction with solvent mixture after



Cured vanilla beans

drying of cured beans was assessed using gas chromatography. Cured beans (dried in desiccators for 6 days) was powdered, extracted using solvent mixture consisting of dichloromethane and n-pentane. The solvent was then distilled using water bath, analysed, for components. Vanillin, which accounted for 64% of volatiles was the major component identified.

VALUE ADDITION TO COARSE TEA LEAVES

The conserve (yield: 8-10%) obtained after the processing of Green tea is evaluated for radical scavenging activity using DPPH model system. The radical scavenging activity of the conserve is about 55-80% and 90-93% at 5 and 10 ppm concentration respectively, which is comparable to the activity (90-94%) of synthetic antioxidant BHA at 40 ppm concentration. These extracts have application in various food systems for preservation and as supplements in health foods.

Generally, cereals are poor source of plant polyphenols. The phenolics from the seed coat fraction of GPU 28 variety of finger millet were extracted using acidic methanol solvent, concentrated and identified by HPLC. Ferulic acid, vanillic acid, gallic acid, caffeic acid, 4-hydroxy benzoic acid, syringic acid and coumaric acid have been identified.

Investigations on the effect of the millet polyphenols on the inhibitory activity of snake venom PLA_2 and the inflammatory PLA_2 have been carried out. Its inhibitory activity is found to be 50 and 63% respectively.

III. ESTABLISHMENT OF GENETICALLY MODIFIED FOOD REFERRAL FACILITY

It is imperative for the Government to have testing or referral centers in place with well-developed robust methods to accurately quantitate Genetically Modified Organisms (GMOs) in foods and food ingredients to assure compliance with threshold levels of GM products and evaluate their safety. The project aims to establish a referral center for food and food products, which will boost export of these items based on their declared absence or presence of the GM component.

PROGRESS:

DNA based methods to detect/construct specific copies of the herbicide tolerant gene of GM-soya were developed. The CP4 EPSPS gene of *Agrobacterium tumefaciens* has been inserted to develop herbicide tolerance. Using various primer pairs that amplify the construct region between EPSPS and the CaMV35S regulator was amplified. The 447 bp amplicon was sequenced and found to contain the cross border region between CP4EPSPS. Primer pair GMO 07/GM08 was used to amplify a smaller segment of the cross border region. This amplified a 196 bp fragment whose sequence was confirmed by DNA sequence analysis. Soya EP4SPS gene 447-bp and 169 fragment was detectable in GM soya but was not amplified in the non-GM soya.

The Cry1Ab gene, inserted in GM-Maize (MON 810) codes for d-endotoxin, which binds to specific sites, localized on the midgut epithelium of susceptible

lepidopteron insect species and interferes with midgut function, thus acting as a potent and highly specific insecticide. Hence detection of this gene by PCR can be used to develop DNA based methodology. The primer pairs Cry1Ab F and Cry1Ab R were used for specific detection of the synthetic Cry1Ab gene that amplifies a 204 bp fragment. A 204 bp fragment was detected in GM-maize samples. The 204bp amplicon could be detected at levels as low as 0.1. Construct specific sequences are unique and thus can be used for the unambiguous detection of genetically engineered food and those derived therefrom. The primer pair MonF and MonR was used to amplify a 194 bp fragment of the Cry1Ab–Hsp construct region. The 194bp amplicon could be detected at levels as low as 0.1 %. The cross border sequence between the regulatory element CaMV 35S and the maize genome was detected by using a pair of primers VW01/VW03. A 170bp amplicon was detected in all the MON 810 maize samples. The gene sequences were confirmed by DNA sequencing and by digestion with restriction endonucleases. Two other construct specific cross border sequences between the CaMV35S regulator and Intron 1 and Exon 1 respectively of the heat shock protein were also detected. These sequences were amplified using the primer pairs Mg1/Mg2 and Mg3/Mg4 respectively. The detection of an amplicon of 401 bp confirms the presence of the cross border between CaMV35S and intron 1 of the heat shock protein. The cross border sequence between CaMV35S and exon 1 of the heat shock protein yields a 149 bp amplicon.

1.8.2 Scientific Achievements under non-network programmes

In addition to network activities, CSIR laboratories have been involved in basic and application oriented R&D in non-network mode also. Some of the achievements are presented below:

NUTRITIOUS PRODUCTS FROM COCONUT SAP

CFTRI has developed a process for the preparation of coconut sap concentrate from fresh coconut sap. The coconut sap, collected by tapping, was clarified, deodourised and concentrated. A palatable nutritious beverage was obtained from the sap. Coconut sap was found to undergo lactic and acidic fermentation to produce alcohol to an extent of 6%, as soon as it is tapped. The sap, in spite of its obnoxious odour, was found to be rich in nutrients and minerals like sugars, citric acid, iron, phosphate and vitamin C. The product is highly nutritious and useful as the base material for the manufacture of spread, jam, jellies and candies. A spread-like product has also been developed by treating the sap concentrate with pectin, citric acid and mixed fruit pulp followed by further concentration to 70°Brix. Alternatively, spice flavourants have also been incorporated instead of fruit pulp.

ELECTRONIC NOSE FOR COCONUT SAP – *NEERA*

Neera, the sugar containing juice or sap, is obtained by tapping the unopened spadix of the coconut palm. *Neera* ferments very quickly and even during the collection process, alcohol is produced in it. CFTRI has developed a simple analytical system, capable of assessing the quality of *Neera*. The system utilizes the unspecific response of the MOS sensors to finger print the samples being analyzed. It has a sample-heating zone for creating the headspace, a sampling chamber, an array of 5 metal oxide semiconductor sensors and a data acquisition system. The *Neera* samples have been analyzed during the course of their fermentation using the electronic nose system. Neural network is used to determine the quality and the amount of alcohol present in the sample. The results from the electronic nose system have shown very good correlation with those of the gas chromatographic analysis (R^2 = 0.9863).

COST EFFECTIVE PACKAGING SYSTEM FOR A FEW TRADITIONAL FOODS

CFTRI has carried out packaging and storage studies on *potarekhu, laddu*, in addition to chips of tapioca, banana and jackfruit. Moisture content - water activity relationships studies for *laddu* was studied to fix the critical moisture content. The changes in the moisture content with time were studied at different humidities ranging from 64% to 90%. The product was evaluated initially for microbiological quality and sensory parameters. Storage study was carried out in composite containers with inert gas (nitrogen) flushing under the accelerated (38°C, 90% RH) and normal or BIS (27°C, 65% RH) conditions. The container comprised an outer chromo paper/3-ply paperboard/kraft liner with aluminum foil and PVDC coating. It has maximum storage of 3 weeks.

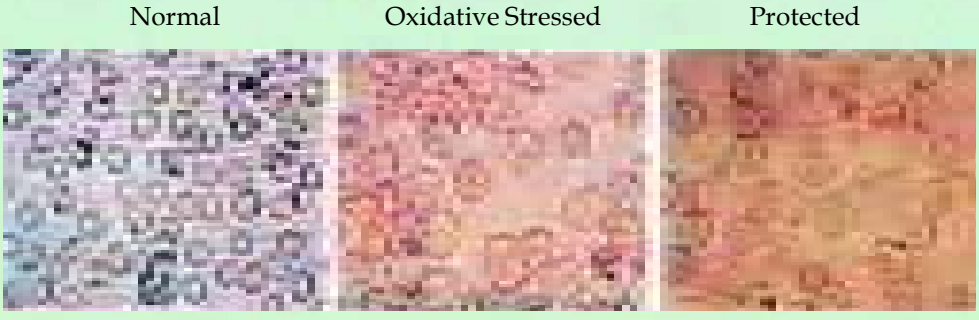
PROTECTION OF INTEGRITY OF ERYTHROCYTES BY DIETARY HYPOLIPIDEMIC SPICES

CFTRI has found that in rats rendered hypercholesterolemic- by maintaining them on a cholesterol enriched diet-erythrocyte membranes were relatively enriched in cholesterol (about 120% of basal control) resulting in a significant alteration in cholesterol to phospholipid ratio. Inclusion of spice principles - curcumin (0.2%) or capsaicin (0.015%) or the spice – garlic powder (2.0%) in the diet, produced a significant hypolipidemic effect. In addition, these dietary spices countered the altered lipid profile of erythrocyte membranes in hypercholesterolemic situation by producing a significant (10-14%) decrease in membrane cholesterol content. As a result of alteration in membrane structural lipids, the structural integrity of RBCs was also affected. RBCs of hypercholesterolemic rats were relatively fragile compared to normal controls. Dietary curcumin, capsaicin and garlic appeared to correct this deformity and increased fragility of erythrocytes. A further insight

into the factors that might have reduced the fluidity of erythrocytes in hypercholesterolemic rats revealed changes in fatty acid profile of the membranes, phospholipid composition of the membrane bilayer, reduced Ca^{2+}, Mg^{2+}-ATPase, and reduction in the sensitivity of erythrocytes to Con-A. ESR spectra and fluorescence anisotropy parameters also revealed altered fluidity of erythrocytes in hypercholesterolemic rats. Dietary capsaicin and curcumin significantly reversed this alteration. Scanning electron microscopic examination revealed that echinocyte population was increased in the erythrocytes of hypercholesterolemic rats, and this was significantly countered by dietary capsaicin. The membrane-protein profile and the active cation efflux appeared to be unaffected in hypercholesterolemic situation.

ISOLATION AND CHARACTERIZATION OF ANTIOXIDANT AND ANTICANCER POLYSACCHARIDES FROM SWALLOW ROOT, BLACK CUMIN AND BELESOPPU

CFTRI has prepared Pectic polysaccharides (PPS) from dietary sources such as *Decalepis hamiltonii* - Swallow Root (SRPP), *Nigella sativa* - Black cumin (BCPP), *Andrographis serpyllifolia* - Bele soppu (APP), *Zingiber officinale* -Ginger (GPP) and compared with that of citrus pectin (CPP) - reported to be an effective antimetastatic polysaccharide even in clinical trials. PPS have been examined for their inhibitory property against Galectin-3 of HeLa cells induced agglutination of red blood cells (RBC). The assay enabled to understand the effect of potential antimetastatic property, since it mimics Galectin-3 mediated cancer cell (HeLa) interaction with normal cells (RBC) as encountered during metastasis *in vivo*. Results indicate that SRPP inhibited agglutination at effective inhibitory concentration ICe - .185 mg equivalent of carbohydrate as opposed to those of BCPP (13mg), APP (4.2mg) and CPP (2.5 mg). Comparative sugar composition analysis indicated that the active polysaccharide is an Arabinogalactan and this will be cancer- cell specific since it binds to Galectin-3, which is expressed only in cancer cell and not in normal cell. Besides this polysaccharide, SR-phenolics are cytoprotective against oxidative stress induced cellular damage (figure given below). Thus SR with antioxidant and antimetastatic compounds is a potential anticancer source.



Cytoprotective effect of SR-Aox against oxidative stress induced cellular damage

SPECIFIC FOOD ADDITIVES FOR ENHANCING SENSORY QUALITY OF SELECTED MARKET PRODUCTS

CFTRI has developed an instant mix formulation, containing selected additives, for the preparation of blackgram *vada*. Oil content of dough based deep fat fried snacks could be decreased by the addition of enzyme treated starches. Enzymatically modified starches were found to considerably lower the fat content of *Samosa* without affecting the sensory quality. An instant mix formulation containing selected additives was developed for the preparation of dough based fried snacks such as *Samosa / Kachori / Karjikai*. Expanded rice flour and thermally processed Semolina were found to be effective additives in the formulation of instant mix for fried snacks containing sorghum and blackgram.

FLAKING FOXTAIL MILLET (*STEARIA ITALICA*)

CFTRI has developed the foxtail millet flakes, which are ready-to-use convenience products similar to rice, wheat, sorghum and other cereal flakes. The flakes could be sprinkled with water and seasoned with spicy condiments or sweetened for consumption as snacks. The thicker grade flakes may be deep fat fried to prepare crispy, ready-to-eat snacks. The broken and pulverized flakes can be mixed with legumes and other ingredients to prepare traditional foods like *Bisi-Bele bhath*, *Idli* and such other products. These flakes can be used after toasting or blistering, similar to corn flakes. These products enhance the variety available in convenience products.

Foxtail Millet Flakes

PCR-BASED DETECTION OF 'GENETICALLY-MODIFIED' FOODS

CFTRI has developed a PCR-based method for the detection of genetically modified foods, by amplification of the 'incorporated genes' viz. 35S promoter of 'cauliflower mosaic virus, NOS terminator and modified EPSPS gene. Amplification of genes for lectin and starch synthase was used as housekeeping genes for soya and maize respectively. To validate the detection method, samples of processed food products were tested for the GM-genes.

AUTO ANALYZER FOR IMMUNOASSAY OF PESTICIDES

Automation of immunoassays ensures precise detection with high accuracy. The objective of the analyzer system developed is to provide a user-friendly system. It employs 8952 microcontroller to control the flow of reagents, samples, substrate and conjugates used for analysis. With the sequence and flow control of buffers used, it also provides the option for reuse of the immobilized antibody column. The system is flexible to accommodate multiple sequences up to a maximum of 99 steps. It is customizable for different flow ELISA applications. It can control up to 8 solenoid valves (DC 24V) and two peristaltic pumps. It has one 12 bit analog channel for data acquisition. With the serial interface port, the system provides convenient means for data acquisition and porting to the computer. The system has been tested for analysis of organophosphate pesticide methyl parathion and has yielded good results.

CHITOOLIGOSACCHARIDES – STRUCTURAL AND BIOLOGICAL ACTIVITY STUDIES

The degradation products of chitosan, viz. low molecular weight chitosan (LMWC) and chitooligosaccharides (CO), find innumerable applications in biotechnology and biomedical fields. They have been obtained by non-specific enzymatic depolymerization of chitosan, derived from crustacean wastes. Several enzymes such as pectinase, papain, pronase and pepsin have been utilized to selectively depolymerize chitosan to LMWC, CO and monomers, in varying yields. Molecular weight (by GPC) of LMWC is found to be in the range of 4-10 kDa, crystallinity index (by X-ray studies) of 60-62% and ^{13}C-NMR data have shown subtle conformational changes. From the degree of acetylation values (by IR and ^{13}C-NMR) it is clear that these enzymes cleave only glycosidic bonds leaving the N-acetyl groups intact. The CO mixture has exhibited a degree of polymerization (DP) of 2-8, with the preponderance of tetramer and hexamer (HPLC data). Both LMWC and CO have shown excellent antimicrobial activity against several of the food borne pathogens

GREEN TEA

Fresh green tea leaves were procured from the estates of Nilgiri hills and withered to bring down the moisture. The withered leaves were subjected to drying using continuous Infrared Dryer to inactivate the enzymes, and to retain the simple polyphenols (i.e., Catechins), which are reported to show several health benefits. Dried leaves were cooled and subjected to leaf distortion, and then stored for further utilization. The novelty of the process lies in employing the infrared energy for enzyme inactivation in tea leaves during the manufacture of superior green tea. Presently green tea is produced either by steaming or pan firing of the fresh tea leaves and then subjected to further processing.

Infra-red drying of green

PRODUCTION OF NATURAL COLOURS

M/s KCP Biotech, Hyderabad have commissioned their commercial plant for producing natural colours (from Turmeric, Chillies and Annota seeds) required for food processing, cosmetics and pharmaceuticals at S.P. Biotech Park. CFTRI has provided technology know-how package and IICT has provided detailed design report for 1 TPD (raw material) commercial plant for the client. The company has invested Rs. 6 crores and has potential to currently employ 65 persons in the plant.

1.8.3 Human Resource Development

CFTRI:

- In all, 36 short-term training programmes were conducted including 10 custom-made programmes. The uniqueness of the programmes has been the participation of a heterogeneous group and the effective means of providing the knowledgebase and informatics in varied areas of food science and technology, which is relevant to the present food industry scenario. A total of 535 participants comprising of entrepreneurs, industry personnel, government and private organizations, academia, NGOs, self-Help groups, women organizations and other institutions have been benefited.

ACADEMICS:

M.Sc. Food Technology (2 years Duration)

Number of the Participants**:** 21; Level of Participants**:** Post Graduate Level; Type of Participants**:** Fresh meritorious graduates from every State of the Country. Participants are immediately absorbed in Food Industries on completion of the course as Management Trainees and thereafter, placed at various Managerial level positions.

Certificate Course in Milling Technology (12 months Duration)

Number of the Participants: 20; Level of Participants: Certificate Course; Type of Participants: Graduates with experience in Flour Milling Industry.

The students who pass out the course are immediately absorbed in the roller flourmills and the mills are greatly benefited by the training in terms of production of high quality milled wheat products to meet the customers' requirements.

Ph. D. Programme (4-5 years Duration)

Number of the Participants: 55 candidates have enrolled for Ph.D. Degree in Food Science and allied basic subjects in the year 2004-2005. Level of Participants: CSIR-UGC NET qualified postgraduates. The participants get equipped with sufficient theoretical and practical knowledge to make a successful career in R & D.

Training of students from other universities and colleges (4 weeks to one year duration)

Number of the Participants: 120 students; Level of Participants: Graduates / Postgraduate students; Type of Participants: Graduates and Post Graduate students from various engineering colleges and universities. In the curriculum of most of the universities and engineering colleges, the students have to undertake a short term project of 4-6 weeks to one year duration in an outside institute / organization. Emerging and frontier areas of Science & Technology with long-range application to foods are given special focus in this training so that the youngsters from universities are adequately equipped to take up a challenging R&D career in future.

CSIR Programme for Youth on Leadership in Science (CPYLS)

37 students attended the programme. During the programme, the students and parents were familiarized with the contribution of CSIR, CFTRI and Indian Scientists to the progress of S&T in the country.

Students interacting with a CFTRI Scientist

1.8.4 Awards & Recognition

Dr. P.B. Rama Rao Memorial Award (2003) - The Society of Biological Chemists (India), Bangalore: In recognition of outstanding Contribution to Biomedical Sciences	Dr. K. Srinivasan, CFTRI
Laljee Godhoo Smarak Nidhi Award (2003) - Association of Food Scientists and Technologists (India), Mysore	Dr. N.K. Rastogi, CFTRI
Prof. V. Subramanyan Industrial Achievement Award (2003) - Association of Food Scientists and Technologists (India), Mysore	Dr. G.A. Ravishankar, CFTRI

1.9 HEALTH CARE, DRUGS & PHARMACEUTICALS

CSIR has developed cost effective and innovative processes for several generic drugs. Herbal drugs were standardized and pharmacopeial standard for Ayurvedic drugs were laid. Also diagnostic tools were devised and introduced in the market and several molecular gene based targets developed. Moreover, CSIR is developing cost-effective and commercially viable technologies for a wide range of essential drugs, such as for anti-cancer, anti-virals, anti-bacterials, anti-glaucoma, anti-inflammatory, analgesics, and cardio-vascular drugs among others, gave the much needed fillip to a nascent Indian drug industry to emerge as the largest producer of generic drugs in the world. CSIR laboratories are working in network mode within themselves and with some pharmaceutical companies. Some of the significant achievements project-wise are given below:

1.9.1 Progress under Network Project

I. ASTHMATIC AND ALLERGIC DISORDERS MITIGATION MISSION

The emphasis is on to explore the mechanism of actions of the preparations / molecules on specific target sites to strengthen the claim with a view to mitigating asthmatic and allergic disorders covering biochemical, immunological, genetical and pharmacological aspects.

PROGRESS:

The genetic association of the beta subunit of lgE receptor (FceRIb) with asthma in the Indian population has been investigated. Four polymorphisma, namely, a G/A polymorphism in exon 7 (E237G) and a C/T polymorphism in 3'-UTR, encompassing a length of 8.74 Kb, were genotyped, and haplotypes are being

generated using PHASE (version 2.02) for unrelated patients and healthy volunteers. The hematological parameters –RBC, WBC, differential leucocyte counts, heamoglobin, ESR, PCV and clotting time were analysed.

Evaluation of the promising peptides for immune responses *in vitro* model indicates their potential to modulate the immune responses to Th1 type. The spleen suspensions of peptide immunised mice shows significantly less proliferations than the untreated control mice challenged with allergens/ antigens.

Using PROTEAN program, 15 antigenic stretches (including T and B cell reactive regions) have been derived. These peptide sequences were then looked for homology to the known allergenic epitopes already submitted in allergen databank.

The Iso electric focusing conditions of the proteins of HI were standardized to identify allergenic components. A narrow range of 5-8 pI was chosen for better resolution of the pollen proteins and approximately 200 spots were separated on the gel size of 8.3 * 10 cm.

Polymorphisms in the promoter and a dinucleotide repeat in the second intron in the *IL4* gene were genotyped by sequencing and genescan analysis, respectively.

II. NEWER SCIENTIFIC HERBAL PREPARATIONS FOR GLOBAL POSITIONING

The basic aim of the project is to develop effective standardized herbal formulation(s) for use as health promoters, or for treating various disorders, adaptogens and immunomodulators etc.

PROGRESS:

- *Bacopa monieri: Bacopa monieri* and *Centella asiatica* were collected in bulk, processed and extracted with aqueous alcohol. HPTLC finger print profiles of above extracts were also developed.
- *Curcuma longa:* The extract was prepared as per the set protocols. The content of *curcumene, demethoxycurcumin*, *Bisdemethoxycurcumin* were determined.
- *Sida cordifolia:* Fresh collection from local area was made and extract prepared. Microbial local determination is being carried out. The extract is isolated for marker compounds.
- *Asparagus racemosus:* Two commercial samples procured from New Delhi and Amritsar market were powdered and extract with aqueous ethanol. The extracts of plant powder are being examined for microbial load. The extract enriched with *saponins* isolated and chemical characterisation of triterpenoid glycosides was done.

- *DNA Fingerprinting:* The main purpose of the DNA fingerprinting is the development of molecular markers for their identification and protection of medicinal plants. DNA fingerprints for plant materials of 8 different species were developed in case of *Asparagus racemosus* and two accessions in case of *Allium satium,* namely ASFP-LVS-1 and ASFP-LVS-2. DNA from leaf tissue of these plants was isolated from green young leaves using CTAB method.

III. PREDICTIVE MEDICINE USING SINGLE AND REPEAT POLYMORPHISM

It is proposed to build an Indian SNP (Single Nucleotide Polymorphism) database of common diseases and drug response related genes, which is in the larger interest of human health in general and predictive medicine & drug response in particular in the country.

PROGRESS:

Discovery phase work on SNPs discovery panel of 40 samples in 24 genes has been analysed. Pooling and multiplexing in the MASSARRAY system using Sequenom has been completed.

IV. DRUG TARGET DEVELOPMENT USING IN-SILICO BIOLOGY

The aim of the project is to create and develop in-house capability in drug target development using in silico biology; to design programmes for developing new software, which enable identification of therapeutic targets; to design and develop new tools for predicting toxicity and drug response in silico; and to generate qualified and trained IT professionals for pursuing research in the area of bioinformatics.

PROGRESS:

Database construction: Two datasets were collected, one positive and another negative for training the neural nets. The positive dataset includes non-redundant, manually curated protease (Aspartic, Cysteine, Metallo, Serine, Threonine) sequences, which were collected from SwissProt database (http://www.expasy.org/cgi-bin/lists?peptidas.txt). The negative dataset includes all the ribosomal protein sequences (not mitochondrial and not chloroplast origin) collected form Swissprot database (http://www.expasy.org/cgi-bin/lists?ribosomp.txt) that are completely different from proteases and are structural proteins.

Attributes: Seven attributes were considered for identification of proteases which includes Aminoacid frequency, Dipeptide frequency, Moments of charge, Multiplet

frequency, Euclidean distance, hydrophobic distance, iso-electric point out of which three modules (Aminoacid frequency, Dipeptide frequency, Moments of charge) were prepared and quality checking was done.

V. ANIMAL MODELS AND ANIMAL SUBSTITUTE TECHNOLOGIES

It aims to influence the process of new drug development and toxicity/ safety evaluation of drugs/chemicals. It is envisaged to introduce state-of-the-art technologies for new drug development, which will reduce the average time taken for development of new drugs by 2-3 years from the current average of 12-14 years in addition to providing better understanding of the drug action and targets.

PROGRESS:

Drosophila Model: Out of eight chemically and mechanistically diverse convulsant and anticonvulsant agents, namely, strychnine, pentylenetetrazol, pilocarpine, tetraethylammonium, ethosuximide, gabapentin, valproate and vigabatrin, pentylenetetrazol finally emerged as a compound that brings about a long lasting behavioral alteration in Drosophila. In mammalian models, pentylenetetrazol is an established agent to induce seizure and anxiety. In Drosophila, pentylenetetrazol withdrawal caused an increased negative geotactic response. Since no seizure-like activity was ever observed under various treatment regimes applied, and because an enhanced response in a startle-induced negative geotaxis assay is seemingly more akin to anxiety, it was considered prudent to further evaluate the potential of fly as an anxiety model.

Yeast Model: Yeast is being used as a model system to study the gene expression profile on exogenous addition of homocysteine. To test if the inhibitory effect of cysteine is due to its conversion to homocysteine, homocysteine and cysteine was added exogenously to yeast strain that had the gene responsible for the conversion of cysteine to cystathionine deleted (str3D). This strain could not convert cysteine to homocysteine. However, even in this strain the inhibitory effect of homocysteine and cysteine were the same as in the wild type strain. Thus clearly, the growth inhibitory effect of cysteine is not due to its conversion to homocysteine.

VI. INFECTIOUS DISEASE HANDLING, STORAGE AND RESEARCH FACILITY

It is envisaged to set up one state-of-the-art biosafety level 4 (BSL4) or P4 facility and five biosafety level 3 (BSL3), where work can be done on exotic micro-organisms. The thrust of these new facilities is to develop new diagnostic reagents, identify candidate genes and proteins for making vaccines, and to develop technology for the large scale culturing and storage of these organisms.

PROGRESS:

Prophylactic potential of Aspergillus peptides against ABPA murine models: Synthetic peptides P1-P5 (6-11 mer) derived from N- terminal region of Asp f 1, a major allergen/antigen of Aspergillus fumigatus, were evaluated for their prophylactic efficacy in protection from ABPA, using murine models. Prophylactically treated mice i.e., peptides administration (i.n. and i.p.) followed by mice sensitization with allergens/antigens of A.fumigatus showed promising results with peptides P1-P3 as seen by increased specific IgG2a:IgG1 ratio, decreased specific IgE levels, reduced infiltration of eosinophils in lung histopathology, decreased peripheral eosinophil count and peptide-induced anergy. These studies may lead to the development of peptide-based vaccines against ABPA.

Administration of rMBL in a murine model of allergic bronchopulmonary aspergillosis (ABPA): The effects of exogenous administration of human rMBL in a murine model of pulmonary hypersensitivity were examined. rMBL was intranasally administered to the ABPA mice at two different concentrations. The ABPA mice exhibited high levels of Afu-specific IgG and IgE, blood eosinophilia, extensive infiltration of lymphocytes and eosinophils in the lung sections. Treatment with rMBL lowered blood eosinophilia, pulmonary infiltration, and specific Ab levels considerably.

Identification of novel allergens/antigens of Aspergillus fumigatus using proteomic approach: The comparative analysis of 2-DE gels (CBB-stained) and specific IgE immunoblots (with ABPA patient pooled sera) of 1st, 2nd and 3rd week culture filtrate protein fractions shows 18, 48 and 65 specific IgE immunoreactive proteins out of 36, 92 and 134 proteins respectively. Third week culture filtrate had maximum number of proteins and specific IgE immunoreactive proteins. MALDI-TOF analysis of 33 spots led to the identification of twenty five proteins, nineteen of which are new to *A. fumigatus* proteome database and six were already known allergens of A. fumigatus. BLAST (TBLASTN) analysis of newly identified proteins with *A. fumigatus* whole genome shotgun assembly showed good homology supporting the search analysis. Availability of allergenic proteome and 19 novel allergens/ antigens would facilitate a sensitive and specific diagnosis, immunotherapy and further understanding of the biology of the fungus.

1.9.2 Scientific achievements under Non-network programmes

CSIR laboratories, apart from working in networking mode, carry their R&D activities in non-networking mode also. Some of the scientific achievements are highlighted below:

NEW TB VACCINE

To facilitate *in vitro* screening, models using nonpathogenic *M. bovis* BCG, *M. tuberculosis* H37Ra, *M. aurum* and virulent *M. tuberculosis* H37Rv as test strains

expressing firefly luciferase and green fluorescent protein as reporters have been developed and adapted to throughput screening along with the Alamar Blue assay for cell viability. Assays against select defined targets viz., *M. tuberculosis* ahpC (target for isoniazid resistance), alpha crystalline (target for latency), isocitrate dehydrogenase available in HTS laboratory has been used for screening of their inhibitors. In addition, new assays for isocitrate lyase (targets for latency) and flavin dehydrogenase (in vivo expressed protein) have been developed for induction in throughput screening. An experimental murine infection model has been developed and is currently being validated for drug screening. The new drug candidate is expected to be active against persistent bacteria and shorten the treatment period with complete sterilization. Secondary *in vitro* screening of potential molecules against virulent strain of *M. tuberculosis* ($H_{37}Rv$) in the non-HTS mode has to selection of molecules, active at 3µg/ml or lesser doses. These molecules have been subjected to *in vitro* cytotoxicity assays using VERO cells. Six CDRI molecules found active have been selected for further development. Herbal extracts of a species active against *M. tuberculosis* have been identified for further development and an international patent has been filed.

HERBAL MEDICAMENT (HM) FOR TREATMENT OF STROKE

CDRI has developed an Herbal medicament (HM) for treatment of cerebral stroke. The HM at the dose of 250 mg/kg provided significant protection in ischemic stroke model, and a dose of 500 mg/kg was effective upto 80%. The HM not only reduced the area of infarction but also reduced edema owing to its anti-inflammatory action. It was very effective in reversing the behavioural deficit produced by the stroke. It also exhibited a cytoprotective effect as the MDA levels returned to basal level and there was an enhancement in the intra-cellular GSH level. Its anti-stroke potential has also been demonstrated by MRI studies. The HM even at 5-fold effective dose was found to be quite safe in the regulatory pharmacology studies in rodents. The anti-stroke effects of HM seem to be due to its anti-apoptotic, anti-inflammatory, antithrombotic and anti-oxidant potential.

ANTIRESORBING AGENTS

CDRI has identified a novel antiosteoporosis agent on the basis of inhibition in parathyroid hormone (PTH)-induced resorption of ^{45}Ca from prelabeled chick fetal bones *in vitro*. It prevents ovariectomy induced decrease in bone marrow density (BMD) and mineral content in ovariectomized adult as well as retired breeder female rats. It inhibits bone marrow derived M-CSF and RANKL induced osteoclastogenesis *in vitro* in a concentration dependent manner and prevents ovariectomy-induced down-regulation of TGF b-3 expression in lumber vertebrae of rats. In addition to being a better antiosteoporosis agent than raloxifene, it is also devoid of any estrogen agonistic activity at uterine/endometrial level. It does

not show any competitive binding to purified human estrogen receptor isoforms alpha and beta, but exhibits significant estrogen antagonistic activity. It prevents DMBA-induced breast cancer and inhibits ovariectomy induced increase in serum total cholesterol in adult female rats. This highly cost-effective, easy to synthesize molecule was devoid of any cytotoxicity and target organ damage and was found to be stable when stored at temperatures up to 60°C.

A BIOMARKER FOR THE DIAGNOSIS OF VISCERAL LEISHMANIASIS

In search of a novel biomarker, IICB has identified the increased presence of disease specific biomarker (glycotype) on erythrocytes of patients with visceral leishmaniasis. The over expression of this biomarker have helped in the development of erythrocyte binding assay to monitor the clinical status of visceral leishmaniasis patients, which can detect VL even under field conditions. The assay can successfully diagnose VL. Only a drop of blood is required for this assay. The assay is cheap, non-invasive and above all is rapid and can be carried out in field conditions. The assay has greater sensitivity and minimal cross reactivity with malaria and tuberculosis. The potentiality of this discovery has been quickly identified by World Health Organisation (WHO) for its global application and the technology has recently been transferred to an Indian company (Zephyr Biomedical, Goa)

BREAST CANCER CELL SEEKING LIPSOME

IICT in collaboration with CCMB created the breast cancer cell seeking liposome by chemically gluing a set of fatty molecules with a drug called haloperidol. Liposomes are vehicles that can carry anti-cancer drugs or anti-cancer genes to the breast cancer cells.

ANTI MALARIAL LEAD MOLECULES FROM GREEN MUSSELS

NIO and M/s Shreya Life Sciences, Mumbai, recently signed a licencing agreement to commercialize two anti-malarial lead molecules developed from green mussels and patented by NIO.

CURCUMIN (HALDI) IN PREVENTION OF INDOMETHACIN-INDUCED GASTRIC ULCER

IICB has studied the regulation of MMP-9 and -2 activities in indomethacin-induced acute gastric ulceration and healing. Indomethacin ulcerated stomach extracts exhibit significant upregulation of proMMP-9 (92 kDa) activity and moderate reduction of MMP-2 activity, which strongly correlate with indomethacin dose and severity of ulcer. The anti-inflammatory and anti-oxidant properties of curcumin,

an active component of turmeric suggest that curcumin may exert anti-ulcer activity either through scavenging reactive oxygen species (ROS) or by regulating MMP activity, or both. To test these possibilities, effect of curcumin in indomethacin-induced gastric ulcer is examined by biochemical and histological methods. The results show that curcumin exhibits potent antiulcer activity in acute ulcer in rat model by preventing glutathione depletion, lipid peroxidation and protein oxidation. Denudation of epithelial cells during damage of gastric lumen is reversed by curcumin through re-epithelialization. Furthermore, both oral and intraperitoneal administration of curcumin blocks gastric ulceration in a dose dependent manner. It accelerates the healing process and protects gastric ulcer through attenuation of MMP-9 activity and amelioration of MMP-2 activity.

GENETIC POLYMORPHISM IN SELECTED GENES AND THEIR ROLE IN PARKINSON'S DISEASE

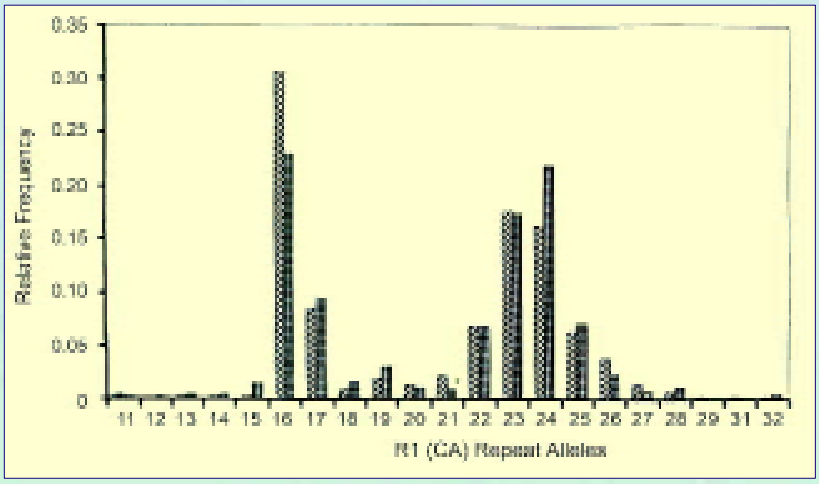
ITRC has studied Parkinson's disease (PD), wherein a case-control study of, the frequency and association of functionally important polymorphism in the genes such as the cytochrome P450 2D6 (CYP2D6), monoamine oxidase B (MAO-B), dopamine receptor-2 (DRD2) and glutathione S-transferase-theta (GST-T) was investigated, using allele-Specific PCR and RFLP assays. Results of 16 PD cases revealed that 6 had the polymorphism in DRD2, 5 in MAO-B, 4 in CYP2D6, and 3 had null genotype of GST-T. Association data further revealed that amongst the 4 patients carrying polymorphism in CYP2D6, 3 had polymorphism in DRD2 while 2 of these also carried polymorphism in MAO-B. It is quite possible that polymorphism in the genes involved in metabolic activation/ detoxification as well as in the processing of dopamine, plays important role in the etiology of PD.

MICROWAVE-MEDIATED RAPID IMMOBILIZATION OF ENZYMES INTO AN ACTIVATED SURFACE THROUGH COVALENT BONDING

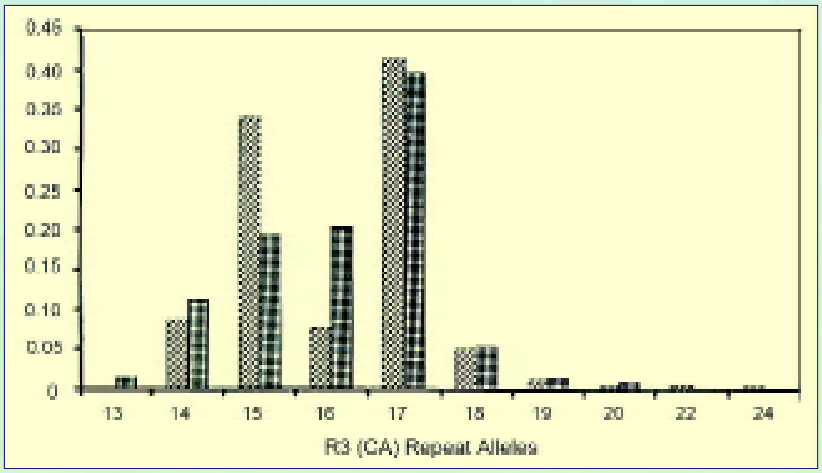
This is the first time demonstration of a microwave-mediated covalent immobilization of enzymes on an activated polystyrene surface in 60s with retention of their catalytic activity. Immobilized biomolecules have versatile applications in pharmaceuticals, food processing, diagnostics, biosensors, affinity chromatography, microarray fabrication, etc. In recent times, immobilization of proteins and nucleic acids has attracted special attention especially in emerging fields such as genomics, proteomics, and high throughput drug screening where stable, efficient, and rapid immobilization is required. A simple and rapid method has been developed for light-induced activation of inert polymers such as polystyrene (PS), 1 polyethylene, and polypropylene for covalent immobilization of protein ligands. Protein ligands were immobilized on activated polymer surfaces in 45min at 37^0C without addition of any other reagent resulting into more than two-fold enhanced immobilization as compared to those obtained on untreated surfaces.

SIGNAL TRANSDUCER AND ACTIVATOR OF TRANSCRIPTION 6 HAPLOTYPES AND ASTHMA IN THE INDIAN POPULATION

IGIB has reported the results of an investigation on the association of signal transducer and activator of transcription 6 (STAT6) with asthma in the Indian population. A novel polymorphic CA-repeat in the proximal promoter region [R1] and a previously identified CA-repeat in the 5'-untranslated region [R3] were genotyped, and haplotypes [R1_R3] were generated using PHASE software. It appears that the R3 and R1 loci together play a bigger role in asthma than either of them alone, and the R3 locus has a larger effect than the R1 locus. Although alleles at the R1 locus appeared to be associated with total serum immunoglobulin E level, the genotypes showed no association, and the R3 locus showed no effect. As no exonic variants of STAT6 are known as yet, repeat polymorphisms in the regulatory regions and their haplotypes could be important in deciphering the genetic role of STAT6 in asthma and atopy.



The frequency distribution of alleles at the R1 locus



The frequency distribution of alleles at the R3 locus

RECOMBINANT ORAL VACCINE FOR CHOLERA

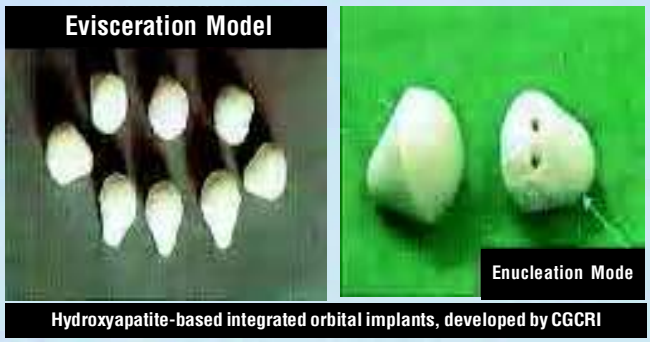
This vaccine, first of its kind anywhere in the world outside USA was constructed by IMT following a novel strategy in which an avirulent strain was converted into a vaccine candidate capable of elaborating only the immunogenic B subunit of the cholera toxin using recombinant DNA technology. This candidate vaccine which has been found to give full protection in animal studies and completely safe has also been found to be completely safe toxicologically. This particular strain, a collaborative effort with the National Institute of Cholera & Enteric Diseases and IICB is undergoing phase II human trials.

PHARMACOLOGICALLY AND BIOLOGICAL ACTIVITY HERBAL FORMULATION

NBRI has developed several herbal formulations namely: a novel immuno-modulator and anti-allergic herbal formulation(s); anticigarette herbal formulation as an antidote to Tobacco; novel and stable enzymatic antioxidant system from plants and the products; dadi ka batua: herbal recipe; antipyretic formulation; anti-arthritic herbal composition(s); novel herbal combination for the treatment of piles; novel herbal composition as memory enhancer in Alzheimer's condition; novel herbal combination as local anesthetic; herbal composition for gastrointestinal disorders; and herbal composition for cuts, burns and wounds.

BIOACTIVE INTEGRATED ORBITAL IMPLANTS

When the eye of a person is damaged due to disease or injury, the surgeon removes the eyeball from the orbit (eye socket) to avoid the risk of life/the risk to the other eye of the patient. The lost eye can be mechanically replaced by an orbital implant to fill up the orbital volume lost after enucleation/evisceration to achieve better cosmetic and rehabilitation of the anophthalmic patient. Orbital implants currently in vogue are made of glass or polymer. They are associated with a number of post-operative disadvantages. CGCRI has designed and fabricated two varieties of porous hydroxyapatite-based orbital implants which have been clinically tried in more than 50 patients at different hospitals in India with as yet no reported post-operative complications. One of the significant advantages of these Hap implants over the glass/polymeric material is that they become invested with fibro-vascular tissues of the orbit and provide natural movement to the eye. If greater movement is desired, an alumina-based peg, also developed by CGCRI, is used to connect the artificial eye to the implant.



Hydroxyapatite-based integrated orbital implants, developed by CGCRI

The alumina pegs for orbital implants

One of the patients implanted with the integrated orbital implant with motility/support peg wearing in his right eye

1.9.3 Human Resource Development

CDRI

Kishore Vaigyanik Protsahan Yojna programme was conducted with aim to attract students of Science, Engineering and Medicine streams to take career in research.

1.9.4 Recognition & Awards

Gold Medal for its contributions to World Science and International Scientific Collaborations by the Scientific Partnership Foundation, Russia	CDRI
President, Society of Biological Chemists (India) 2005-2006	Dr. C.M. Gupta, CDRI
2004 Honorary Medal from Scientific Partnership Foundation, Russia.	Dr. A.K. Saxena, CDRI
Mrs. J.R. Vakil Oration for Cardio-Pulmonary Disease – 2004 by Association of Physicians of India	Dr. A. Ghatak, CDRI
Prof. B.K. Bacchawat Memorial Young Scientist Award from National Academy of Sciences, Allahabad (2003-04)	Dr. P. Srivastava, CDRI
Young Scientist Award by Indian Society for Parasitology	Mr. R. Vatsyayan, CDRI

1.10 HOUSING & CONSTRUCTION

CSIR developed techniques and technologies covering the whole gamut of construction activities right from foundations to construction equipments. Newer and innovative building components developed have greatly helped the building industry to standardize optimal structural elements. In the area of structural engineering, CSIR laboratories have specialized in making design and analysis of special and complex structures such as high rise, long span, suspended, offshore, ships etc. and in the integrity assessment of these structures. CSIR is also known for its contribution to the roads sector through designs and constructions techniques of rigid and flexible payments using local skills and material resources. CSIR is excelling in these areas both through network and non-network mode.

1.10.1 Progress through Network projects

CSIR is operating three network projects. The achievements during the year are presented below.

I. DEVELOPING NEW BUILDING CONSTRUCTION MATERIALS AND TECHNOLOGIES

It is envisaged to develop low cost/ alternative building construction materials such as bricks, blocks, tiles, boards, cement/ concrete products, fibre reinforced composites, wood substitutes, coatings, sealants, paints, pigments etc. to replace/ supplement the conventional building materials which are in short supply in the country.

PROGRESS:

Wall putty and Red iron oxide has been developed. Concrete mixes for compressive strength of about M30 i.e. controlled and 5% replacement of cement by flyash has been done. Characterization of coatings, long-term corrosion resistance assessment has also been done.

II. DESIGN ANALYSIS AND HEALTH ASSESSMENT OF SPECIAL STRUCTURES INCLUDING BRIDGES

Early detection of structural health degradation can help in prevention of catastrophic failure. One method of health monitoring is by the use of fibre optic sensors, which allows the acquisition of valuable information about the structural integrity, environment and behaviour of structures, without damaging the chemical and physical properties of the materials used in the structure. This would develop expertise in applying these sensors to real life problem.

PROGRESS:

Advanced analysis and design methods for steel frames: A kinematically exact Euler Bernoulli beam element formulations for the large deformation and post buckling analysis of steel frames was developed. The formulations were calibrated against fifteen benchmark problems recommended by the Australian Institute of Steel Construction.

Studies on fatigue and fracture behaviour of piping components: Fatigue crack growth data for 15 carbon steel (SA333 Grade 6) pipes having circumferential surface crack under bending obtained from fatigue tests were analysed to study crack initiation and through-wall crack. The cyclic stress amplitude and stress ratios were varied for the pipes. The pipes tested have shown that there is sufficient margin for crack initiation and through-wall crack growth. The residual strength of the pipes after through-wall crack is also found to have sufficient margin against SSE loading.

Pushover analysis: A frame-by-frame pushover analysis procedure is developed to evaluate the performance of asymmetric horizontal setback buildings with a flexible floor diaphragm. The procedure is validated with respect to nonlinear dynamic time history analysis. It greatly minimizes the complexity in modeling and computational efforts involved in 3D pushover analysis.

III. NEW AND IMPROVED ROAD TECHNOLOGIES

The project aims to provide the cutting edge technologies for developing the required road infrastructure with reference to construction materials for specific purposes, drainage systems, road management systems, information systems, and models for traffic measurement systems etc.

PROGRESS:

High performance materials for construction and repair of pavements: Few experimental stretches (each about 10- 30 m in length) of different specifications i.e. High performance concrete, high volume fly ash concrete, high performance fibre reinforced concrete using various fibres have been laid in Delhi and evaluated using Falling Weight Deflecto-meter, Non destructive Testing, Instrumentation - using sensors for temperature and strain, British Pendulum Tester, Dipstick for measuring riding quality, Sand patch test method for measuring texture depth etc.

Materials for special road application: To develop custom tailored special materials for construction and maintenance of roads in hilly and desert areas, a new binder – porous bituminous concrete has been developed which is an excellent noise absorbing material. A state-of-the-art report on various noise absorbing materials has been prepared. Noise emission properties of different types of road surfacing have been investigated.

1.10.2 Scientific achievements under Non-network programmes

IMPROVED CEMENT STRENGTH

NML has used mechanically activated Granulated Blast Furnace Slag (GBFS) in the range of 50 to 95% to replace clinker in Portland Slag cement (PSC) for improved cement strength. The slag and clinker were activated separately using an attrition mill and mixed to prepare cement formulations. Use of activated slag resulted in a remarkable increase in strength vis-à-vis commercial slag cement. Both 1-day and 2-day strength was found to increase with an increase in slag content upto 70%. The strength of the sample containing 80-85% slag was comparable to the commercial cement (40% slag) used as a reference. It is established that microstructural changes resulting from enhanced reactivity of slag and densification are related with the improvement in cement strength.

EPOXY-CARDINOL IPN PROTECTIVE SYSTEM FOR STEEL STRUCTURES

CBRI has developed Epoxy-Cardinol IPN protective system for the protection of steel structures exposed to humid/saline environment. Paints to be used as primer, intermediate and finishing coats were formulated using synthetic iron oxide, zinc phosphate, zinc powder, micaceous iron oxide, blank fixe, calcite, magnesium silicate and titanium doixide pigments along with other additives and solvents. Recently developed Epoxycardanol IPN resin along with unmodified epoxy resin and polyamino-amide hardener was used as binder. Pigmented polyurethance and acrylic based paints were also used as finishing coat. It was found that coating system comprises of Epoxy-cardinol IPN resin based primer and middle coat having polyurethane based finishing coat has superior properties and corrosion protection efficiency as compared to other formulated coating systems.

URETHANIZED BITUMEN SYSTEM FOR WATERPROOFING OF ROOFS

Conventional bitumen is brittle at low temperatures and fluid at high temperatures. CBRI has prepared urethanized bitumen with variable viscosity, adequate elastic resiliency and a reduced thermal susceptibility. This behaviour is confirmed by thermal, Differential Scanning Calorimetry (DSC), rheological and IS: 1208-78. Waterproofing functions is further assessed by IS:1580 and IS:1834-84 ASTM D-3409-95 respectively. The urethane bituminous system has been prepared as per the requirement of end use applications.

SOLAR DISTILLATION SYSTEM FOR EXTRACTION OF ESSENTIAL OILS FOR AROMATIC PLANT MATERIALS

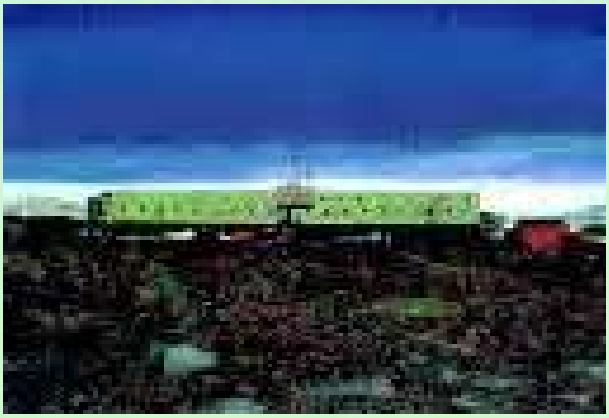
RRL-Bhubaneshwar has designed and developed the solar still of the distillationsystem, which is of green house type capable of accumulating heat

energy through appropriate mirror arrangements. The inside surfaces of the still and the four numbers of removable trays of the distillation system, are painted with Chrome black to act as absorbers. The trays are used to hold the aromatic plant materials and water. The oil plus water vapour from the still are collected via adequate ducting system and is condensed in a water-cooled condenser. The yield for Citronella and Lemon grass 80% and 88% respectively. From techno economics point of view this level of yield is quite profitable as the fuel cost is nil.

Solar Distillation Unit

STRUCTURAL ASSESSMENT OF THE SECOND INDIAN STATION 'MAITRI' IN ANTARCTICA

'Maitri' is the second Indian Station built in Antarctica during 1988-89. As against the original design life of ten years, it has already served as a permanent station for the last fifteen years. SERC has carried out structural assessment of the 'Maitri'. The analysis shows that the structure is sensitive to dynamic wind action and detailed wind tunnel studies are recommended in simulated boundary layer flows when a new station is planned. Based on the structural assessment carried out, it has been concluded that two Blocks of the station warrant immediate replacement.



Front view of Maitri station

View of crack in column

SELF-COMPACTING CONCRETE

Self-compacting concrete (SCC) freely flows through structural elements having complicated sections, around congested steel reinforcement and accessories while maintaining homogeneity and gets compacted without the need for any vibration. SCC requires careful proportioning of its ingredients to achieve the above characteristics. SERC has tried to develop the self-compacting concrete mixture using locally available materials. Full-scale vertical structural members (piles) as well as horizontal members (beams) were cast and the pile behaviour under monotonic (compression and tension) and dynamic loadings was evaluated. Highly reinforced concrete beams of size 150 X 400 X 3000 mm were also cast and tested for static flexure, using a two point loading system to evaluate the structural behavior such as load deflection characteristics, ultimate load carrying capacity, crack pattern, crack width, number of cracks and strains in concrete and steel. Studies revealed that due to several advantages offered by SCC over conventional concrete, including easy placement and self-compaction, it could be used with confidence in structures and foundations.

PRESSURE CALIBRATED MODEL FOR WIND-INDUCED RESPONSES ON A RECTANGULAR TALL BUILDING MODEL

SERC has designed and fabricated a new pressure calibrator model for experimental determination of wind-induced responses on a rectangular tall building model. The pressure calibrator model (PCM) consists of an air chamber, rubber diaphragm, a spindle and a frequency generator. A rigid model of a tall rectangular building to a geometrical scale of 1:100 was fabricated using acrylic material and tested in the boundary layer wind tunnel of SERC, under simulated open terrain conditions.

Based on the pressure data the variations of mean and rms pressures at different levels along the height and circumference and the spatial correlation between pressures at different points were evaluated. Also a detailed wind tunnel investigation had been carried out on six steel chimney models of equal diameter arranged in a row as well as on an aeroelastic model of a cooling tower model, (1:300 scale) in an isolated condition. The results of this study will be helpful in developing an empirical mathematical model for prediction of across-wind forces/ responses.

1.10.3 Human Resource Development

CBRI

- A National Workshop for the Executives of Rural Building Centres organized.
- Training Programmes organized on "Pest Management in Buildings" and "Earthquake Resistant Design & Construction"

CRRI

- 'Design, Construction and Maintenance of Bituminous Roads' for the Engineers of M/s Punj Lloyd Ltd at Jaipur during April 16-17, 2004.
- A Foundation Course of Highway Engineers of IRCON at Gurgaon during June 14-30, 2004
- 'Planning, Design, Construction and Maintenance of Rural Roads' for the Engineers of Rural Engineering Services, Lucknow at CRRI during July 5-9, 2004
- 'Design, Construction and Maintenance of Rural Roads' for the Engineers and contractors of Tripura PWD during August 2-6, 2004
- 'Contact Management, Transport Planning and Policies, Environment and Road Safety' for the Engineers of Rural Engineering Services, Lucknow during November 1-5, 2004.

SERC

- An Indo-US Workshop on High Performance Cement Based Concrete Composites was organised on 4th and 5th January 2005. The proceedings of the workshop were brought out as a special volume by the American Ceramic Society Ltd., which contained 27 invited papers. An International Conference

on Advances in Concrete Composites and Structures (ICACS-2000) was organised during 6th to 8th January 2005. The conference attracted over 250 delegates.

- Prof. Dr. Ing. Balthasar Novak, University of Stuttgart, Germany, was with SERC under CSIR-DAAD Exchange programme and delivered a series of lectures, in addition to interaction with scientists.

1.11 INFORMATION DISSEMINATION & PRODUCTS

Realising the inevitable explosive growth in the IT sector and knowledge based society powering the current century, CSIR laboratories have evolved strategies to derive the greater benefits from the rich data and information base and the update of domain knowledge possessed. One of the major initiatives towards this is to work in Network mode.

1.11.1 Progress made under Network projects

I. COMPREHENSIVE TRADITIONAL KNOWLEDGE DIGITAL DOCUMENTATION AND LIBRARY (TKDL)

The project envisages to prevent misappropriation of traditional knowledge that exists in public domain by creating a database on this knowledge in five international languages that are English, German, French, Spanish and Japanese and making these available to patent examiners throughout the world to prevent bio-piracy. The codified knowledge of the country will be converted into easily accessible and retrievable patent application digital format.

PROGRESS:

After completing the first phase of TKDL Ayurveda covering 36,000 formulations from 14 authentic Ayurveda texts in five international languages, namely English, French, German, Spanish and Japanese, in patent application format, the activities of the TKDL has got diversified to include Unani system of medicine also. In this system the transcription of 77,000 formulations will be carried out from 42 Unani texts in the same format and languages as in the case of TKDL Ayurveda. Approximately 35,000 formulations have been identified, 17,000 formulations have been transcribed and 9,000 formulations have been scanned from the original texts.

Ayurveda Phase II: Images of all the multiple references of 36,000 formulations transcribed were included in the database. More than 13,500 formulations have

been identified from the Ayurveda texts and they have been checked for the duplicates. Transcription of formulations has been competed for 2,700 formulations.

II. NATIONAL SCIENCE DIGITAL LIBRARY (NSDL)

To contribute for national development by reaching the un-reached, i.e. students of undergraduate, postgraduates science & engineering level located in far flung areas of e-learning facility and access comprising curriculum-ware-text books, help books, question banks, etc.; To facilitate access to remote areas at level similar to Metros; To contribute in preparing future scientists, researchers and engineers and ultimately to have professional of high calibres in large numbers; To design and adopt/adapt state of art technologies in digital library solutions suiting the national needs.

PROGRESS:

Activities during the year focused on capacity building in terms of IT infrastructure required and planning for the project.

III. CONSORTIUM ACCESS TO ELECTRONIC JOURNALS

To provide CSIR S&T staff, electronic access to world S&T literature to strengthen the facilities for pooling, sharing and electronically accessing the CSIR information resources; To nucleate the culture of electronic access with a view to catalyse the evolution of digital libraries.

PROGRESS:

Agreement made with M/s Elsevier Science to e-access their journals. Print subscription of 550 journals is maintained. S & T Staff of CSIR accessing 1200+ e-journals. Trainers - training programs at 6 locations of CSIR labs. Organised. Monitoring of usage Statistics is being carried out on monthly basis. The participants of these trainers training programmes are organising training programme in respective labs to lab based users.

1.11.2 Scientific achievements under Non-network programmes

Apart from network projects CSIR laboratories are delivering scientific output to the society in non-network mode also. Some of the significant achievements are highlighted below:

DISSEMINATION OF INFORMATION TO S&T COMMUNITY

NISCAIR has been making a significant contribution to Indian science by publishing as many as 19 scholarly journals, covering all the major disciplines of science. The

journals are: *Journal of Scientific & Industrial Research* (JSIR) (monthly), *Indian Journal of Chemistry (sec. A)* (IJC-A) (monthly), *Indian Journal of Chemistry (sec. B)* (IJC-B) (monthly), *Indian Journal of Experimental Biology* (IJEB) *(monthly)*, *Indian Journal of Pure & Applied Physics* (IJPAP) (monthly), *Indian Journal of Chemical Technology* (IJCT) (bimonthly), *Indian Journal of Engineering & Materials Sciences* (IJEMS) (bimonthly), *Indian Journal of Radio & Space Physics* (IJRSP) (bimonthly), *Journal of Intellectual Property Rights* (JIPR) (bimonthly), *Indian Journal of Marine Sciences* (IJMS) (quarterly), *Indian Journal of Biochemistry & Biophysics* (IJBB) (bimonthly), *Indian Journal of Fibre & Textile Research* (IJFTR) (quarterly), *Indian Journal of Biotechnology* (IJBT) (quarterly), *Indian Journal of Traditional Knowledge* (IJTK) (quarterly), *Natural Product Radiance* (NPR) (bimonthly), *Bhartiya Vaigyanic evam Audyogic Anusandhan Patrika* (BVAAP) (half-yearly), *Annals of Library & Information Studies* (ALIS) (quarterly), *Medicinal & Aromatic Plants Abstract* (MAPA) (bimonthly), and *Indian Science Abstracts* (ISA) (fortnightly). The papers published in the journals are indexed and abstracted in most of the international indexing and abstracting journals and thus provide international exposure to Indian R&D workers. The contents and abstracts of all the periodicals are regularly updated on the NISCAIR's website: www.niscair.res.in.

SCIENCE POPULARIZATION

For the popularization of science among the masses NISCAIR publishes three well-circulated science journals, *Science Reporter* (English monthly), *Vigyan Pragati* (Hindi monthly), and *Science ki Duniya* (Urdu quarterly).

SCIENCE REPORTER

Launched in 1964, *Science Reporter* entered into its 42nd year of publication in 2005. This is one of the oldest English languages popular science monthly published in India, enjoying a wide readership throughout the country. Four special issues were brought out on, environmental issues with special focus on water scarcity in the country; biotechnology; the Year of Scientific Awareness declared by the Government of India and Wildlife.

VIGYAN PRAGATI

Vigyan Pragati is a monthly popular science magazine in Hindi that reaches far and wide in the country. Launched in 1952, it is now running in its 54th year of publication. A special issue on 'Environment' was brought out.

SCIENCE-KI-DUNIYA

Science-Ki-Duniya, the quarterly popular science magazine in Urdu, reaches far and wide across the country. During 2004-2005, *Science-Ki-Duniya* continued to

disseminate information on current scientific topics in very easy and attractive manner.

POPULAR SCIENCE BOOKS

NISCAIR has brought out over 60 popular books in English under different series, viz. CSIR Golden Jubilee Series (25), Sci-Fun Series (7), Q-Series(3), Vistas in Biotechnology Series (10), Foundations of Biotechnology Series (6), Others (9), and the encyclopedic publication *Golden Treasury of Science & Technology*. Also, 28 books have been brought out in Hindi.

SCIENCE AND SOCIETY IN THE 21ST CENTURY: THE ROAD AHEAD

NISCAIR has brought out *Science and Society in the 21st Century: The Road Ahead* (pp 284). It gives overviews of the various sessions of the 91st Session of the Indian Science Congress held in Chandigarh, and interviews of eminent scientists conducted by the NISCAIR team during the session.

IT LITERACY PROGRAMME

Simple-to-use, practical books on various subject areas of IT published in English language have been translated in different Indian languages such as Hindi, Punjabi, Tamil, Kannada, Gujarati, Marathi, Bangla, Malayalam, Urdu, etc. so that the knowledge of IT moves from cities to villages.

CSIR NEWS

CSIR News, the fortnightly newsletter (ISSN 0409-7467) is intended to serve as a useful link among the various CSIR establishments and to communicate activities/ accomplishments of the Council to other R&D organizations, universities, S&T agencies/departments, industry and other users, mass media, etc. Running into 55 year (2005), it also disseminates information regarding CSIR to other countries through Indian missions abroad and foreign missions in India. During the year, NISCAIR published news pertaining to R&D accomplishments, technology transfers, marketing, commercialization/ utilization, sponsorships, collaborations, IPR, etc.

CSIR SAMACHAR

Launched in 1984, *CSIR Samachar* is now in its 22nd year. It is a monthly news bulletin in Hindi, which covers the news pertaining to various activities/programmes, particularly the R&D activities of the various laboratories of CSIR and consequently serves as a useful link among the various CSIR constituents. It also disseminates information to other S&T departments, universities, etc.

THE WEALTH OF INDIA

The Wealth of India Raw Materials, is an encyclopaedic publication describing the plant, animal and mineral resources of India used as a reference standard particularly in the current global trend to incorporate traditional knowledge systems into the proprietary mainstream.

The fifth and final volume of the *First Supplement Series* encompasses plant, animal and mineral entries within the alphabet R to Z. The important entries included are *Solanum, Terminalia, Vigna, Zea, Zingiber,* Silk & Silkworms, Starfishes, Tortoises & Turtles, Weasels, Steatite & Talc, Vermiculite, Zirconium Minerals, etc.

CONSULTANCY SERVICES PROGRAMME

This involves identification of crude drug samples in order to check their genuineness by studying the samples and related literature. During the year, 237 crude drug samples were identified for clients (on payment basis) comprising pharmaceutical companies, crude drug dealers, students, teachers, and researchers.

INDIAN PATENT DATABASE (INPAT)

INPAT is a bibliographic database, compiled by NISCAIR that provides information on 52,624 patents granted in India during 1975-2002. The information on a patent in the database comprises: patent title, applicant(s) name(s), inventor(s) name(s), patent number, application number, application date, publication date, international classification code, and country. The database can be searched by various parameters including keyword(s) from title, applicant name(s), inventor name(s), patent number, subject code or subject, application number, application date, publication date, country, and any combination of the above parameters.

TRANSLATION SERVICES

NISCAIR provides translation of S&T documents from various foreign languages to English, on request and over 900 translated pages were produced.

SCIENCE POLICY AND RELATED STUDIES BY NISTADS

NISTADS undertakes studies specifically to generate novel research methods, to engender capacity building in analytics of policy sciences and to deepen skill sets on issues that are important to the country and to the domestic science institutions. Some of the studies carried out during the year and briefly provided in the following paras.

PATENTING TREND

Studies on patenting were employed to map trends, sectoral and institutional activity, technological areas addressed and gaps that needed to be filled up. Studies on domestic knowledge generating institutions particulars from the education indicated Indian strengths and weaknesses. It was observed that changes in the Indian Patent Act allowing product patents in pharmaceutical sector would have substantial impact. Indian industry appears to be well prepared for the changes, however, patent policies need to involve more institutions namely firms and research and university organizations. It was found that very few organizations are major players in patenting. Universities are slowly entering in patenting. CSIR is the most active organization especially filing patents under USPTO. Much needs to be accomplished in the area of design patenting. Similarly technological linkages across Indian organizations need to be upgraded. Foreign organizations have chosen areas from high technology to patent in India.

INDIAN INDUSTRY & EMERGING HIGH TECH AREAS

Several studies addressed Indian industrial issues pertaining to the emergent high technology areas. Biotechnology and information technology including micro-areas such as nano-technology or the stem cell were examined to draw policy lessons on what types of institutions and what kinds of policies could support contemporary advances. Study on commercialization of biotechnology showed how access to funds and skills remained the bottlenecks, how major technological risks posed barriers and how skills remained trapped to medium quality only. It was observed that large companies did well through networking. Incentives and policies needed to facilitate commercialization were highlighted.

S&T POLICY FOR RURAL INDIA

Studies conducted on areas of artisanal technology, artisan clusters and on policies pertaining to improving the S&T wherewithal's of rural India. S& T and managerial inputs to improving the system of traditional manufacturing for example, or S& T inputs to improving skills of traditional rural craftspersons or design and technology upgradation for handicrafts were undertaken; and such studies and interventions in the nature of action research suggested how novel mechanisms of delivery including of re-designing of institutions could improve the S& T resources availability to the rural artisans, the handicrafts or the system of production. Policy issues pertaining to capacity building of technological resources for the rural craftspersons including upgradation of technology and accesses to credit, raw materials were pointed out. Study concluded that major thrust needs to be given to domestic and global marketing initiatives.

1.11.3 Human Resource Development

NISCAIR

NISCAIR offers several HRD programmes to provide leadership opportunities and to train and empower professionals in the fields of Information, Documentation and Science Communication, for example, Associateship in Information Science (AIS**);** Education, Training and Translation Group (ETTG); Attachment Training Programmes; IGNOU Sponsored Courses; IT Human Resource Development.

NISTADS

NISTADS is running student practical training programme where students pursuing higher studies work for focussed projects.

1.12 LEATHER

Central Leather Research Institute (CLRI) of CSIR is the largest leather institute in the world. Through inputs of S&T and extension activities it has been transforming the leather industry to a modern, vibrant, environment responsive industry. CSIR's pioneering inputs have been at all stages of the industry's activities starting from techniques for flaying of dead animals to storage of skins, using 'no' or 'less' salt, to appropriate time saving and low pollution tanning and processing techniques, to 'low chrome' and 'no chrome' tanning chemicals, to modernization by computerization of net operations in tanning, to new techniques for generating value added specialty leathers, to computer aided designs for footwear, garments, and goods, fashion colour forecasting export certification and not the least of all in creating the human resources needed for the leather industry and the R&D in the sector. It had successfully mounted a pioneering Leather Technology Mission for the sustainable development of the Indian leather industry with vast grass-roots coverage.

1.12.1 Progress made under Network projects

I. STANDARDIZATION OF TECHNOLOGIES FOR BIORESOURCES FOR AND FROM LEATHER

The project envisages to consolidate lead processes and products and standardization of technologies for bio resources for and from leather sector based on leads already gained; and to develop technologies for use of solid and other

biomaterials as new bio resources and feed stock for use in cosmetics, agriculture, biomedical products and related high value applications

PROGRESS:

Six collagen products developed by CLRI have been commercialized. Calfskin collagen extracted was constructed as gels and used as a substrate for *in vivo* culture of human fibroblasts. A potent lipase producing strain *Aspergillus niger* MTCC 2594 was isolated. An innovative method for utilization of flesh into dog biscuits and chicken feed has been developed.

II. ENVIRONMENT FRIENDLY LEATHER PROCESSING

The project aims to design, develop and disseminate through appropriate measures viable technologies environment friendly leather processing in India at near-zero environmental risk; to develop technologies for reducing the consumption of water in leather processing; to develop secure technology options for reducing the TDS level of discharged tannery wastewaters to 2100 mg/liter (minimum acceptable limit).

PROGRESS:

A mobile chilling system has been designed. A ten-fold reduction in water discharge has been achieved. For converting raw hide/skin into chrome tanned leather recycling and reuse system of water has been developed by which it was enabled the reduction of water from 17000 litres to 7000 litres with discharge being limited from 1600 litres to 1000 litres. A system for improved evaporation of saline soak liquor and Reverse Osmosis (RO) system has been designed at lab scale. The sources of odor in pre-tanning processes are mainly sulphide ions (hydrogen sulphide) and ammonia. Methods of removal of odor sources by means of adding reactive chemicals or passing compressed air or adsorption by activated charcoal have been standardized.

1.12.2 Scientific achievements under Non-network programmes

CONTRIBUTION TO ENVIRONMENT

After 1996, Indian leather sector and particularly that of Tamil Nadu has faced major crisis on account of environmental problems. The lasting and enduring partnership of CLRI with industry has made it possible to provide meaningful solutions to the tannery sector in the state. Today all functional tanneries in the state are connected to pollution control devices. There are a total of 14 CETPs now in leather sector in TN. They have been receiving inputs of technology for

upgradation and modernization. It has emerged an ongoing partnership with traceable impact on environmental preparedness.

TDS CONTROL IN LEATHER PROCESSING

CLRI has pioneered in Total Dissolved Solids (TDS) reduction measures, which include effective desalting, hair saving, less sulfide -enzyme assisted unhairing, recycling of reliming liquor, recycling of pickle liquor. This has been implemented in two tannery clusters in Tamil Nadu viz. Dindigul and Pernambut. TDS reduction by 67%, chloride reduction by 40%, water (input) reduction by 15-20%, BOD reduction by 35% and reduction in sludge volume 20% has been feasible.

A Neem oil based preservation has been developed with shelf life of more than 5 months without putrefaction or deterioration skins can be preserved by applying on both sides.

ZERO DISCHARGE TANNING

CLRI has developed a process for near zero discharge wastewater by enzyme aided washing and pickling wastewater. The wastewater discharge is 1litre /kg. This method has been tested at semi commercial scale in wet blue production and it has been found that the process does not render any negative effect on physical or organoleptic properties of leathers.

PRODUCT DESIGN & DEVELOPMENT

CLRI has initiated measures to develop new products and seek copyright protection as well as on contract development mode. Design outputs from CLRI have registered figures like 150 designs per year currently. There is an attempt to increase this further.

DESIGN AND FASHION FORECASTING

In the preparation for the MODEUROP roundtable for the Autumn/Winter 2005-06 season held in June 2004 'Curtain raiser' on the season's trends in leather colors and textures has been presented. 400 leather/color proposals were presented from India. 15 out of a total of 20 colors were chosen for shoes and 7 out of a total of 10 colors for garments were selected. The Modeurop Colour Card for the Autumn/ Winter 2005-06 seasons was released on 8th July 2004.

THERMAL INSULATION STUDIES IN GARMENTS

CLRI has studied thermal insulation property in garments by measuring the heat supply after bringing equilibrium between the environment temperature and heat

source temperature. It was found that among all leather types (expect suede) the zipped garment has more thermal insulation than buttoned garments. Thermal insulation is found to be more in cow nappa apparels among the selected nappa and suede apparels. Based on the study, various types of leathers can be arranged in decreasing order of thermal insulation Fur (sheep-nappa)>Cow nappa>Goat nappa>Sheep nappa>Goat suede.

DATABASES FOR LEATHER PRODUCTS

Basic design for developing on-line courses for products design & development and a database has been designed for leather products. A new dimension has been added by extending it to physically challenged candidates. A database for leather products and a web enabled design solutions for products manufacturers has been implemented. Also, on-line status tracking system for leather product manufacturers has been developed.

1.12.3 Human Resource Development

CLRI

- Centre for Human & Organizational Resource Development (CHORD)

Technical education to varied target group has been carried out for the artisanal sector aimed at improving the quality of life and work of this leaner target group. A total of 165 students underwent education in Leather and Footwear Science under CLRI-Anna University collaboration.

1.13 MATERIAL, MINERALS, METALS & MANUFACTURING

CSIR laboratories have played a significant role in the development of special materials for aerospace, defense and sophisticated industrial sectors viz. electronic materials such as amorphous and polycrystalline silicon, ferrites, gallium, luminescent phosphors for display, piezoelectric, high purity alumina, conducting polymers, silver pastes; aerospace materials such as high density carbon-carbon composites, Nalar - a Kevlar equivalent high strength fibre, aluminium – lithium alloys, high performance industrial materials such as silicon carbide, silicon nitride bonded silicon carbide, silicon carbide whiskers; aluminium-metal matrix and aluminium-graphite composites; special glasses for optical fibres, infrared range finders, laser glasses radiation shielding glasses and sol-gel techniques for glass coatings etc.; and superconducting materials.

CSIR has made significant contributions to all aspects of mining operations, especially in coal mines (to the exclusion of only heavy mining equipment). CSIR studies and efforts on subsidence prediction and control have enabled the extraction of coal locked up in pillars and underneath surface structures and water bodies. CSIR has been the principal source for designing appropriate mine ventilation systems and now for the mine disaster management in the country. CSIR is getting an edge in these areas both through Network and Non-network projects. The progress achieved is presented in following paras.

1.13.1 Network Projects

I. CUSTOM TAILORED SPECIAL MATERIALS

Advanced information and communication technology and ultra-fast processing devices are based on custom tailored special materials. It is envisaged to generate strong knowledgebase and up to date expertise by developing new generation materials like novel non-linear optical materials, bio-molecular electronic materials and functional nano-materials. The knowledgebase would be needed by both the Indian industries and also the strategic sectors to remain globally competitive in terms of technological and financial advantages.

PROGRESS:

Gold (Au) nanocluster doped films in SiO_2 and mixed SiO_2-TiO_2 hosts have been prepared on glass substrates and characterized by different techniques. Increase of refractive index of the host (by increasing titania content in the film matrix) the Au surface plasmon resonance peak is shifted from 540 nm to 600 nm. Process for solid state processing of $Ba(Mg_{1/3}Ta_{2/3})O_3$, $Ba(Zn_{1/3}Ta_{2/3})O_3$ and $RETiNbO_6$ and $RE'TiNbO_6$ ceramics has been developed. Porous nano alumina powder and tape cast multi layer composites (MLC) of 3, 5, 10 and 20 layer configurations were prepared to about 63 to 70% theoretical density. These MLC samples showed much higher failure energy (10 -70 KJm^{-3}) than that (4.38 KJm^{-3}) of the porous nano alumina single tape. A new series of $La_2Mo_2O_9$ based oxides of the general formula $La_2Mo_{2-x}Nb_xO_9$ where x = 0.4 were prepared by a citrate-nitrate combustion process and the electrical and thermal properties were evaluated. The composition with the lowest Nb-doping, viz. $La_2Mo_{1.94}Nb_{0.06}O_9$, exhibited a conductivity of 0.113 S/cm at 800°C, which is nearly double that of the undoped material and this is the highest value so far reported in this family of oxides.

II. CAPACITY BUILDING FOR COASTAL PLACER MINERAL MINING

In spite of having maximum enriched placer deposits, India continues to play a minor role in the marine mineral export compared to other dominating countries

that have lesser potential than India. There is a high scope to improve the status of Indian placer export market through the development of indigenous mining and processing technology especially for buried placers and offshore resources. It is aimed to enhance the capability of country's technologies in the field of placer mining. The output of this work would put India as a global leader in this field, besides appreciable economic returns from the export potential.

PROGRESS:

Geological and field studies have been carried out just after Tsunami in central parts of Coastal Tamil Nadu. More than 35 km stretch of coastal zone from Cuddalore to Velanganni including Karaikal and Nagapatinam was under detailed study. Beach profiling has been done in many places and the earlier profiles were correlated to find out the changes of beach profiles due to Tsunami. Sediment and sand samples were collected for analysis. Digitization of base maps of various locations of placer deposits was completed through GIS environment.

III. DEVELOPING CAPABILITIES IN ADVANCED MANUFACTURING

The project aims to explore the applications of advanced manufacturing methods and to upgrade the indigenous expertise both in manufacturing automation and near net shape manufacturing to become self-reliant.

PROGRESS:

Experimental models of Autonomous Mobile Robot and Robocasting (2.5D) were developed and the algorithm being tested for obstacle avoidance. Hydroxyapatite coated dental implants were administered to ten patients. Orbital implants developed and implanted successfully on 50 patients.

IV. BIOMINERAL PROCESSING FOR EXTRACTION OF METAL VALUES FROM ORES AND CONCENTRATES AND WASTES

The project aims at bioleaching of low grade copper ores of Malanjkhand (0.3%Cu); Bioleaching of uranium (UCIL, 0.026% U); Strain improvement; Continuous down-stream processing for recovery of metal values (10 litres/hr capacity).

PROGRESS:

Bioleaching of lowgrade copper ore of Malanjkhand (0.3%) were made. Laboratory scale bioleaching work in shake flasks were carried out using low grade copper ore by varying parameters like pH, pulp density and particle size. Leaching kinetics was studied using mixed culture containing acidophilic microorganism. The copper

recovery was around 40% in 50 days at a pulp density of 20%. Bioleaching of Uranium (UCIL 0.02% U) Uranium leaching was carried out using acidophilic microorganism by varying parameters like pH, pulp density and particle size. Uranium recovery was more than 70% in 30 days of leaching. Strain improvement. Plasmid analyses were carried out using heterotrophic *Acidiphilium* strain.. The fungal strain isolated from Cu and U mines were grown to generate large amount of biomass. Preliminary studies showed that two strains such as *Aspergillus niger* and *Aspergillus flabus* have the potential to remove copper from aqueous solution.

V. TECHNOLOGY FOR ENGINEERING CRITICAL ANALYSIS

The project aims at development of technology for Engineering Critical Assessment of the following components: Pressure vessels and pipelines of the thermal and nuclear power plants, petrochemical and process industries; Airframes and aeroengine components; Infrastructural assets of the transportation industry: e.g. concrete and steel bridges, railway wheels and railway tracks; Offshore structural components; The development of the requisite technology is sought to be implemented through the following planned tasks; Quantification of damage resistance of engineering materials; ECA for sub-structural and surface processes; Signal and image processing techniques for damage assessment; Sensor device for surveillance; Modelling and simulation of damage evolution & software tools for ECA; ECA of full scale structures.

PROGRESS:

Experiments on Inconel 718, En steel, medium carbon steels and Al alloys have been conducted using BIT and conventional mechanical test. Microstructural evaluation and hardness measurements were carried out. Conceptual design has been made for a PORTABLE-BI SET-UP. For enhancing component performance by grain boundary engineering first phase of Thermo-mechanical treatment is over. Analytical studies have been conducted and phenomenological mathematical models have been developed to quantitatively predict the ash particle erosion behaviour on coal fired boiler components. The following model based simulation codes have been developed: -EROSIM-1 (A Computer Code for the Prediction of Erosion rate in Boiler Components) is the first version of the code applicable to coal-fired boiler components at elevated temperatures. On the basis of available data on the steel grades related to erosion behaviour, the model incorporates the following grades of steel: Carbon steel, 1.25Cr-1Mo-V , 2.25 Cr –1Mo, 12Cr-1Mo-V, 300 and alloy 800. Software has been developed to measure the thin coating layer using Labview and used to measure oxide scale thickness ~ 400 micron of service exposed super heater tube. It has also been used to measure the different coating layer of tri-metallic bearing specimen received from RDSO, Lucknow. Deposition parameters of amorphous PZT thin films on corning glass 1737 and platinised

corning glass from a stoichiometric $Pb(Zr_{0.52}Ti_{0.48})O_3$ target have been optimised. Optimisation of film deposition conditions of Pt films to be used as electrode material for the sensor configuration has been done.

VI. UPGRADATION OF SI BASE UNITS, NATIONAL STANDARDS OF MEASUREMENT & CREATION OF A NETWORK OF CALIBRATION AND TESTING LABORATORIES AND PREPARATION & DISSEMINATION OF CRMS

The project aims at upgradation of the Base Units and National Standards of measurements for : Mass,; Luminous Intensity, Time; Chemical Metrology: Upgradation of Apex level calibration facilities in the following parameters- Mass, AC Power & Energy, AC Voltage & Current, Length,; Force, Temperature, Ultrasonics, Acoustics, Networking of calibration and test facilities existing in 12 CSIR laboratories for providing high quality testing and calibration facilities to users in all parts of the country at a reasonable cost and in a reasonable time; Preparation, certification and dissemination of certified reference material.

PROGRESS:

Four training courses have been organized for traceable and globally acceptable calibration services to Indian industry through out the country at minimum cost an in minimum time.

1.13.2 Scientific Achievements under non-network programmes

CSIR laboratories are carrying out R&D activities in non-network mode also. Some of the significant achievements are given below.

FULLERENE DOPED GLASSES

CGCRI has developed a series of fullerene C_{60}-borate glasses composites of optical quality bearing high concentration of C_{60} and their nonlinear optical properties were studied to identify their suitability as Non-Linear Optical (NLO) materials. These composites show moderate third order nonlinear optical properties and good optical limiting properties i.e. they can limit the transmission of high intensity light and hence can serve as a protector of laser detectors. It differs from the ordinary light filters by the unique characteristics that its efficiency of limiting the light transmission, increases with the increase of intensity of the incident light. Such materials are also useful in generating light of higher frequency from laser light of lower frequency.

SPECIAL FIBRES FOR WRITING FIBRE BRAGG-GRATING (FBG)

Fibre optic Bragg grating (FBG) in different configurations have found major applications in Er-doped fibre amplifier (EDFA) and provides practical solutions for laser wavelength stabilization, pump wavelength filtering and gain flattening in multi-channel wavelength amplification for reducing problems of non-linearities encountered in optical network. CGCRI has fabricated preforms containing suitable dopants in the core in different proportions by Molecular chemical vapour deposition (MCVD) process and fibres were drawn from the preforms with online resin coating. The core-clad dimension was varied in the range of 10:125 to 22:125. The core was doped with different dopants like GeO_2, B_2O_3 + GeO_2, SnO_2, SnO_2 + GeO_2 along with rare earths Er & Nd. GeO_2 content within the core of fibre was varied in different concentrations. It was observed that under the influence of laser irradiation colour centre generation viz., Ge (E') center increases via the breaking of Ge-Ge bonds indicating change in refractive index in the fibre core.

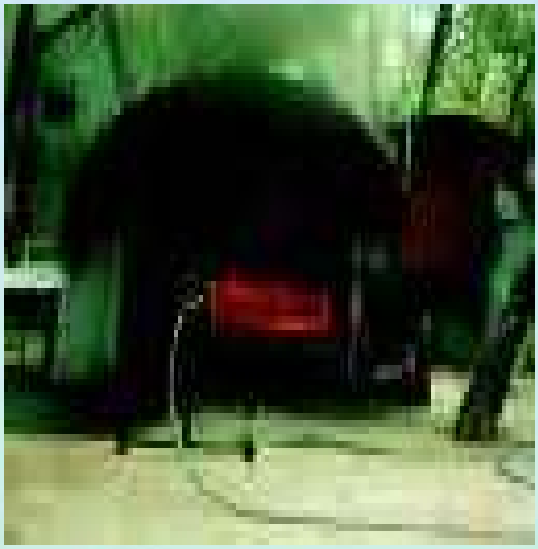
In-fibre Bragg grating writing set up us

WATER MIST- AN EFFECTIVE AGENT FOR CONTROLLING OPEN FIRE IN UNDERGROUND MINES

CMRI, after detailed investigation proved that water mist infusion is safe and very effective technique for not only controlling open fire in underground mines but also reducing toxic gases, minimizing backlash and improving visibility in the fire affected area. The average reduction of temperature was found maximum (294°C per hour) after spraying of water mist, whereas it was 207°C per hour in case of high-pressure high stability (HPHS) nitrogen foam. But the value was much below after injection of liquid nitrogen (LN_2). The reason behind the efficacy of water mist in reducing the temperature is that the heat generated due to fire is carried away by the injected water mist while flowing along with the air current through the fire area resulting into creation of cooling effect. Reduction of CO_2 generation was maximum (89 percent) in case of water mist, whereas it was 80 percent and 30 percent after injection of HPHS nitrogen foam and LN_2 respectively. Carbon monoxide percentage came down to 93 in case of both water mist and LN_2 compared

to 85 after use of HPHS nitrogen foam. These findings indicate maximum cessation of combustion processes after application of water mist and hereby confirm the decrease in the intensity of fire to the maximum extent. During application of water mist no substantial increase in H_2 percentage was observed. The maximum value of H_2 concentration was recorded as 0.26 percent, which is well below the explosive limit. No water gas found discounting the possibility of explosion.

Generation of water mist



Water mist system in operation to control open fires

BIOPROCESSING OF INDIAN OCEAN NODULES WITH REFERENCE TO EXTRACTION OF VALUABLE METALS

NML has done extensive studies on bioprocessing of sea nodules. These nodules were bioleached by bacteria and fungus viz. *Thiobacillus ferroxidans* and T.Thiooxidans, Bacillus, circulars and *Aspergillus niger*. The recovery of Cu, Ni and Co at 308 K in 60 days time and 2.0 pH was found as 96%, 79% and 50% with pyrite and 71%, 71% and 37% with sulphur. Bioleaching of the metals followed diffusion-controlled model in the temperature range 293 – 308K with both the additives. The activation energy acquired for the biodissolution of metals corroborated the diffusion control leaching model. Bioleaching by *Bacillus circulans* is a direct enzyme mediated process. Upto 92% Cu, 73% Ni, 72% Co, 38% Mn and 17% Fe were recovered by *Bacillus circulans* at pH 2 in 25 days at 35oC temperature, 5% pulp density using the sea nodules of < 300 mm size. Fungal bioleaching is an indirect nonenzymatic process. Easy desorption of adsorbed metals by acid wash of fungal biomass supports this conclusion. About 97% Cu, 98% Ni, 86% Co, 91% Mn and 32% Fe was recovered by *A. niger* by bioleaching of sea nodules under the above condition except the pH which was mai

INVERSE MELTING IN THE Ti-Cr SYSTEM

In the Ti-C system, it is possible to retain the body centered cubic (bcc). structure at room temperature on quenching. When this structure is annealed at 873 K, it transforms to the w and to an amorphous phase, simultaneously. This is an unusual phase reaction where a loosely packed structure transforms to a close-packed structure and a totally open structure. NML has presented a model of inverse melting, which states that it is the close-packed hexagonal closed packing (hcp). structure that transforms to the amorphous phase whereas the transformation of the relatively open bcc structure to the amorphous phase is forbidden thermodynamically. The phenomenon of inverse melting also offers the opportunity to produce amorphous solid by heating an ordered crystal structure.

ZnS:Mn NANOPARTICLES

NPL has devised a unique and simple method for synthesizing ZnS:Mn nanoparticles capped in-situ by ZnO. Characterization studies show the formation of ZnO capping layer on the surface of ZnS:Mn nanoparticles. The change in photoluminescent properties with ZnO capping thickness variation has been studied and the optimum ZnO thickness is determined. Particle size of the ZnS:Mn nanophosphor developed is about 4 nm. The growth parameters for ZnS:Mn nanophosphors were also systematically studied inside a SiO_2 gel matrix, which can act as capping agent as well. The samples were prepared using sol-gel technique followed by annealing at different temperatures to remove trapped fluid inside the amorphous silica cage. It has been observed that the nanocrystals grow in size and undergo phase transition from cubic to hexagonal at temperatures between 700-900^{o}C. This is one of the first reports on hexagonal ZnS formation in nanophase.

LOAD CELL CALIBRATOR FOR THE LOAD CELL USED IN DIGITAL WEIGHING MACHINES

To meet the requirement of standardization of load cells, NPL has indigenously designed, developed and fabricated a fully automatic dead weight machine –the Load cell Calibrator.The machine has a capacity of 500 Kg and an uncertainty of ±50 ppm throughout the range of measurement. It can be operated both in auto and manual mode via a menu driven Window-based Software or through a toggle switch on the front panel. The machine uses a novel method for loading and unloading of the dead weights individually using pneumatically operating cylinders. The mechanism minimizes vibration and oscillation of dead weights thus reducing the stabilization time and precise control of Load–Time cycle. Further the load cell can be loaded sequentially or randomly in steps of 20 kg multiple thereof depending upon the requirement. The major advantages achieved are the lowering of repeatability deviation and increase in the efficiency of the calibration of load cells.

Load cell Calibrator

RECOVERY OF CENOSPHERES FROM FLY ASH

RRL-Bhopal has developed a novel process for the recovery of cenospheres from fly ash. Indian coals contain high ash content and during generation of thermal energy by coal combustion a large quantity of fly ash is generated. Cenospheres are lightweight, inert and nonmetallic hollow ceramic spheres found in fly ash in sizes below 500mm. The shell is composed of silica and alumina and hollow space inside is filled with gasses like N_2 or CO_2. The cenospheres have high compressive strength and excellent free flowing characteristics. These are good insulators for sound, electricity and heat. By virtue of the above properties they find widespread application as filler material in several engineering materials as replacement to mineral filler. The areas of applications include rubber, plastics, polymers, paint, oil, refractory etc. The cenospheres have been selectively separated and judiciously integrated to achieve maximum product quality. A process flow sheet for the recovery of cenospheres from different grades of fly ash has been developed. The processed Cenospheres are characterized to have bulk density around 400kg/m^3, unburnt carbon below 1.5%, broken particles (sinkers in water) below 2%.

Photo Micrograph of Cenosphere concentra 1

CLOSED PORE ALUMINUM FOAM

RRL-Bhopal has synthesized aluminum alloy foam and aluminum –SiC composite foam of varying relative density (0.1-0.5) through liquid metallurgy route using thickening and foaming agent. These foam materials are very useful for shock and energy absorption. The mechanical properties of the RRL- aluminum foam is comparable to the commercially available foams with energy absorption capacity varying from 2-4J/cc. Attempts are being made to synthesize aluminum foam in relatively larger scale through continuous casting technique for obtaining foam sheet suitable for preparation of sandwich panels.

COST EFFECTIVE FIBRIZER HAMMER TIPS FOR SUGAR MILLS

Hammer tips, mostly imported, are the most essential components of a fibrizer unit of a sugar mill used for fibrizing the sugar cane. There is a requirement of around 1.50 Lakh of hammer tips by all the sugar mills in the country every year. RRL-Bhopal has fabricated using the developed materials and joined by brazing technology with mild steel substrate. The hammer tip component (60 Nos.) of two different compositions are under field trial in a sugar mill for the last three months for performance evaluation. Field trial analysis indicated that the developed hammer tips are performing 1.2 times better than the conventional imported ones. The developed components would be cheaper by around 50% as compared to the conventional (imported ones) ones with improved performance thereby leading to a substantial monetary savings in view of the large volumes of consumption of the component in various sugar mills in the country.

Sugar mill along with fibrizer fitted with the hammer tips developed at RRL, Bhopal under field trials

PHYTOSTERDS FROM DEODORIZER DISTILLATE OF VEGETABLE OIL

An Integrated process with phytosterols was developed RRL-Trivandrum at hench scale. Residual phytosterols are also recovered at this step, enhancing the phytosterol recovery to 90%. Concentrate with > 60% has good commercial value as natural vitamin 'E' for food supplements and for pharmaceuticals. After the bench scale studies (500-100 g) the process was successfully tested at pilot scale 25 g. By this process 85% of the free sterols were recovered from the distillate with 98% purity.

1.13.3 Human Resource Development

NPL

"User awareness programme on material characterization techniques" was arranged during January 10-14, 2005 at NPL New Delhi. A total of 45 participants from different industries, R&D institutes including CSIR labs & universities attended the programme.

RRL- THIRUVANATHAPURAM

Fifty class XI students participated in CPYLS programme held on 27-28 December, 2004.

1.13.4 Recognition & Awards

NRDC Technology Award for the Invention – Process for the production of prorous orbital implants from synthetic calcium hydroxyapatite- 2005	Drs. D. Basu and M.K. Sinha, CGCRI
MRSI- Medal 2004 given by Materials Research Society of India	Dr. D. Basu, CGCRI
CSIR Young Scientist Award of 2004 in the field of Earth, Atmosphere, Ocean and Planetary Sciences	Dr. Bijuranjan Nayak, NML
Elected Fellow, Maharastra Academy of Science, for contribution in the field of Environmental Chemistry and Retrieval of Heavy Metals	Dr. D.M. Dharmadhikari, NEERI

Metallurgists of the Year Award of Indian Institute of Metals for the year 2004.	Dr. S. Srikanth, NML
MRSI Medal for the year 2005	Dr. Arvind Sinha, NML
Young Scientist Award 2004 of CSIR	Dr. Haranath, NPL
NPL Young Scientist Award of 2004	Dr. Haranath, NPL
NPL Scientist of the Year Award 2004	Dr. S.M. Shivaprasad, NPL
ISO.9001:2004	RRL, Bhopal
Fellow of Indian National Academy of Engineering	Dr. N. Ramakrishnan, RRL- Bhopal
IIME Coal beneficiation award	Dr. J.P. Barnwal, RRl-Bhopal
National Metallurgist's Day Award 2003	Dr. S.Das, RRL-Bhopal
NOCIL Award for excellence in design or development of process plant and equipment for the year 2004	Ms D. K. Dutta of RRL-Jorhat, S. C. Bhattacharyya, A. K. Manda, and S. Bas, of High Energy Materials Research Laboratory, Pune
CSIR Process Technology shield for the "Swing Technology for producing essential oils, oleresins and active compunds from fresh and dry spices" for the year 2004	RRL-Thiruvanathapuram

CHAPTER-2

Central Management Activities

CENTRAL MANAGEMENT ACTIVITIES

2.0 PREAMBLE

CSIR has, under its umbrella, a network of 38 laboratories and 39 field/extension centers, which are multi-disciplinary and multi-locational, manned by around 17,600 committed staff. The R&D activities and affairs of CSIR are managed by the Director General with the assistance of a multifunctional and multi divisional CSIR Hqrs. under the guidance and direction of the Governing Body (GB) and the Advisory Board (AB). The policy directions are outlined by CSIR Society, which has Hon'ble Prime Minister as the President and Minister of State for Science & Technology & Ocean Development (IC) as Vice President. The Central Management Activities during the year are outlined here:

2.1 CSIR SOCIETY

The meeting of the CSIR Society was held on 26th July 2004 at 7, Race Course Road, New Delhi. The following items were adopted by the Society:

- Confirmation of the Proceedings of the Meeting of CSIR Society held on 10th April, 2004;
- Consideration and adoption of the Annual Accounts of CSIR for the year 2002-2003; the audit report and CSIR's comments thereon;
- Adoption of CSIR Annual Report 2002-2003.

The proceedings of the meeting are as under:

At the outset, Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development and Vice President, CSIR extended a warm welcome to the Hon'ble Prime Minister and President, CSIR, Dr. Manmohan Singh, Hon'ble Finance Minister and the members of the CSIR Society to the AGM.

He thanked Hon'ble Prime Minister for setting up new paradigms - giving India a new vision through the Common Minimum Program in the short span of two months. Excerpts of his address are:

He said, "*I am proud and fortunate to be the Vice-President of CSIR. I am happy to notice the commitment and passion with which members of the family view their responsibilities. This makes me feel optimistic about the future of CSIR*".

He applauded leadership of CSIR for its impact on the society particularly mentioning Swaraj and Sonalika tractor, Amul baby food, E-MAL for cerebral Malaria, DNA finger printing technique, indelible ink etc. He stressed upon the need of wide publicity of these path-breaking developments amongst the common man. As the same time he was of the opinion that CSIR was yet to achieve its real potential. To tap the real zeal of CSIR he mentioned about the implementation of Kelkar Committee Report.

He congratulated the 'TEAM SARAS' for opening a new chapter in the field of the Aviation by the maiden flight of SARAS that took place on 29th May, 2004.

Shri Sibal then invited Dr. Mashelkar to make his presentation on the ongoing journey of the CSIR.

Dr. Mashelkar welcomed the Hon'ble Prime Minister to his first meeting of the CSIR Society as its President and thanked him for sparing his time to preside over the meeting. He said that the Hon'ble Prime Minister had been intimately connected with the CSIR earlier in capacity of the then Finance Minister. Even at that time CSIR was privileged to receive his valuable guidance. He was confident that now as the President of the CSIR Society, he (PM) would guide CSIR's destiny. He also said that CSIR was privileged to have a forward-looking leader like Shri Kapil Sibal as its Vice-President.

Dr. Mashelkar made a detailed presentation tracing back CSIR's status in 1995-96 and comparing it with the status in 2003-04. He said that CSIR has brought sea changes in management of its laboratories, projects and programmes and has become quality conscious and patent and business savvy. He added that CSlR today was nation's strongest holder of intellectual property rights and was leading the way for protecting traditional knowledge strength. He briefly mentioned about general appreciation of CSIR from business community by placing it on the same

platform shared by corporate stalwarts like Infosys, Wipro, Hindustan Lever, Reliance, and Ranbaxy etc. He also referred to the book by Dr. Jayant Narlikar "The Scientific Edge" which graded CSIR amongst the top ten achievements of 20th Century.

He categorized the activities and accomplishments of CSIR in four broad categories namely (i) private goods and services (ii) public goods and services (iii) strategic goods, services and technology options and (iv) social goods and services.

Concluding his presentation, Dr. Mashelkar expressed his gratitude to the members of CSIR Society for their time and hoped that CSIR would benefit from their wise counsel in its future endeavours.

The Prime Minister assured the Society of his keen interest in the development of science & technology and scientific and industrial research in India. He said that he would like to reassure that these areas would remain subjects of high priority for him and the government.

The Prime Minister sought advice and support with respect to policies and programmes in the area of science and technology. He congratulated CSIR for the remarkable transformation into a performance driven and user focused organization.

The Prime Minister stated that he felt proud by the successful maiden flight of SARAS and was sure that it would herald the dawn of civil aviation industry in India and would become a 'brand name' for small aircrafts world over. He dwelt upon the decisive role of S&T system for the well being of all sections of society not just a privileged few; "*A theme that is close to my heart is on 'making technologies work for the poor and the underprivileged'.*" He stressed on the need to develop technologies, which would ameliorate the poverty, create jobs, remove the disease burden of the poor, and improve the overall quality of life. He was sure that CSIR could address the special issue of the disease burden of the poor by developing life saving drugs at reasonable prices and not only drugs, but also the areas like water, housing for the poor, fireproof structure etc. where CSIR can contribute a lot.

The Prime Minister advocated an approach to rural development by applications of science to break new grounds in increasing productive capacity of small farms and small businesses by implementing employment intensive schemes. He pointed out the importance of having decentralized power in terms of local electricity generation, where CSIR could be of much help.

[The full text of the speeches made by the Hon'ble Prime Minister and President-CSIR Society and Hon'ble Minister of Science & Technology, and Ocean Development and Vice President, CSIR Society are given in Annexure VII.]

2.2 GOVERNING BODY (GB)

The Governing Body of CSIR met two times during the year i.e. on 26th July 2004 and 15th December 2004. The GB in its meetings deliberated on several crucial subjects and gave directions on these issues.

On 26th July, 2004 in its 162nd meeting, the GB approved: creation of National Innovation Foundation (NIF); Institution of an Award "G.N. Ramachandran Gold Medal for excellence in science"; report of the Committee to review the performance of outreach center setup by CSIR; modification in existing procedure for processing of industry originated NMITLI proposals; formulation of CSIR innovative suggestions and outstanding performance Award Scheme 2004; re-fixing of core S&T strength of CSIR and exemption from implementation of GOI, Min. of Finance instructions relating to deemed abolition of posts kept in abeyance or lying vacant for a period of one year or more; amendment to CSIR Scientists recruitment and assessment promotion rules, 2001; amendment to CSIR service rules 1994 for recruitment of scientific, technical and support staff; applicability of new pension scheme to the autonomous bodies/ PSUs; introduction of new pension scheme; modification of scheme for grant of temporary status.

On 15th December, 2004 in its 163rd meeting, the GB approved: financial support to industry under NMITLI scheme- policy directive for sanctioning loan; review of NMITLI project scheduled for completion; provision of providing financial support in the intermittent period to the projects supported under NMITLI scheme; utilization of loan repayment for NMITLI scheme projects; deputation of scientists abroad- devolution of powers to Heads of national labs./instts; scheme for engagement of consultants for business development; provision for temporary affiliation of the appointed consultant with the respective CSIR laboratory; CSIR Technology Awards-2004; CSIR Diamond Jubilee Technology Award-2004; Shanti Swarup Bhatnagar Prizes-2004; CSIR Young Scientist Awards-2004; amendment to CSIR Administrative Services Rules-1982; proposal for construction of aircraft hangar (SARAS) and associated building at NWTC by NAL,Bangalore; amendment to CSIR Service Rules, 1994 for recruitment of Technical and Support Staff; mobility of staff between CSIR and other organizations of autonomous nature-delegation of power to DG,CSIR to grant retention of lien beyond two years; modernization and upgradation of equipment and R&D facilities in the 9th Five Year Plan-review and ratification.

2.3 ADVISORY BOARD (AB)

The Advisory Board (AB) is an apex body of CSIR to provide S&T inputs to Governing Body, advise CSIR in implementing its vision, review major R&D areas of CSIR and suggest new R&D perspectives, network/ mission oriented programmes and their priorities. The Board discussed the performance appraisal of all the laboratories carried out by Performance Appraisal Boards (PABs) comprising knowledgeable and experienced experts from industry, government, research and academia. The reports of PABs were submitted to a High Level Committee (HLC) chaired by Prof. M.M. Sharma. The HLC recommended that laboratory wise performance appraisal be divided into two parts (i) confidential and (ii) non-confidential. The non-confidential part and the overarching executive summary are to be processed by AB. The eighteen actionable points vis-à-vis recommendations of HLC were presented before the AB.

The report of the Kelkar Committee was presented to Advisory Board. The Committee had studied various methods employed for assessment and evaluation of publicly funded R&D organizations abroad and decided upon social Benefits Cost Analysis (BCA) as a general framework for the study of CSIR. Selected six representative CSIR laboratories NAL, NCL, NPL, CCMB, CFTRI and RRL Jorhat for the study. The Kelkar Committee inter-alia recommended that CSIR must realize autonomous society status; revisit the R&D managerial processes; initiate CSIR Jewels Scheme; optimize outcomes through relationship management, enhance human centered resources and create incentives for the growth.

The AB considered recommendation of the High Level committee of PAB and the Kelkar Committee. The AB appreciated CSIR openness and transparency in bringing the system for periodic appraisal. It suggested that Research Council (RC) of the laboratories should be mandated appropriately and expeditiously to implement these recommendations. AB also suggested that CSIR should ensure that new areas of Science & Technology were given higher priority.

2.4 DEPARTMENT RELATED PARLIAMENTARY COMMITTEE

The Department Related Parliamentary Committee on Science & Technology, Environment and Forests examines and recommends the demands of grants of the DSIR including CSIR. It also takes up specific topics/ subjects of national S&T interest for deliberation from time to time. The Committee considered the Demand of grants for the year 2004-05. A background note was prepared highlighting

activities, programmes and financial summary. The Committee has made following observations/ suggestions:

- efforts should be made to raise funds from industry by successful transfer of technologies and also a need for wider dissemination of technologies so that there is a greater interface between industry and R&D laboratories;
- an agreement should be reached with various financial institutions for providing loans to the research scholars for setting up their own enterprises;
- emerge as a pioneering institute to achieve number one position in Indian & Foreign patent filings and remain vigilant in future to safeguard our age old indisputable rights to our traditional knowledge;
- closer co-ordination be promoted among research laboratories for producing better products, which would eventually reach the end users of such products;
- develop new scientific tools to monitor and review the existing health based ambient quality standards to curb & prevent pollution in the country;
- publicity of the medicine already discovered by the CSIR is grossly inadequate, special attention needs to be focused on allergic Asthmas;
- usher a silent revolution for improving the living conditions in rural areas;
- develop fuels from waste matter and other non bio-degradable substances which otherwise cause environmental pollution;
- develop technologies to use locally available material for construction of house, as large parts of our country live in villages;

2.5 CSIR FOUNDATION DAY

Twenty-sixth September is a very important day for the Council of Scientific & Industrial Research (CSIR). It was on this day in 1942 that CSIR was established. All the 38 CSIR labs celebrate this day as the Foundation Day. It is a day for introspection – to take stock of the progress of the past years – and plan for the future. It is also a day for recognizing excellence through various awards and acknowledging the contributions of the CSIR family members who have retired and those who have completed 25 years of service during the past year.

CSIR Headquarters organized the main function this year in NPL auditorium. The Chief Guest was Dr. Ashok Ganguly, Chairman, ICICI One Source Ltd. and the function was graced by Shri Kapil Sibal Hon'ble Minister of State (IC) S&T and Ocean Development.

In his Welcome Address, Dr. R. A. Mashelkar, Director General, CSIR announced that CSIR's birthday was being celebrated across all the 38 laboratories of CSIR. He said that Shri Sibal, since taking over the reins as Minister and as Vice President, CSIR has "both charmed and charged" the entire CSIR family by his 'dynamism, his vision, his optimism and his penchant for action.' He expressed the hope that, as CSIR tries to forge ahead, it would be Shri Sibal's momentum and drive that would "take us to our destiny".

He highlighted some of the exciting things that have been happening during the last three or four months. He chose to focus on four events that according to him symbolized the fact that Indian S&T was taking a new turn. He elaborated each of these four especially chosen "exciting things" and underlined the symbolism behind his choice; the four exciting things' were:

- SARAS: maiden flight on 22nd August, 2004, which signified "Sanctions cannot be put on our minds."
- The launch of BioSuite® – an unique software that was developed with Public-Private Partnership (PPP) with Tata Consultancy Services (TCS) and 18 other institutions – many of them from CSIR – at San Francisco, USA. It showed "What we cannot do alone we can do together."
- The breakthrough in tuberculosis, which affects people around the world. Five lakh people die of it in our country annually. The breakthrough came in the form of a new molecule – the first to be discovered after 1963.
- Completion of the Phase 1 clinical trials for the treatment of psoriasis.

Shri Kapil Sibal, Hon'ble Minister of State (Independence charge) for S&T and Ocean Development presented the CSIR Young Scientist and CSIR Technology Awards for the year 2004. The winners of Shanti Swarup Bhatnagar Prizes for 2004 were also announced. The Minister in his address to the gathering mentioned of the importance of an institution's maturity in S&T for the development of the country. He appreciated the way indigenous R&D has responded to the challenges in the form of inaugural flight of SARAS; manufacture and export of Indica and Indigo cars to the western world and many more. He highlighted the currently small but potentially large electronics industry and the achievements of the thriving software industry. The Hon'ble Minister stressed upon today's need of Public-Private Partnerships. He stated that he was extremely delighted to note the four noticeable recent achievements in Indian science, three were the results of Public-Private Partnerships (PPP) under NMITLI.

Shri Sibal also stressed upon the need for education, not just primary education, which of course, should be available to all children in India, but for quality higher education. He stated that with the removal of quota restriction under the WTO,

the textile industry has grown into a vital sector of Indian economy. Another important sector was the service sector, which could generate a lot of money and was going to be a fifty million dollar industry in the times to come. Similarly there were other areas of significance such as hydrocarbons and biofuel industry, agro based industries, electronics etc. important to the growth of Indian economies.

In summation, Shri Sibal reiterated, *"Technology is the way ahead and in technology innovation is the key word."* His parting message to the young scientists was, *"Let us think of another dream we want to fulfill, step to step, hand in hand."*

Chief Guest Dr. Ganguly delivered the foundation day lecture on `CSIR-THE CHALLENGE OF RENEWAL'. He recalled his long association with CSIR in various capacities. He stated that most CSIR laboratories had successfully redefined/ remodelled their role in order to enhance their wealth creating abilities in partnership with Indian and international companies and in tune with India's economic reforms to meet the challenges of the global marketplace. However, in the process of reinventing itself now CSIR needed to rise to the challenge and address some of the uncompleted tasks that affect the vast majority of Indians, he said.

Later, Shri Kapil Sibal released a book entitled *Vaigyanik Bharat ka Nirman* by Dr R. A. Mashelkar. He also gave away the CSIR Young Scientist Awards (2004) and the CSIR Technology Awards (2004). Winner of the CSIR Diamond Jubilee Technology Award, Shanti Swarup Bhatnagar Prizes and CSIR Diamond Jubilee Invention Awards for School Children 2004 were also announced.

Dr. Vikram Kumar, Director, NPL proposed a vote of thanks.

2.6 SHANTI SWARUP BHATNAGAR PRIZES 2003: PRESENTATION CEREMONY

Shanti Swarup Bhatnagar Prizes for 2003 were presented by the Hon'ble Prime Minister Dr. Manmohan Singh at a glittering function held on 13th September 2004 at Vigyan Bhavan. The function was presided over by Shri Kapil Sibal, Hon'ble Minister of State (independent charge) Science & Technology and Ocean Development and Vice President of CSIR. It was attended by a large number of dignitaries and distinguished scientists.

Welcoming the invitees, Dr. R. A. Mashelkar, Director General, CSIR said, "This is a great evening—an evening of celebration of the very best that both Indian Science and Technology have to offer. It is a very unique event as normally, previously science events used to be held separately and technology events used

to be held separately. He believed that it was the first event when the best of Indian Science and the best of Indian Technology were being applauded together."

He spoke glowingly of the indigenously designed and built *Saras'* soaring "flight into the future" and the breakthrough in psoriasis ("a very difficult disease") and tuberculosis ("the first new molecule on the horizon since 1963"). He spoke of development of the unique partnership with Tata Consultancy Services and the development of Bioinformatics software Bio Suite ("software first launched in San Francisco, then in Hyderabad").

In his address, Shri Kapil Sibal said that it was an "intermingling of high science with technological innovation and daring entrepreneurship that was necessary to propel India to a developed nation status". He said that the marriage of high science and high technology in a sense symbolizes the underlying spirit of CSIR, that is, to strive for excellence in science and to apply it to uncharted technology domains.

Dr. Manmohan Singh Hon'ble Prime Minister, gave away the first Diamond Jubilee Technology Award for 2003, instituted last year in commemoration of the

Hon'ble Prime Minister presenting 1st Diamond Jubilee Technology Award to Shri Ratan Tata

CSIR's diamond jubilee. The award was given to Shri Ratan Tata, Chairman of the Tata Motors, for "setting a major milestone in the Indian auto industry" with the design, development, manufacturing and commercialization of India's first indigenous passenger cars—Indica and Indigo. The award consists of a cash prize of Rs. 10 lakhs and a shield, conceptualised and designed in association with the National Institute of Design, Ahmedabad. It is given to a technology that is developed in the country by Indian innovators and meets the highest global standards.

The annual CSIR Diamond Jubilee Technology Award was instituted to acknowledge the most outstanding technological innovation that has brought prestige to the nation. Technologies leading to commercially successful products, processes and services, which give India a sustainable competitive advantage, are considered for the award.

In his acceptance speech, Shri Ratan Tata, Chairman, Tata Motors Limited said, "It is an extremely great honour to receive this Award on behalf of Tata Motors. I am honoured to receive it on behalf of the 700 young engineers who accepted the challenge that many said couldn't be done." He said that the team persevered despite teething troubles and frustrations and finally the Indica project was brought to fruition. As "an Indian who is proud of his country", he felt, "There are many, many such projects and many, many such achievements that are possible in the Science and Technology arena in India today. We have the manpower, we have the skill and the human capital, but we sometimes lack the belief that we can do it. We, as Indians need to believe in our (own) capabilities." He continued "There is tremendous talent in young scientists and young engineers. We need to give them a chance to prove themselves. We need to recognise their abilities and achievements. This kind of recognition is a tremendous shot in the arm for such engineers and such scientists and given this kind of opportunity, I think this country can shine far, far more than it has done."

In his address, Hon'ble Prime Minister Dr. Manmohan Singh emphasised the need for reconstruction of the university system and rebuilding of the science

Hon'ble Prime Minister addressing the audience

base in the universities. He pointed out that this rebuilding could not be done in a piecemeal fashion and had to be taken up comprehensively. "New strategies need to be developed to induct, nurture and retain young talent in the science stream. In particular, science education at 10+2 and undergraduate levels needs special attention," said the PM. He was particularly concerned that science was no longer the automatic choice for many students. "We must redouble our efforts to make science an attractive career for our young people," he said.

Dr. Singh on the occasion announced that he would soon constitute a Science Advisory Council to the Prime Minister that would be headed by a distinguished scientist. The mandate of the Council would be to provide advice on strategies, policies and programmes for using S&T as an essential input for all developmental processes.

Shanti Swarup Bhatnagar Prizes-2003-2004

Later, Dr. Manmohan Singh gave away the Shanti Swarup Bhatnagar Prizes for the year 2003. The Shanti Swarup Bhatnagar Prizes are awarded every year by CSIR to outstanding Indian research workers in seven disciplines of science and technology. The Prizes are awarded to scientists for their outstanding scientific contributions made primarily in India during the last 5 years preceding the year of the award. The Prize comprises a citation, a plaque and a cash award of Rupees two lakh. This year 13 scientists were given this award.

Earlier, referring to the Awards Dr. Mashelkar had stated, "There is no question that the Shanti Swarup Bhatnagar Prize is the most prestigious award that India has to offer. One can get many awards and international honours in one's life time but as a scientist, it is the most cherished award."

Prof. Samir K. Brahmachari, Director, IGIB proposed a vote of thanks and expressed gratitude to all those who made the occasion a grand success.

2.7 SHANTI SWARUP BHATNAGAR PRIZES 2004

CSIR formally announced the winners of *Shanti Swarup Bhatnagar Prizes,* for the year 2004 the country's highest award in science, as a part of the CSIR Foundation Day Celebration organized at the National Physical Laboratory, New Delhi. The Hon'ble Minister of State (Independent Charge) Science & Technology and Ocean

Development, Shri Kapil Sibal, presided over the function. The winners of this year's Bhatnagar Prize are:

Biological Sciences: Dr. Gopal Chandra Kundu, National Centre for Cell Sciences, Pune and Dr. Ramesh V. Sonti, Centre for Cellular & Molecular Biology, Hyderabad.

Chemical Sciences: Dr. Vinod K Singh, Indian Institute of Technology, Kanpur and Dr. Siva Umapathy, Indian Institute of Science, Bangalore.

Engineering Sciences: Dr. Subhasis Chaudhuri, Indian Institute of Technology, Bombay and Dr. Vivek Vinayak Ranade, National Chemical Laboratory, Pune.

Mathematical Sciences: Dr. Arup Bose, Indian Statistical Institute, Kolkata and Dr. Sujatha Ramdorai, Tata Institute of Fundamental Research, Mumbai.

Medical Sciences: Dr. Chetan Eknath Chitnis, International Centre for Genetic Engineering and Biotechnology, New Delhi.

Physical Sciences: Dr. Madan Rao, Raman Research Institute, Bangalore. This year, no Award has been given in the field of Earth, Atmosphere, Ocean and Planetary Sciences.

2.8 DIRECTORS' CONFERENCE

The Directors' Conference is an annual forum of CSIR Directors to meet and discuss issues/ problems of generic interest. A two day conference of CSIR Directors was organized in August 21-22, 2004 at NAL, Bangalore. The major issues discussed were:

Kelkar Committee Report's recommendations; Guidelines for the Network Projects; Business Development including I.P. Valorisation; Recruitment, Assessment, Training and HRD issues (Introduction of centralized examination for Scientist 'B' recruitment); Release of funds; E-Governance in CSIR, Deemed University status and Web ISTAD

The Directors Conference was preceded by Directors sports meet organized as a part of Silver Jubilee function of CSIR Sports Promotion Board.

Directors' sports meet

CHAPTER-3

Headquarters Activities

HEADQUARTERS ACTIVITIES

The CSIR Headquarters is the central hub of its 38 laboratories, whose prime activities include strategic planning; repository of organizational learning; policy guidelines; managing intellectual property; front face to the Planning Commission; gateway to international linkages and collaborations; business development; extramural human resource development; solving legal matters and vigilance related matters. These are carried out through the technical and administrative divisions set up for the purpose. Some of the major activities carried out by the divisions during the year are summarized below.

3.1 R&D PLANNING DIVISION (RDPD)

R&D Planning Division is the nerve center of CSIR Hqrs. with broad activities such as interaction with Government departments; Demand for grants; Annual Plan; Five Year Plan and related matters; Annual Report (AR); Report to Cabinet, Planning Commission etc.; Advisory Board (AB); Performance Appraisal Board (PAB); Directors' Conference; Research Council (RC) and matters pertaining to formulation, approval, co-ordination and monitoring of national laboratories, S&T plan projects/ proposal, databank of whole CSIR R&D activity, and execution of New Idea Fund.

With reference to the network and similar projects, the division has the responsibility to co-ordinate externally with Planning Commission, Finance Ministry, and other sector specific departments and internally with Finance Division and laboratories. It also has the responsibility to provide technical support to Investment Sub Committee and GB.

MID TERM APPRAISAL OF THE TENTH FIVE YEAR PLAN (TFYP)

The year 2004-05 was the third year of Tenth Five Year Plan and as such Planning Commission has sought thorough examination of the impact of the TFYP on the Indian economy at mid-term stage. The aim was three-fold- (i) to assess the possibility of reaching the objectives of the Tenth Plan, with progress achieved so far, (ii) identification of the areas of significant shortfall in Plan performance and the possible reasons thereof, and (iii) the mid-term corrections in the implementation by evolving appropriate measures. CSIR undertook a massive exercise to address these issues. Since the TFYP was based on network projects, a well comprehensive proforma seeking information on various issues were evolved in consultation with laboratories and inputs were accordingly sought. The information so received were analysed and shortfalls and bottlenecks were identified. Based on the analysis, a Mid Term Appraisal (MTA) document was prepared and sent for the perusal of Planning Commission. A presentation on salient features of the MTA was made before Member (Science) Planning Commission particularly highlighting the achievements and the status of various projects/ programmes. Also new programmes particularly the facilities to be created were identified. These were National water quality assurance & training facility; BSL-4 facilities for handling, storing hazardous microorganisms and breeding and maintenance of transgenic knock out mice; Augmentation of national trisonic & aerodynamic facility; National regulatory toxicology facility; National proteomics and genomics facility; Laboratory of conservation of endangered species; National battery development research center; and National nano science and nano technology programmes. The National Common Minimum Programme (CMP) of the Government had emphasized the role of Science & Technology in the developmental process and included three main issues viz. introduction of programmes that strengthen India's vast S&T infrastructure; development and application mission in key areas covering global leadership and local transformation; and mobilization of skills and expertise of Indian scientists, technologists and other professionals working abroad for institution building and other projects in the country. CSIR in consonance with the objectives under CMP has identified prgrammes specially linking these to the socio economic needs and aspirations and got approved by the Planning Commission. An additional funding of Rs. 400.00 crore was also sought which was approved in principle by the Planning Commission.

ANNUAL PLAN 2005-06

As a sequel to the mid term corrections of TFYP, Annual Plan 2005-06 was formulated for CSIR. As a publicly funded organization, CSIR derives its finances from the three major sources, namely: budgetary support from the Government; funding from contract R&D, consultancies and technical services (External Cash Flow); and internal receipts. The TFYP was devised with an assumed annual GDP

growth rate of the economy of 8 percent and the national R&D expenditure increasing to around 2 percent of GDP by the end of the Plan period. In the TFYP of CSIR, there are six schemes in total, of which five are continuing and one is a new scheme (two schemes of the Ninth Plan period have been closed or merged with others). The emphasis on continuing schemes is on consolidation of ongoing activities and building on the existing investments and infrastructure to initiate new priority programmes. The division sought detailed information from the national laboratories/ institutes through a comprehensive proforma, wherein the progress of network programmes against the planned activities as envisaged and approved by the competent authority were ascertained along with the future targets vis-à-vis financial requirements. In addition, information on non-networked activities/ progress was also sought. The information was analyzed and keeping in view of the priorities through operational planning, the Annual Plan document 2005-06 was formulated and sent for the consideration of the Planning Commission. A plan investment of Rs. 935.00 crore for various schemes was projected. After detailed in depth discussion and later with Planning Commission, a plan outlay of Rs. 797.53 crore was approved for CSIR.

NETWORK PROJECTS

GUIDELINES ON NETWORK PROJECTS

In the Tenth Five Year Plan, CSIR has embarked upon programme of networking the R&D activities within CSIR laboratories. 55 of these networked projects are now in operation.

These networked projects are a new experience for CSIR. As a number of laboratories are participating in each project, many issues pertaining to smooth functioning of these networked projects have cropped up. In order to sort out the issues at laboratory level and to achieve timely deliverables, DG-CSIR has constituted a Committee to prepare `Guidelines for Financial, Administrative, Scientific, Monitoring of Networked projects'. The Committee dwelt upon many issues related to smooth execution of networked projects and involved all CSIR labs during the preparation of guidelines. The guidelines, operational from 1st October, 2004, broadly address the issues pertaining to functional aspects, administrative aspects, co-ordination mechanisms, monitoring and evaluation mechanisms, information flow, project expansion and foreclosure. The operationalisation of guidelines is expected to reduce the laboratories dependence on Headquarters for directions and thus increasing the efficiency in terms of deliverables.

MONITORING COMMITTEE

On the recommendations of RDPD, DG-CSIR has constituted external Monitoring Committee for each of the networked projects. The purpose of the Monitoring Committee is to achieve the objectives of the programmes through periodic monitoring. The main functions of the Monitoring Committee is to:

- evolve suitable and monitorable parameters for each network projects;
- review the progress of projects on half yearly basis;
- monitor the timely delivery of agreed goals and milestone targets;
- assess and advice the mid course changes in network composition;
- provide adequate internal warning system for projects registering no or slow progress;
- recommend additional fund release, inclusion of laboratories deletion of an activity, and foreclosure of projects.

PROGRAMME ON 'DISCOVERY, DEVELOPMENT & COMMERCIALIZATION OF NEW BIOACTIVES AND TRADITIONAL PREPARATION'

Programme on "Discovery, Development & Commercialisation of New Bioactives and Traditional Preparations" was mounted so that new discoveries can be made and as a result thereof India gets a recognition in the international arena. The strategy evolved has been able to give many leads for various diseases in discovering single molecules from the leads and taking them to the stage where IND can be contemplated. The programme has been converted into a Task Force Networked Project of CSIR. The project has made a steady progress and around sixty drug discovery groups formed which are *in vitro* and *in vivo* active. Some of the leads have reached to single molecule stage for diseases like ulcer, cancer, tuberculosis, parkinson's disease, immunomodulation and hepatoprotection. These are at various stages of development as herbal formulations and new chemical entities. In this programme a total of six thousand plant extracts have been made and sent for bioevaluation after coding them to protect IPR. During the year thousand plant extracts (three thousand samples, i.e. in aqueous, alcohol and 50% alcohol) and equal number of microbial extracts have been prepared. 120 single molecules have been synthesized and sent for bioevaluation. 2500 samples have been screened for different diseases and 3000 samples for pesticidal activity.

NEW IDEA FUND (NIF)

New Idea Fund proposals having potential of a discovery or breakthrough are invited from the scientist working in CSIR laboratories. This year, seventeen proposals for support under NIF were received. After rigorous evaluation seven proposals were selected. The Project Investigators (PIs) of the shortlisted project proposals were invited for presentation of their proposal before the Expert Committee. Only one idea of IMTECH, Chandigarh entitled `Identification of the function of unknown ORF's/genes through genome-wide perturbation analysis carried out in a heterologous host' was considered to be supported under NIF scheme. Progress of the three ongoing projects, approved earlier was also reviewed in terms of the achievements and thereafter the Committee gave its observations/ suggestions.

The Committee also considered enlarging the scope of ongoing NIF scheme by inviting collaborative proposals from University, R&D institutions in addition to CSIR labs. Guidelines and proforma were prepared for inviting the proposals on `Collaborative research support programme under New Idea Fund. The wide publicity of the scheme was given through the advertisement in `Current Science'.

CSIR REVIEW COMMITTEE ON OUTREACH CENTERS

A Review committee was constituted in March 2004 under chairmanship of Prof. B. B. Dhar to review the performance, relevance and utility of CSIR outreach centers setup by the CSIR laboratories for various purposes over a period of time. The division collected information from all the concerned CSIR laboratories, prepared database and provided technical analysis & secretarial assistance to the committee, which enabled formulation of the recommendations.

The Governing Body of CSIR has approved the recommendations of the review committee, which has been further approved by President of the CSIR Society.

CSIR'S RURAL ACTION PLAN AND RELATED ACTIVITIES

The Rural Action Plan document of CSIR was unveiled by Shri Kapil Sibal, Hon'ble Minister of State (I/C), Science & Technology and Ocean Development during the Directors' Conference held at Bangalore during 21-22 August, 2004.

CSIR has prepared this plan for its own orientation towards rural development programs in core areas of strength. The plan would also enable CSIR to contribute through applications of technology for rural development programs under National Common Minimum Program (NCMP).

For encouraging development of suitable technologies for rural sector, CSIR already have Advisory and Monitoring Committee on rural action plan, which recommends suitable projects for funding. RDPD invites fresh project proposals and progress report of the ongoing projects for consideration of the committee. The division also provides technical and secretarial assistance to enable committee in formulating recommendations expeditiously.

Hon'ble MOS (S&T) I/Cr unveiling Rural Action Plan document of CSIR

This year, nine ongoing projects of four CSIR laboratories namely CFTRI, IHBT, IICT and NCL and two new projects from two laboratories IICT and NISTADS were supported by CSIR. Funds were also provided to RRL-Bhopal for setting of gallery, depicting success stories of the CSIR in the area of rural development and for publication of four issues of the "Journal of Rural Technology".

Division has also brought out Hindi version of the publication "Technologies for the Rural Sector" this year. Technologies related to information have been given special place in this publication. With this Hindi version, the reach of CSIR technologies is likely to be much more wider and deeper among its users.

On behalf of CSIR the division is also providing its technical comments in Executive Body and General Body of CAPART, so as to enable funding to deserving NGOs for dissemination of CSIR technologies. The Division distributed CSIR publication "Technologies for Rural Sector" to more than 500 government departments/ NGOs/ farmers/ individuals voluntarily on request. The division also facilitated dissemination of specific technological details through concerned CSIR laboratories to large number of people on request.

CONTRIBUTION TOWARDS DEVELOPMENT OF NORTH EAST

A multi-disciplinary task force under the chairmanship of the DG-CSIR and Co-chairmanship of DG-ICAR has been constituted in December 2004. This task force would develop scientific vision and draw a road map of R&D for next 25 years to enable development of technologies, which can blend with the traditional cultures and skill profiles of the people of the region. Division has been assigned the responsibility of working as a secretariat for the Task Force.

The division interacted with North East Council (NEC) on regular basis for disseminating CSIR technologies in the North East region. Based on interactions with NEC, the division coordinated with CSIR laboratories and facilitated preparation of ten detailed and revised project proposals, which have been forwarded to NEC for funding.

DEEMED UNIVERSITY STATUS FOR CSIR

CSIR has been contributing to the training of skilled manpower for Indian industry and academia. In association with UGC it is conducting UGC-CSIR joint test, i.e. National Eligibility Test (NET) which aims to identify and select prospective researchers and teachers for R & D and S & T needs of the country. In addition, CSIR introduced many programmes for human resource development such as CSIR Diamond Jubilee Research Interns Award, Dr. Shyama Prasad Mukherjee (SPM) Fellowship, Catch them young programme, CSIR Programme on Youth for Leadership in Science (CPYLS), Shanti Swarup Bhatnagar Prize etc.

Realising that it has the capacity to create a large number of high quality specialized scientific human resource pool especially in the trans-disciplinary areas, CSIR proposes to convert its existing entity "Human Resource Development Centre" into an autonomous body "CSIR-Advanced Institute of Science Training (CSIR-AIST)". CSIR has initiated a move to obtain the status of deemed university for CSIR-AIST.

TECHNOLOGY MISSION ON OILSEEDS & PULSES (TMOP)

R & D Planning Division is also designated as nodal agency for technology mission on oilseeds, pulses and maize. Fourteen new R&D programmes, out of 24 received, with total budgetary outlay of Rs. 222.00 lakh were approved for implementation after evaluation by Expert Committee. The physical and financial progress of 51 ongoing programmes was also reviewed on quarterly basis through quarterly progress reports and utilization certificates and on annual basis through meetings of Review Committee. Extra budgetary resources (EBR) of Rs.133.00 lakh for new R&D projects and Rs. 112 lakh for ongoing projects were mobilized from Department of Agriculture & Cooperation, Ministry of Agriculture.

Ten R&D programmes were declared as completed during the year. Some of the significant outputs of these R&D programmes are (a) Design and development of Modem Oil Expeller of 6 Tonnes per day capacity with water cooled cage bars and chamber for production of pungent mustard oil; design and development of spouted bed continuous Dryer of 200 kg/hr capacity for groundnut; and Improved nutrient management protocol for control of pre-harvest aflatoxin in ground-nut.

The division has funded and coordinated the generic promotion of soybean for health benefits accruing from consumption of soybean among general public through electronic and print media.

The division coordinated the evaluation study with M/s. Agriculture Finance Corporation and national laboratories for all programmes funded under Technology Mission on oilseeds.

PROF. G.N. RAMACHANDRAN GOLD MEDAL FOR EXCELLENCE IN BIOLOGICAL SCIENCES & TECHNOLOGY

CSIR has instituted a gold medal award for excellence in biological sciences in the fond memory of Prof. G.N.Ramachandran, pioneer of protein chemistry research and the founding father of Structural Biology R & D area in India. The award is to be given each year at the annual meeting of Indian Science Congress for notable and outstanding contributions in biological science & technology. Prof. M. Vijayn, Molecular Biophysics Unit, lISc., Bangalore, was honoured with the first gold medal award for the year 2003-04 for his outstanding & sustained contribution in the area of structural biology and molecular biophysics.

INTERMINISTERIAL LINKAGES

The Division represented CSIR on various committees of the Government, namely Ministries of Chemical and Petrochemicals, Petroleum and Natural Gas, Environment & Forest, Health & Family etc. and Department of Biotechnology, Indian System of Medicines, Science & Technology, Scientific and Industrial Research, Thyagarajan Committee for consolidation of core competencies of CMRI and CFRI, Dhanbad, Ramasami Committee for drought, etc.

THYAGARAJAN COMMITTEE FOR CONSOLIDATION OF CORE-COMPETENCIES OF CMRI AND CFRI

DG-CSIR, on the basis of action arising out of performance appraisal of laboratories, has constituted a committee for a thorough re-examination of the charter and the possibilities for consideration of core-competencies of the two laboratories, CFRI and CMRI both situated at Dhanbad, considering their resource endowments,

programmes, activities and performance. The division is coordinating the functioning of this committee.

R&D MANAGEMENT CONFERENCE - 2004

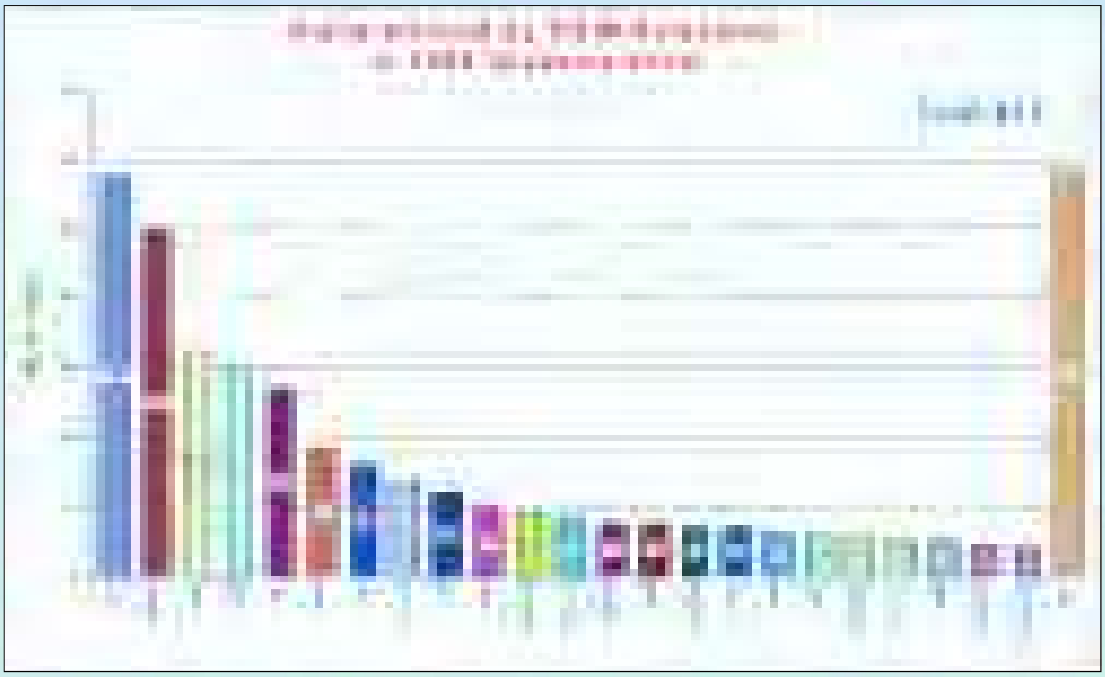
In continuation, this year as well, CSIR (RDPD) organized the sixth R&D management conference with the theme of 'Value realization through knowledge networking'.

The keynote address was given by Dr. A. S. Abhiraman, while theme address was delivered by Dr. N.K. Ganguly, Director General, Indian Council of Medical Research.

This year around 36 abstracts were received. 23 papers were presented in six sessions, namely knowledge teams; knowledge sharing; knowledge management; knowledge markets; knowledge engineering and knowledge future. Selection of papers was made in a manner, which fairly represented cross-section of intelligentia from R&D institutions to academia and industry. Scientists of eminence chaired the sessions, which further raised the level of the discussion and participation. The last session was Panel Discussion. About 180 delegates attended the conference. The event provided a multi-disciplinary overview on innovative and intriguing main streams in knowledge management and networking to the participants. The proceedings of two days conference were brought out.

3.2 INTERNATIONAL SCIENCE & TECHNOLOGY AFFAIRS DIRECTORATE (ISTAD)

ISTAD continued its activities aimed at building and fortifying bridges of understanding between CSIR and all its major overseas S&T partners to develop synergies and leverage CSIR's capabilities in core areas of S&T interest. The division interfaced with as many as 25 bilateral & multilateral partners located across the globe in like USA, Germany, France, Japan, UK, China, Italy, Singapore, Australia, Russia, South Korea, Mauritius, Thailand, South Africa, Sri Lanka, Canada, Oman, Bangladesh, Malaysia. The visits to various countries during the current year are as shown:



BILATERAL CO-OPERATION

BRAZIL

CSIR and Brazilian National Council of Scientific & Technological Development (CNPq) signed a Memorandum of Understanding in February 2004 for scientific partnership through exchange of scientists for implementation of joint research projects in the areas of biotechnology, aeronautics, new Materials and oceanography.

BULGARIA

CSIR participated in the 3rd Meeting of the Indo- Bulgarian joint S&T Commission held at Delhi on 1st Nov.'04. Secretary, DST and Prof. Kamen Velev, Bulgarian Deputy Vice Minister for Education & Research chaired the meeting. Five projects out of eleven selected at this meeting were from CSIR labs. in the areas of *nano-wire,* food technology, mapping of sub-surface Geoelectric structure and energy storage.

CHINA

IGIB signed a Memorandum of Understanding with Beijing Genomics Institute (BGI), China to carry out joint research in the area of Genomics and Bioinformatics.

There is one ongoing project also in the area of S&T Policy between NISTADS, New Delhi & Institute of Policy and Management, Beijing, China under this cooperation.

EGYPT

A collaborative project proposal "Establishing a Micro-Fabrication Facility at Electronics Research Institute (ERI), Cairo, Egypt" between ERI & CEERI, has been approved for implementation under the ongoing CSIR-The Academy of Scientific Research & Technology (ASRT) S&T Cooperation.

FINLAND

A three-member delegation from Academy of Finland (AKA) visited CSIR on 23rd Nov.'04 with an aim to understand R&D system in India/CSIR and also to explore possibilities of scientific partnership. An interactive meeting was organized for the purpose, wherein presentations were made on CSIR activities & its international networking and research schemes funded by HRDG. It is now in principle agreed that CSIR and AKA, Finland may join hands for research partnership.

FRANCE

A MoU between CSIR and CNRS (French National Centre for Scientific Research) to launch an Indo-French programme for research on weather and climate was signed during the visit of a ten-member delegation from CNRS (headed by its Director General, Dr. Bernard Larrouturou) to CSIR on 28th September 2004. Under this programme, it is proposed to carry out the following projects:

(i) Carbon fluxes in India and Central Asia;

(ii) Life cycles of convective systems;

(iii) Monsoons and the Intra-seasonal-interannual variations experiment;

(iv) Variational assimilation in meteorological and oceanic systems;

(v) Aerosols and Indian monsoons;

(vi) Forecasting extreme events.

Eleven visits of CSIR scientists under ongoing collaborative projects funded by the Indo French Centre for the Promotion of Advanced Research in the areas of Materials, Environment Catalysis, Polymers and Drugs took place during the current year.

GERMANY

Under the CSIR- FzJ Cooperative Science Programme, two new projects on Optical MEMS (CEERI & Technical University Darmstadt, Germany) and New Materials for Eco-friendly Catalytic process (IICT & Institute for Angewandte Chemie Berlin-Adlershof) have been approved for implementation.

Three joint projects in the areas of Chemical Sciences (NCL), Bioactive molecules (RRL-Jammu) and Earth Sciences (NGRI) are ongoing.

CSIR-Humboldt reciprocity research award for the year 2005 was awarded to Prof. Juergen Kurths, Institute of Physics, Potsdam University, Germany on invitation from IICB, and Prof. Michael Hunger, University of Stuttgart, Instt. of Chemical Technology, Stuttgart, Germany on the invitation from IIP.

Three scientists each from India and Germany exchanged visits under the CSIR-DAAD Exchange Programme in the areas of immunosensors, ceramics, marine microorganisms, and concrete structures.

CGCRI entered into research collaboration with ZAE, Bayern, Germany for "Development of low emissivity coatings on different types of substrates by Sol-Gel processing".

Two research projects under the DST-DAAD PPP, in the area of Photo-catalytic, Super-hydrophilic Sol-Gel coatings (RRL-T & Institute fur keramische Werkstoffee, Freiberg.) and development of novel sensitizers (RRL-T & Institute for Pharmazie, Univ. of Mainz, Mainz, Germany) have been approved for implementation.

ITALY

CSIR–CNR, Italy made excellent progress with the successful completion of the joint project on Toxic wastewater treatment between NEERI and University of Venice. Three joint projects on Somatic hybridization by protoplast fusion (NCL), Bioactive Polyphenols (IGIB) and Bioactive Metabolites from benthic organisms (NIO) were jointly carried out with CNR Institutes. Six scientists from CNR, Italy visited India against four visits of CSIR scientists to Italy.

JAPAN

There have been seven visits under the ongoing projects with Japan being implemented under various S&T programmes in the following areas:

Oceanography (NIO and Institute of Observational Research for Global Change, JAMSTEC), *Materials* (NCL and Department of Chemistry, Tokyo Institute of

Technology) (RRL, Thiruvanthanpuram & National Institute of Advanced Industrial Science and Technology), *Advanced Materials for Environmental Applications* under an MoU between NEERI, Nagpur and National Institute for Materials Science,Tsukuba) and Molecular Biology (CCMB & National Institute of Basic Biology, Okazaki).

MYANMAR

At the fourth meeting of the Joint Indo-Myanmar working group for scientific and Technological Cooperation held on 23rd December 2004 three CSIR projects / workshops in the areas of oceanography, leather and food technology were recommended for implementation.

Under the ongoing activities, a mid-term review of the Myanmar component of India-Myanmar collaborative project "India-Myanmar joint oceanographic studies in the Andaman Sea" was held from 16 to 23 September 2004 at Myanmar. Two scientists from NIO participated in the mid-term review meeting.

NEPAL

At the second meeting of the Indo-Nepalese joint committee on S&T held at New Delhi during 7-8 April 2004, CSIR offered to train Nepalese Scientist at various labs. Two Nepalese scientists from Royal Nepal Academy of S&T (RONAST) have been accepted for training in the areas of medicinal plants at RRL, Jammu & CIMAP under this arrangement.

NETHERLANDS

A major programme on Benthic biodiversity across oxygen minimum zone between NIO and Netherlands Institute of Ecology (NIOO) was initiated in October 2004 with collection of benthic samples. The detailed proposal has been worked out for funding by the Dutch Science Foundation to the tune of Euro 4.4 lakes (about Rs. 2.5 core).

NORWAY

Under Indo-Norwegian programme of Institutional Cooperation, NGRI and Norwegian University of Science & Technology (NTNU) signed an agreement on 3rd Feb., 2005 for a major joint project on reservoir modeling for enhanced oil recovery.

PORTUGAL

The following projects submitted by NIO have been included under the Indo-Portuguese inter-governmental S&T cooperation:

(i) 'Reconstruction and Past Changes in Productivity of Arabian Sea' in collaboration with Institute of investigation of fisheries and Sea (IPIMAR);

(ii) 'Variability of Oceanic Processes in the West Coast in India and the Azores Archipelago' in collaboration with University of Azores;

(iii) 'Biomarker Response in Estuarine/Coastal Fishes for pollution monitoring and management' with CIIMAR.

There were four visits under the ongoing projects between India and Portugal under the Inter-Governmental S&T Cooperation in the areas of marine pollution, hydrothermal vents and medical instrumentation. One scientist from Portugal visited CSIR under this programme.

RUSSIA

Six projects, one in the area of catalysts (NCL & Institute of Catalysis, Novosibirsk) and five projects from NGRI with Russian Institutes like Oil & Gas Res. Instt RAS, Moscow, Institute of Inorganic Chemistry SB RAS, Russia, VNII Oceanology, St. Petersburg, Russia, GRI, Troitsk and United Institute of Physics of Earth, Moscow were cleared from security and sensitivity angles for implementation under ILTP Projects. Six CSIR scientists visited Russia under the Integrated Long Term Programme (ILTP).

SOUTH AFRICA

Four CSIR projects under the inter-governmental S&T cooperation in the area of drugs (NCL & University of Capetown.), artificial Intelligence (CBRI and University of Witwatersrand), Catalysts (NCL & University of Capetown) and antituberculosis and antimalarial agents (IICT and University of Capetown) have been approved.

Besides, there are two on-going projects under the inter-governmental S&T Cooperation Programme in the area of low temperature oxidation and nano metals between RRL-Bhubaneswar, IICT and University of Witwatersrand.

SOUTH KOREA

"Design of Ultra-wideband High Efficiency Helix TWTs and development of relevant critical technology" is an ongoing collaborative project under a MoU

between CEERI and School of Physics, Seoul National University (SNU), South Korea. Three exchange visits from both sides under this programme took place this year.

SRI LANKA

NEERI and University of Kelaniya, Sri Lanka have an ongoing project in the area of environmental biotechnology under the Indo-Srilanka Cooperation programme in biotechnology. One visit of Srilankan project coordinator to NEERI took place this year.

Two Srilankan scientists from the government analysts department, Sri Lanka, were trained at CFTRI in a custom made training programme on "Food Analysis".

TAIWAN

Two researchers from AVRDC's International Cooperation Office visited CIMAP to get specialized training on production and consumption of medicinal and aromatic plants in the region, research programs at CIMAP, and explore possibility of collaboration.

THAILAND

Metrology was identified as one of the areas for joint co-operation at the first meeting of the joint committee on co-operation in S&T. NPL & National Institute of Metrology, Thailand were identified as the two institutes in this area. The focus areas identified for mutual cooperation were electricity, mass & related quantities, photometry. A Thai delegation from National Institute of Metrology, Thailand (NIMT) visited NPL for discussions and identification of areas for mutual cooperation in the area of metrology under the PoC between India and Thailand. Also, scientists from NPL visited NIMT to finalize the areas for joint cooperation.

UK

Two CSIR scientists out of 11 were selected under Indo- UK Young scientists networking Programme 2004 – 05. The visits are expected to establish CSIR-UK partnership in the area of management of chromium in ore processing and chemical transformations over catalytic molecules.

CGCRI and University of Leeds initiated a joint research project on decontamination of water using UV emitting fibre optics under British Council link scheme for a period of three years.

Prof. Julia Higgins, Vice President, The Royal Society visited CSIR and had a detailed discussion with DG, CSIR for possible CSIR- Royal Society partnership with a focus on industrial research.

CDRI and NML bagged two projects under Indo-UK Science Network programme. CDRI's project on *Mycobacterium Tuberculosis* (National Institute of Medical Research, London) and NML's project on *Methane emission (university of Glasgow)* are the new beginning of project mode partnerships between CSIR and UK Institutions.

USA

CRRI was chosen as the nodal agency in India for modelling of vehicular emission and air quality under a MoU between Ministry of Environment and US-EPA.

NIO and Pacific Marine Environmental Lab (PMEL), USA successfully deployed four TAO and one ADCP moorings (supplied by PMEL) during Sagar Kanya cruise. The moorings are providing the real time series data on atmospheric and oceanic parameters.

A Memorandum of Understanding was signed between NAL and Florida State University, USA for joint research partnership in the area of Advanced Flow Measurement, which is of direct relevance to NAL's major programme on Aerospace design.

REGIONAL S&T COOPERATION

ASEAN

A two-day workshop on "Management of Technology Innovation" was held at New Delhi. The focus was on:

- facilitating the creation and growth of innovation driven enterprises;
- strategies for supporting R&D and technology transfer from universities/ research laboratories;
- role of IPR in effective technology management.

The main objective was to share experiences between scientists from India and their counterparts from ASEAN on mechanisms to promote S&T, particularly "Managing the various links of the Innovation chain right from development and up-scaling successful research work upto commercialization".

MULTILATERAL S&T COOPERATION

EUROPEAN UNION

A project entitled "Assessing impacts of TBT (tributylin) on multiple coastal uses" submitted by Tata Energy Research Institute (TERI) has been approved by European Union for funding under the VI framework programme. The project involves three participants from India apart from NIO; Tata Energy Research Institute; Central Institute of Fisheries Education (CIFE); and National Ship Design and Research Centre (NSDRC) and 4 participants from the European Union, Italy, Sweden and the Netherlands. The project will be coordinated by TERI, Goa.

A project proposal entitled "Development of a low cost technology for in-situ treatment of groundwater for potable and irrigation purposes" of NML has been approved for collaboration under European Union's ASIA Pro Eco Programme in collaboration with School of Chemical Engineering, Queen's University of Belfast, UK with funding from the European Commission's ASIA Pro Eco Programme.

HUMAN RESOURCE THROUGH TRAINING

817 CSIR scientists were deputed under different programmes by ISTAD during 2004-05. Of these, around 476 were deputed for participation in international conferences/seminars, 24 on cruise, 4 for business development, 78 for training, 130 under bilateral exchange programmes, 64 for higher studies/assignments, 39 under fellowship and 2 as experts. During the current year, 254 (out of 655 applicants) non-CSIR Scientists were awarded partial financial assistance to attend conferences/workshops abroad.

The growth of foreign visits by CSIR Scientists continued and reached a peak during the year with 817 overseas visits by CSIR scientists for capacity/capability building and international networking.

FELLOWSHIPS

RAMAN RESEARCH FELLOWSHIPS

Seven Raman research fellows selected from various CSIR labs visited their host countries during 2004-05. Nominations of six CSIR scientists have been approved for the award of Raman research fellowships for 2005-06.

TWAS FELLOWSHIP

During the year 2004-05, ten candidates, (five each for Postgraduate and Postdoctoral Fellowships) from Egypt, Kenya, Mongolia, Myanmar, Nepal and Nigeria have been awarded CSIR- Fellowship to carryout their research in CSIR Laboratories.

Under the TWAS Fellowships for Postdoctoral research and advanced training Dr. (Mrs.) M.A. Osman of Medicinal and Aromatic Plants Research Institute, Sudan has been awarded the fellowship by TWAS to carryout her advanced research on medicinal plants at CIMAP.

3.3 INTELLECTUAL PROPERTY MANAGEMENT DIVISION (IPMD)

IP PROTECTION IN CSIR

CSIR continued to maintain its dominant position in IP arena by filing 500 foreign and 418 Indian patent applications during 2004-2005.

WORKSHOP ON DISPUTE RESOLUTION IN TECHNOLOGY AGREEMENTS

The workshop on 'Dispute Resolution in Technology Agreements' was organized by CSIR jointly with WIPO and FICCI -IIPD on April 26-27, 2004 at FICCI, New Delhi. The theme of the workshop was 'Arbitration and mediation in intellectual property rights'. About 80 representatives from private and public sector industry, the Govt., R&D institutes, law firms, and IP professionals attended the workshop.

The workshop exposed the participants to the world's current practices in Arbitration and Mediation in IPR and to enable them to plan their strategies on dispute resolution in technology agreements. Prominent speakers were Dr. Heinz Goddar, Boehmert & Boehmert, Munchen, Germany; Mr. J. Christian Wichard, WIPO Arbitration and Mediation Centre, Geneva; Ms. Dawn Osborne, Rouse & Co. International, London. Eminent Indian Speakers were Mr. Pravin Anand, Attorney, Anand and Anand, Dr. H R Bhojwani, Emeritus Scientist, CSIR and Mr. R K Gupta, Head, IPMD, CSIR.

SECOND CSIR DIAMOND JUBILEE INVENTION AWARDS FOR SCHOOL CHILDREN- PRIZE DISTRIBUTION

A special function was organised on World Intellectual Property Day (26th April) at FICCI, Federation House, New Delhi for the distribution of prizes of the 'Second

CSIR diamond jubilee invention awards for school children'. The prizes were distributed by Dr. R A Mashelkar, DG-CSIR. Out of total number of sixty prizes to be given only eight inventions were selected for the various categories of prizes. The awardees were presented a plaque, certificate and cash prize. They have briefly explained their inventions. Master Madhav Pathak, the first prize winner of CSIR Diamond Jubilee Invention Award-2002 was also presented the WIPO medal and certificate by Mr. J. Christian Wichard, WIPO for being the 'Outstanding Student Inventor' for his invention 'Braille Writer'.

DG-CSIR lauded the efforts made by these young awardees and said that not only they have intellectual and innovative capacity but also have good entrepreneur skills. The function was attended by parents, teachers of awardees, invited guests from CSIR and Directors of Delhi based CSIR labs, participants of workshop. Those who attended the function shown keen interest in the model / flow charts displayed by the awardees and had lively interaction with them.

THIRD CSIR DIAMOND JUBILEE INVENTION AWARD FOR SCHOOL CHILDREN-2004:

CSIR announced the third diamond jubilee invention awards for school children on 26th April 2004. Out of 442 proposals received from various parts of the country seven inventions were selected for the various categories of prizes. The prizes were announced on CSIR foundation day, September 26, 2004.

M-CAM DOORS TRAINING

CSIR has signed an agreement with M/s M-CAM Doors Inc. USA to assist CSIR in licensing of its IP internationally. The agreement has also resulted in a partnership with M-CAM Doors to provide access to the patent risk management and analysis tool for determining the unique commercial opportunities and threats of patents issued and applied for in the US and around the world. A one-day training on 'M-CAM Doors – a patent risk management and analysis tool' was held. The use of this tool would help in reviewing patents from a commercial application perspective using competitive intelligence through an internet browser and to find IP risk management solution.

INTERNATIONAL WORKSHOP ON 'IP LITIGATION'

An International workshop on 'IP Litigation' was jointly organized by CSIR, DSIR and CII. The theme of the Workshop was to address the emerging issues related to IP enforcement. The faculty was drawn from a panel of eminent judges and industries from the US, Europe and Japan. This includes Judge Randall Rader, Court of Appeals of the Federal Circuit, USA. Sir Hugh Laddie, Chief Judge of the

Patent Court of England. Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development inaugurated the session and explained the Indian position on amendment in the patent laws effective from 1/1/2005 and its implication in various industrial sectors and especially relating to drugs and pharmaceuticals.

3.4 TECHNOLOGY NETWORKING AND BUSINESS DEVELOPMENT DIVISION

Technology Networking and Business Development Division (TNBD) steers the New Millennium Indian Technology Leadership Initiative (NMITLI) on one hand and overarching business development activities of CSIR on the other. TNBD division also facilitates functioning of two CSIR units namely Unit for Research & Development of Information Products (URDIP) and Customer Satisfaction Evaluation Unit (CSEU) directly under its charge. Some of the important activities undertaken and managed by the TNBD during the year are summarized hereunder:

PROGRESS UNDER NMITLI

CSIR operates New Millennium Indian Technology Leadership Initiative (NMITLI) which has emerged as a unique initiative of the government, carving out a niche in the innovation space. It enjoys an unprecedented brand image and is looked upon as a role model in the domain of public-private-partnership initiatives launched by a federal government. During the year, TNBD catalysed and developed 11 new ideas as focussed projects. Besides proactive R&D management support was provided to 20 ongoing projects in order to realize the objectives. These projects cover diverse areas ranging from liquid crystals to decentralized power packs; mesoscale modeling to nano-material catalysts; microbiological conversions to biotech molecules; functionalisation of alkane to advanced nano-materials and composites; defunctionalisation of carbohydrates to biodegradable plastics; novel expression systems to medical implants; novel office computing platform to low cost horizontal axis wind turbine; and new targets and markers for cancer to advanced drug delivery systems.

Some of the achievements under NMITLI include:

- **New TB Therapeutic Molecule – IND filing and clearance:** A new molecule is discovered for the treatment of tuberculosis. After carrying out the extensive pre-clinical studies, an Investigational New Drug (IND) application was filed during the year. The IND was cleared by the regulatory authorities for Phase I clinical trials. The molecule is currently undergoing clinical studies. This is

the first success achieved in developing a new tuberculosis therapeutic in the last 40 years globally. The molecule works through combination therapy (compatible with the present drugs), is less toxic, clears the total infection within two months and no recurrence has been observed. It fits well into the present four drug therapy by replacing one or two drugs from the (present) cocktail. Some new drug targets have also been developed alongwith a novel drug delivery system.

- **Launch of BioSuite®:** The BioSuite®, a versatile portable software for bioinformatics was launched by Hon'ble President of India Dr. APJ Abdul Kalam on July 14, 2004 to mark Indian success in the domain of bioinformatics. The software is poised to be globally competitive and affordable to the Indian community.

- **Refining and strengthening monsoon and weather prediction based on mesoscale modeling:** NMITLI has supported a project on mesoscale modelling which has three distinct components: (i) Parallel processor (hardware); (ii) Software A - a new software taking into account tropical region dimensions; and (iii) Software B - a modified version of the known software incorporating the tropical region features. A powerful computer has been developed with eight processors forming an independent node interconnected by an indigenously developed FloSwitch based on optical technology which is as good as any in the world. A 32 processor system is ready. It would be extended to form a 128 node machine by interconnecting with such four 32 node machines. Software A and B are being tested on these machines. CSIR in association with IMD (DST) is endeavouring to develop 12 numbers of 8 node machines for validating the software at different locations. The same 8 node machine will also be used to test the Linux Cluster Version of Bio-Suite.

- **Using functional genomics in tea and mentha for gene expression modulation:** The effort was to use the latest technologies for characterizing genes involved with key metabolic pathways and to develop new technologies for gene tagging and promoters for enhanced targeted expression. Specific leads have been obtained:

  - **Niche pathway engineering in tea:** tea database profiling catechin content has been developed for the first time in the world. Genes involved in catechin biosynthetic pathway have been cloned. A kit for catechin estimation has been developed;

  - **Gene expression vectors:** an artificially designed synthetic promoter, bidirectional and two – element dependent novel gene expression vectors have been developed. Two patents covering the promoters developed have been filed.

GLOBAL RESEARCH ALLIANCE (GRA)

CSIR is the founding member of the GRA, which is established around the vision of a global knowledge pool for global good. It encompasses a breadth of scientific and technological fields and technology transfer expertise of its members, viz. Battelle - USA; CSIRO - Australia; CSIR - India; CSIR -South Africa; Danish Technological Institute (DTI); Fraunhofer-Gesellschaft - Germany; TNO – Netherlands; SIRIM-Berhad - Malaysia and VTT - Finland. A process of technology fusion has been put into practice to ensure that the technical expertise of the members is afforded the opportunity to explore areas of cooperation. To establish a track record of working together as a large Alliance, one of the strategies implemented is to respond to development funding agency expressions of interest and project implementation. Among various responses made to potential opportunities in a variety of specialist fields and across a wide geographic spread, CSIR took the lead role in formulating two major proposals; one for the Kalpasar project in Gujarat and the other on Addressing Vulnerability to Climate Variability and Climate Change through an Assessment of Adaptation Issues and Options for the World Bank. The GRA and World Bank have embarked on a new initiative on Indigenous Knowledge to focus on critical issues such as validation, benefit-sharing and the issues of management of the intellectual property rights. CSIR is the designated core member of the group set-up to pursue this initiative further. The GRA is embarking on the next stage of integrating and implementing cross-cutting initiatives between these five focus areas to foster creative synergies to address whole issues.

BUSINESS DEVELOPMENT AND MARKETING OF KNOWLEDGEBASE

The Division has taken several new initiatives in the domain of business development. Major among these were: undertaking revision of the marketing guidelines so as to align them with the changes in the external policy settings and making them more customer friendly; increasing one-to-one interaction with Indian as well as international companies; bringing out special publications etc. The division was contemplating to organize a CSIR-Industry meet to create awareness as well as demand for CSIR's knowledgebase. The results of these proactive efforts have been felt. The division has negotiated a Master Collaboration Agreement (MCA) with the Procter and Gamble Inc. for undertaking projects in diverse R&D domains. P&G is keen to develop a long term mutually rewarding relationship with CSIR. The Division also continued to render proactive assistance to laboratories for business development and marketing of knowledgebase. It maintained organic linkage with national level industry associations and other stakeholders. Over 100 license agreements were executed for CSIR's intellectual property and contract worth Rs. 400 crore for contract R&D and consultancy were in hand during the year.

SECURITY AND SENSITIVITY CLEARANCE

The R&D proposals involving foreign scientists/agencies were examined and assessed in the division from security and sensitivity angle. The proposals covered basically contract R&D. During the year, about fifty such proposals were processed. Some of the clientele covering these proposals included DuPont, Invista, ISIS Pharmaceuticals, Honeywell, Bayer, FAO, ESCOM, Lanxess, Bell Helicopters, Procter and Gamble, Unitel Technologies, Scios, Fritz – Haber Institute (Germany) etc. The list also includes other clients from Srilanka, Nepal, Malaysia, Kyrgyz Republic, Singapore, Dubai, South Korea, etc.

COMMITTEE FOR REVISITING THE CSIR GUIDELINES FOR TECHNOLOGY TRANSFER AND UTILIZATION OF KNOWLEDGEBASE

Arising out of the Annual Business meet (ABM) 2004, CSIR had constituted a Committee under the Chairmanship of Director, NCL to review the guidelines on "technology transfer and utilization of knowledgebase". The guidelines currently in place were framed in 1989 and were enlarged in 1993 with the inputs of the Mashelkar Committee. Several developments have since taken place, particularly in the industrial sector. Indian industry has begun to recognize R&D as an engine of growth. MNCs and TNCs were looking at India as a major R&D hub. It was therefore imperative to revisit the marketing guidelines so as to position CSIR advantageously and derive maximum benefit from the changing scenario. The terms of reference of the Committee were to: review the present marketing guidelines in consonance with the emerging global R&D scenario, Singhania Committee recommendations and suggestions made by ABM-2004; suggest new marketing strategies; evolve facilitative models and mechanisms; recommend enabling incentive schemes; and dwell upon any other matter as referred to by DG,CSIR. The recommendations of the Committee have been classified in three categories and pertain to: (i) reiterating those recommendations of the Mashelkar Committee that have not been implemented; (ii) modifications in CSIR guidelines for technology transfer and utilization of knowledgebase; and (iii) putting in place new initiatives. These recommendations have been approved by the GB for implementation in two phases. The phase one will comprise of implementation of recommendations at point (i) and (ii). While in the phase two, new initiatives namely: setting up of knowledge alliance; setting up of section 25 company scheme; mobility of scientists; setting up of off shore business entities; co-locating industrial R&D centers proximate to CSIR laboratories / co-sharing resources with industry; and macro protection will be implemented through working out details for each of the initiative and inclusion of these in the guidelines. TNBD Division assisted the Committee.

THE CHANGE TEAM TO IMPLEMENT KELKAR COMMITTEE RECOMMENDATIONS

A Committee under the chairmanship of Dr. Vijay Kelkar, Adviser to Finance Minister, was set up in June 2003 to assess and value the socio-economic-environmental benefits arising from CSIR's R&D outcomes and S&T activities. The Committee systematically undertook in-depth studies and evolved a methodology to value publicly funded organizations, a first of its kind and made several far reaching recommendations to enhance value of CSIR's contributions(report submitted in July 2004). To implement the recommendations in a time bound manner a committee christened "The Change Team" was constituted under the chairmanship of Director, NCL. The terms of reference of the committee are to: prepare a blueprint and evolve a road map to implement the Kelkar Committee recommendations in a time-bound manner; revisit the Memorandum of Association, Rules & Regulations and By-laws of CSIR to bring in necessary amendments to realize full autonomy in its governance; constitute appropriate specialist-committee(s), as considered necessary to take up specific tasks; and attend to any other matter assigned by the DG, CSIR. TNBD Division assisted the Committee.

UNIT FOR RESEARCH & DEVELOPMENT OF INFORMATION PRODUCTS (URDIP)

URDIP, in quest of developing value added IT products benefiting professionals, academicians and industry developed and maintains number of information products. Significant ones are:

- The database contains abstracts and claims of nearly 10000 patents granted on 2000 widely used medicinal, aromatic and economic plants. The database has been web-enabled. The development of patent database on plants and monitoring of claims will help the country to take appropriate actions in protecting its bio resources.

Phytoinformatics: On a continual basis, URDIP has conducted phyto-informatics studies for the development of various nutraceuticals and therapeutic products. As an effort towards new product development, the information search and analysis was conducted for various diseases conditions. The project involved identifying the mechanism of action through which herbs must work in order to control any of the disease conditions and then highlighting how traditionally used plants probably function via modern scientific mechanisms. The project also involved identifying the well-validated plants in terms of clinical studies as well as in-vitro, in-vivo testing data and toxicity.

- **URDOC**: A Document Management System has been developed that manages any content, data or information securely. Its easy and user-friendly interface

lets user to create/update, upload/download any document and share it with other users or groups securely with different level of access privileges.

- **URLog** is a management system/tool that can add, categorize, rearrange and annotate URLs making it easy to build a well-organized collection of URLs. It is a complete solution for managing frequently visited or favorite websites.

CUSTOMER SATISFACTION EVALUATION UNIT (CSEU)

The CS activity was initiated at all Physical and Information Sciences group of laboratories/ institute during the year. A new questionnaire was designed for CS activities. It will help provide in depth understanding based on the customer feed back for year 2004-05. The Oracle database were upgraded and updated based on the customer satisfaction feed back received from LR. The software was developed to record CSI Report on compact disk to the layout design of Project Information, Customer Profile and Customer Satisfaction Feedback databases were changed to give relevant information in particular format.

CSIR TECHNOLOGY AWARDS 2004

The Division invited nominations for the CSIR Technology Awards for the year 2004. 23 nominations were received. Technology Awards Selection Committee constituted by DG, CSIR selected four Technology Awards for the year namely: Prize for Chemical Technology to CSMCRI (Development and scale up of high flux thin film composite reverse osmosis membrane technology and its application for water desalination and purification); Prize for Engineering Technology to National Institute of Oceanography (Developing a system for quantitative estimation of the seafloor roughness parameters using multi-beam echo sounding at high acoustic frequency range); the Shield for Engineering Technology to the team at National Aerospace Laboratories (Design, prototype fabrication and successful flight-testing of multi-role light transport aircraft- 'SARAS'); and the Shield for Process Technology to Regional Research Laboratory, Thiruvananthapuram (Development and commercialization of swing technology for processing fresh/ dry spices for flavour, oleoresin and active compounds).

CSIR DIAMOND JUBILEE TECHNOLOGY AWARD 2004

CSIR Diamond Jubilee Technology Award (CDJTA) recognizes and honours those outstanding technological innovations that have contributed greatly for enhancement of national prestige. For the year 2004, 117 nominations were received from diverse constituents. Midas Communications Technologies Pvt. Ltd., has been selected for the award this year. Midas Communication, in collaboration with TeNeT (Telecommunication and Computer Network) & IIT-Madras designed,

developed and commercialized corDECT WLL (Wireless in Local Loop) access system and optiMA, a Fiber-in-Local Loop (FLL) access system.

3.5 HUMAN RESOURCE DEVELOPMENT GROUP (HRDG)

The group has a mandate to develop and nurture S&T manpower at the national level. It also promotes, guides and co-ordinates scientific & industrial research through scientific projects at the national level. The activities of the HRD Group include: Award of Shanti Swarup Bhatnagar prizes (SSB) and CSIR Young scientist Awards (YSA); Selection of Junior Research fellows (JRF) through National Eligibility Test (NET); Selection of Senior Research fellows (SRF), SRF Extended Research Associates (RA), Senior Research Associates (SRA) and Shyama Prasad Mukherjee fellows (SPMF); Funding of Extra Mural Research (EMR) schemes at universities/ R&D organizations; Visiting associateship scheme; travel / Conference / symposium grants; CSIR Program on Youth for Leadership in Science (CPYLS).

SHANTI SWARUP BHATNAGAR PRIZE AND YOUNG SCIENTIST AWARD 2004

CSIR gives recognition to Indian scientists for doing outstanding research work in the country, in the form of prizes/awards. The Shanti Swarup Bhatnagar Prizes-(SSB) for the year 2003 were presented by Dr. Manmohan Singh, the Hon'ble Prime Minister of India and President, CSIR to ten outstanding scientists at a glittering function organized at Vigyan Bhawan on 13th September, 2004.

In the year 2004, ten scientists were selected for the SSB Prize, making a total of 398 awardees till date. The names of the 2004 SSB Prize awardees were announced by Dr. R. A. Mashelkar, DG-CSIR, on 26th September 2004, the Foundation day of CSIR.

Six scientists were selected for the CSIR Young Scientist Awards during the year. These awards were presented by Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development Science & Technology & Vice President, CSIR at the CSIR Foundation Day function held at NPL Auditorium on 26th September 2004.

JUNIOR RESEARCH FELLOWSHIP (JRF)

CSIR conducts CSIR-UGC NET examination twice a year. In June 2004 examination 66,458 candidates were registered out of which 46,404 appeared in the examination and 2,440 qualified the exam. A total of 1217 candidates were selected for Junior

Research Fellowship and 1223 were declared eligible for lectureship. The subject wise split of the result is given below.

	Chemistry	Earth science	Life science	Maths	Physics	Total
JRF Selected	340	26	614	112	125	1217
Lectureship	365	55	567	103	133	1223

The total number of candidates registered for the CSIR-UGC joint examination JRF-NET held on 19th December 2004 examination was 76,060, out of which 56649 appeared.

SHYAMA PRASAD MUKHERJI FELLOWSHIP (SPMF)

The SPM Fellowship Scheme was started in the year 2001 with the objective to nurture budding scientific talent towards pursuit of scientific research. The scheme is open to top 20% CSIR-UGC JRF-NET scholars along with top 100 GATE qualified candidates with percentile 99 and above who have to qualify a specially designed written test followed by an interview to be eligible for the fellowship. Six candidates were selected for SPM fellowship 2004 – two each in life, mathematical & physical sciences.

SENIOR RESEARCH FELLOWSHIP (SRF), SRF EXTENDED AND RESEARCH ASSOCIATESHIP (RA)

About 2700 applications were received in 15 subject categories. The selection process started from November 2004. Out of 15 subject categories, Selection Committees in 11 subject categories have already met and selected 202 candidates for SRF, 23 candidates for SRF (Ext) and 60 candidates for RA. Four Selection Committees are yet to meet and give their recommendations.

JUNIOR RESEARCH FELLOWSHIP FOR GATE QUALIFIED ENGINEERING GRADUATES (JRF-GATE)

CSIR has introduced a new research fellowship in 2002 for the GATE qualified candidates with B.E./ B.Tech/ B.Arch/ B.Pharm degree to pursue research leading to Ph.D. This is known as the GATE qualified Junior Research Fellowship (JRF-GATE). JRFs selected under this scheme get excellent opportunity to work with the CSIR scientists with state-of-art R&D facility and obtain Ph.D. degree. Around 145 JRF-GATE Fellows are at present working in different laboratories of CSIR.

SENIOR RESEARCH ASSOCIATESHIP (SRA)

The Senior Research Associateship (SRA) is primarily meant to provide temporary placement to highly qualified Indian scientists, engineers, technologists, and medical personnel who are not in regular employment in the country, including those returning from foreign countries. The selections made during the year 2004-2005 are as given below:

Year	No of SRA Selected	No. of SRA Joined	Total No. Supported
2002-2003	134	93	202
2003-2004	82	88	206
2004-2005	95	71	166

EXTRA MURAL RESEARCH SCHEMES AND SPECIAL SUPPORT PROGRAMS

CSIR provides financial assistance to promote research in the field of Science and Technology including agriculture, engineering and medicine. It is given in the form of research grants to Professors/ Scientists in regular employment in Universities/ Academic Institutes/ IIT's etc. The number of research schemes recommended during 2004-2005 are as given below:

Year	Total No. of Proposals	Recommended	Renewals
2002-2003	555	223	511
2003-2004	576	179	543
2004-2005	563	159	549

Under the Emeritus Scientists Scheme, financial assistance was provided to 24 outstanding superannuated scientists out of a total of 130 proposals received and 97 renewals were made during the year 2004-05. In the Sponsored Scheme category, 15 schemes were sanctioned out of 29 proposals received and 37 ongoing schemes were renewed. Under the one time grant category, out of 14 proposals received two were granted.

TRAVEL / CONFERENCE GRANTS

Travel grant is provided by CSIR to young researchers for presenting research papers at the International Conferences held abroad. The travel grant committee considered a total of 678 applications out of which 380 cases were recommended. The same committee considered 532 proposals from scientific societies/ institutes etc. for organizing national / international conference/ symposium/ workshops, etc. and recommended 468 cases for organizing these events.

CSIR PROGRAM ON YOUTH LEADERSHIP IN SCIENCE (CPYLS)

Most of the CSIR laboratories had organized two open days programme. Some of the reports received from the coordinators of these programmes show a very good response both in terms of participation and appreciation of the scheme.

NEW HRD INITIATIVES:

CSIR DIAMOND JUBILEE RESEARCH INTERNS AWARD SCHEME

The CSIR Diamond Jubilee Research Interns Award Scheme was announced by Hon'ble Minister for Science and Technology on the occasion of Diamond Jubilee Celebrations of CSIR on 26th September 2002. It is a preparative scheme through which young interns shall be trained in the tools and techniques of research under supervision of experienced scientists in CSIR. The scheme has taken off in 2003-2004. A total of 296 candidates have joined in different laboratories since the inception of the scheme.

ENTREPRENEURSHIP SUPPORT TO RESEARCH SCHOLARS

The objective of this program is to broad base the perspective of the research scholars so that they can make linkages of their scientific and technical knowledge to the buoyant world of business and industry and thus become effective wealth creators for their organizations and the nation.

The first training program was organized (as a pilot exercise) at NCL. About 19 research scholars participated in the month long exercise. Around 50 research scholars participated in the second training programme.

3.6 HUMAN RESOURCE DEVELOPMENT CENTRE (HRDC)

HRDC during the year carried out significant activities in the area of human resource development. It interfaced*I* interacted with its stakeholders, the laboratories and the Headquarters. The focus of the activities was on training & development of the CSIR employees. Training activities were carried out with emphasis on helping the employees to acquire/ sharpen their skills and capabilities to perform their functional roles and also enable them to discover and exploit their inner potential for their own and organizational development. With these objectives, the Centre organized a number of training programmes for different categories of CSIR staff. A few training programmes were conducted for developing capabilities in the emerging specialized needs e.g. project management and accrual based accounting system. CSIR in the Tenth Five Year Plan has launched large networked projects, which are inter- laboratory, and multi-agency projects with fixed time schedule and identified deliverables. The Centre has launched training programmes on project management for senior scientists and project leaders. Similarly, with the introduction of commercial accounting system, the Centre organized training programmes for accrual based accounting system for finance personnel. The Centre also undertook training programmes in each laboratory for familiarization of new annual performance appraisal system for the scientists.

One of the initiatives taken by the Centre during the year has been for setting up of Human Resource Groups (HRGs) in all the CSIR laboratories. The HRDC shall be looking at the human resource development issues centrally at global CSIR level; the Groups shall be responsible for meeting the specific HR needs of the laboratories.

3.7 UNIT FOR SCIENCE DISSEMINATION (USD)

USD is fully responsible for furthering favorable public image of CSIR as a whole. During the period, several image-building activities were executed to achieve the overall objective through `Team USD'. Besides, this Unit is the hub center for some other large number of activities.

Effective media relations helped in furthering result-oriented relationship with the key press persons covering science in their respective dailies. Appropriate logistics support was ensured to all of them to earn their confidence in this Unit; several features/ stories (about 10) were published with the support of inputs provided by this Unit.

Press coverage was successfully organized during important CSIR events, including Bhatnagar Awards Function, announcement of the discovery of Anti TB drug molecule under NMITLI Programme, CSIR Diamond Jubilee Awards function, 63rd CSIR Foundation Day celebrations, the release of "Vaxipred – a Commercial Software Package" by IMT, Training Programme on Herbal Drug Industry for Compliance to Quality Parameters by RRL (Jammu).

CSIR participated in the various national/ international exhibitions and other relayed events with two main objectives: Creating awareness about CSIR and its achievements, and supporting its business development efforts. This important activity was consolidated and efforts were made to project, as far as possible, an integrated picture of CSIR overall contribution to the theme areas of each event through extensive coordination with the participating CSIR labs on one side and the other. The Unit organized CSIR pavilion in the following events: Technology Pavilion, India International Trade Fair, ITPO, New Delhi (won First Gold Prize for Technology Innovation); Pharmaceuticals Expo 2004; 3rd International Exhibition & Conference `INDIACHEM 2004'; International Healthcare and Herbal Expo 2004; Infra R&D 2004, Infra Education-2004; Bangalore Bio-2004 (won First Prize among the Government Sector participation); Building Innovative Pharma in India; TRANSMAT Expo 2004; 2nd Infra Comm India 2004, International Exhibition & Business Summit; Uttaranchal International Trade Fair 2004; 92nd Indian Science Congress 2005; 2nd Nutraceuticals Summit; Biotech India 2005; CHEMTECH World Expo 2005; Technovation 2005.

CSIR PARTICIPATION IN VIGYAN RAIL EXHIBITION

The Unit coordinated, at the central level, the display of CSIR showcase in Vigyan Rail – Exhibition on Wheels being organized by DST. A large number of displays, including models and audio-visual presentation were fabricated and displayed aesthetically for effective dissemination to the visitors at 31 stations across the nation during its Phase I.

3.8 RECRUITMENT AND ASSESSMENT BOARD (RAB)

Recognizing human capital as the most critical & valuable asset, CSIR has been introducing progressive career advancement policies for its staff. In accordance with this perspective CSIR introduced 'CSIR Scientists Recruitment & Assessment promotion Rules, 2001' for Group IV Scientists. The **Recruitment and Assessment Board (RAB)** was established under the provisions of Rules 2001 with a mandate to carry out the recruitment and assessments of Scientists Gr IV centrally, following a suitably structured standardized framework.

Assessment being the major activity with RAB, during 2004-05 the board conducted assessment of around 1000 scientists at the level of Scientist B, C , E I & E II pertaining to the year 2002-03. The assessment interviews were carried out at 18 different locations under 17 assessment committees. RAB also constituted 6 assessment committees in different subjects for assessment of 150 Scientists F (For promotion to G), these assessments were pertaining to the year 2000-01 and 2001-02.

The recruitments are being made jointly by RAB and the respective labs, adequately ensuring uniformity in the process. During the year 2004-05 the board constituted over 20 selection committees for recruitment of around 200 scientists.

RAB also organized a one day seminar wherein 39 Departmental Core members, most of them Scientists "G" level , participated. The panel discussion centered around the basic framework of the assessment committee, choice of location, selection of external experts and the conduction of the assessment interviews, including the presentation of candidates and interaction with the committee. It was agreed upon that RAB has a crucial task at hand in maintaining the organizational health of CSIR. In this direction the selection of the experts in the assessment committee is central to this issue. The participants gave valuable feedback based on which appropriate steps are being taken to further improve the entire process of assessment & recruitment of CSIR.

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CHAPTER-4

Dateline CSIR

Dateline CSIR

April, 2004

6th –7th	CSIR Programme on Youth for Leadership in Science (CPYLS) was organized at CSIO.
7th	CRRI celebrated World Health Day. Prof. P. K. Sikdar, Director, gave a broad canvas of 'Menace of Road Traffic Accidents'. Dr. T.S. Reddy, Area Coordinator, Traffic Engineering & Transportation Planning, gave a lecture on Road safety.
7th	Reminiscence Day of IGIB celebrated.
8th	NEERI Foundation Day celebrated.
23rd	Dr. R.A. Mashelkar, DG-CSIR dedicated Digital Information Resource Center at NCL to the Nation. A Seminar on "Digital Information - Emerging Trends" was also organised.
30th April – 7th May 31st	Workshop on "Respiratory Allergy: Diagnosis and Management" was organized at IGIB.

May, 2004

11th	CSIR constituent laboratories celebrated National Technology Day
	CFRI: Prof. Sankar Chakraborty, President, Paschim Vigyan Manch, Kolkata delivered a lecture on "Importance of Traditional Knowledge for the Welfare of the Society."
	CFTRI: Prof. J. Shashidhara Prasad, VC, University of Mysore, presented the mementoes to licensees who had taken CFTRI technology during the year.

CIMAP: Around five hundred students visited the institute and interacted with the scientists of CIMAP for gathering knowledge on recent development in medicinal and aromatic plants and their processing technologies and bi-products. The farmers were rewarded for adopting and exploiting the CIMAP's technologies/plant varieties.

CMERI: Prof. D.B. Singh delivered the Technology day lecture Open day observed by CSIO

IGIB: The Centre for Genomic Application (TCGA) Core Share Facility at IGIB (A Government-Institution-Industry Partnership Project) was launched.

IHBT: Padma Bhushan Prof. S.S. Johl delivered the Technology Day lecture and Dr. Shrikant Baldi, D.C. Kangra at Dharamshala was the Chief guest.

NBRI: Prof. J.K. Das of the Indian Institute of Management, Lucknow delivered a lecture on "From Innovation to Business Success: Winning the Marketing Warfare". Entrepreneurs meet was also organized, in which representatives from various organizations like, Tata Consultancy Services, Lupin, Lucknow Management Association, CSA Agriculture and Technology Institute, Kanpur, Indian Association of Industries, etc participated.

NEERI: Dr. H.R. Bhojwani, Emeritus Scientist, CSIR delivered a lecture on "India Emerging as a preferred R&D destination".

MoU was also signed with M/s N.H. Consulting Private Ltd. New Delhi for future collaborations.

NISTADS: seminar was organized on "Towards socially sensitive technologies".

NML: Mr. Suresh Thawani, Managing Director, JAMIPOL, Jamshedpur delivered the Technology Day lecture.

RRL-Jammu: Dr. S. D. Seth, National Professor, ICMR Chair in Clinical Pharmacology, AIIMS, New Delhi delivered lecture on 'Good Clinical Practice'.

IIP: Dr. S. Vardarajan, Former DG,CSIR delivered the

	Technology Day Lecture on "The Doyen of Hydrocarbon industry in the Country".
12th	NCL: On the occasion of National Technology Day, Prof. Anil K. Gupta, Kasturbhai Lalbhai Chair in Entrepreneurship at IIM, Ahmedabad and Executive Vice Chairperson, National Innovation Foundation delivered the second Prof. B. D. Tilak Memorial Lecture on "How do Creative Grassroots Innovators Think: Building Bridges between Formal and Informal Science".
15th	NCL organized Workshop on Polymer Clay Nanocomposites for Industry
20th –21st	CEERI organized two days Administrative Hindi Workshop.
25th-26th	Two days visit of Dr. T.A.V. Murthy, Director, INFLIBNET to NISCAIR.
29th	First test flight of SARAS aircraft by NAL.
31st May - 4th June	Five days visit of Mr. G. M. Sadyalunda, System Administrator and Mr. Emmanuel Kofi-Agyir Sackey, Patent Examiner, African Regional Industrial Property Organization to NISCAIR.
June, 2004	
4th	World Environment day celebrated at NEERI.
5th	ITRC celebrated World Environment Day. A lecture on "Biodiversity and Our Environment" was delivered on the occasion of World Environment Day by Mr. Mohd. Ahasan (Chief Conservator of Forest, UP) who outlined the methodology of conservation of wildlife and endangered species.
8th	NIO in association with Marine Conservation Society of India (MCSI) conducted marine awareness programme as a part of World Ocean Day at Candolim Beach,Goa. Sixty team members actively participated in the programme.
10th	The Ground Water Day: NBRI and UP Ground Water Officers' Association, jointly organized a one-day conference on 'Rain Water Conservation and Community Participation".

11th	A workshop on "Innovative Wastewater Treatment and Reuse Options" was jointly organized by NEERI and Institute of Science of Modern Art Gallary, Mumbai.
14th	CDRI organized Science Awareness Programme-cum-Health Camp at Chinhat, Lucknow.
15th	IHBT celebrated its foundation day. Dr. Lalji Singh, Director, CCMB delivered lecture on `The Human Genome: A Gift of the 20th Century & Challenges for the 21st. Prof. C.L. Khetrapal, Chief Guest released IHBT Annual Report 2003-04 on the occasion.

July, 2004

1st	The National Institute for Material Science (NIMS) Tsukuba, Japan and NEERI, Nagpur jointly organized a one day workshop on Advanced Materials for Environmental Applications at NIMS, Tsukuba Japan.
4th	RRL-Jorhat programme for the Year of Scientific Awareness 2004 was inaugurated by Prof. Kulendu Pathak, VC, Dibrugarh University at Radha Kanta Handique Bhawan at Jorhat.
8th	Hon'ble Minister of State Shri Kapil Sibal, (Independent Charge) Ministry of Science & Technology and Department of Ocean Development visited IGIB.
11th-16th	Global Research Alliance Technology Fusion Workshop on Health was organised by NCL. Dr R.A. Mashelkar, DG-CSIR delivered the keynote address on "The Golden Triangle – The Alternative Pathway to New Therapeutics".
25th-27th	First National Convention on `The Science and Tradition of Food – 5000 Years of Heritage' was held in association with CFTRI and Academy of Sanskrit Research, Melkote. Prof. R. M. Varma, noted neurobiologist, inaugurated the meet. About 60 food scientists, technologists, industrialists and researchers in the field of Indian medicine participated.
26th	Meeting of the CSIR Society was held. Hon'ble Prime Minister and President, CSIR Dr. Manmohan Singh presided over the meeting. Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development, Hon'ble Finance

	Minister and distinguished members of the Society also graced the occasion.
	162nd meeting of GB was held. It approved the Institution of an Award on G.N. Ramachandran Gold Medal for excellence in science; creation of National Innovation Fund (NIF); approval of report of the committee to review the performance of outreach centers setup by CSIR; modification in existing procedure for processing of industry originated NMITLI proposals; applicability of new pension scheme to the autonomous bodies/PSUs; amendment to CSIR scientists recruitment and assessment promotion rules, 2001; formulation of CSIR innovative suggestions and outstanding performance Award Scheme 2004 etc.
	An agreement was signed between CEERI, CGCRI and Optiwave Photonics Ltd., Hyderabad for the collaborative project on "Development of Hermetically Scaled Packaged 980 nm Pump Laser chip suitable for Erbium Doped Fiber Amplifier".
28th	CECRI Foundation Day was celebrated.
29th	An MoU between CEERI and Swami Ramanand Teerth Marathawad University, Vishnupuri, Nanded (Maharashtra), regarding collaboration for Joint Research in Electron Tuner, Materials, Devices, Vacuum and Gas Discharge tubes for a period of five years was signed.
30th	39th Convocation of Indo-Swiss Training Centre of CSIO was held.
31st	IIP: Shri S.C. Triphathi, Secretary, Min. of Petroleum and Natural Gas inaugurated the "Journal Bearing Rig".
August, 2004	
4th	Shri Kapil Sibal, Hon'ble Minister of state (Independent Charge), S&T and Ocean Development, and Vice President, CSIR visited CCMB & IICT.
6th	Prof. Kumar Krishen, Chief Technologist, NASA Johnson Space Centre, Houstan, USA visited NISCAIR.

7th	MOU signed between CSIO and GMCH, Chandigarh for collaborative programme for conducting B.Sc (Opth. Techniques)
	IGIB organized one day symposium to celebrate monumental discovery of Triple Helical Structure of Collagen by Prof. G.N. Ramachandran "50 Years of Collagen Triple Helix: A Celebration of Science" was organized at Vigyan Bhawan, New Delhi, in collaboration with Vigyan Prasar and CLRI, in which H.E. Dr. A.P.J. Abdul Kalam, President of India and Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge), Ministry of Science & Technology and Ocean Development and Vice President CSIR addressed the gathering.
8th	Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development visited CCMB. He was apprised with the activities of the laboratory.
12th-13th	Workshop on Total Quality Management in Small Scale Food Processing Industry was organized by RRL-Jammu in collaboration with National Small Industries Corporation Ltd. and All India Food Processors' Association.
18th-19th	National seminar on Corrosion, Failures and Mitigation (CFM-2004) was held at NML.
19th	Ms. Alison Brimelow, President Elect:, European Patent Office visited NISCAIR.
21st-22nd	Directors' Conference of CSIR Laboratories held at NAL.
22nd	Inaugural Flight of SARAS.
	Shri. Kapil Sibal, Hon'ble Minister of State (Independent Charge), Science & Technology and Ocean Development visited NAL's Flosolver Lab to see the work on "Monsoon Prediction".
25th	Foundation Day lecture of NAL was delivered by Dr. G Madhavan Nair, Chairman, ISRO on "Future Space Transportation System"
27th	One day seminar on 'Amorphous & Nanocrystalline

	Materials: Synthesis and Characterisation' was held at NML.
28th	Mr. Shakeel Bhatti, Global Intellectual Property Division, World Intellectual Property Division, Geneva, Switzerland visited NISCAIR.
30th	8th National Conference on Chemistry & Biology entitled `The Path to Drug Discovery' was organized by CDRI. Dr. R.A. Mashelkar, DG, CSIR was the chief guest.
	An MoU signed between CEERI and Banasathali Vidyapeeth to promote academic and research interaction and cooperation.
	Shri Kapil Sibal, Union Minister of State (Independent charge) for Science & Technology and Ocean Development and Vice-President, CSIR visited CSIO & IMT.
30th	Hindi Fortnight was celebrated at NAL.

September, 2004

1st	An interactive Meet on Food Based Industries in North East Region held at RRL, Jorhat.
1st-14th	Hindi Pakhwara was celebrated by NML. On this occasion various programmes on Hindi language were organised.
6th-7th	Two-day National workshop on "Information Management of Biodiversity (plant genetic) Resources in Botanic Gardens of India" was held at NBRI.
1st -30th	Hindi Month organized at IIP.
6th-8th	Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge), Science & Technology and Ocean Development and Vice President, CSIR visited NCL.
8th	Mr. Hamanzu, Vice Governor, Tokyo, Mr. Nhlanhla Mabaso, Head, CSIR Open Source Centre, Dr. Dimakatso McKay Motshabi, Sita Pvt. Ltd, Pretoria Mr. Mandla Ngcobo, Department of Public Service and Administration, South Africa visited NISCAIR.

8th-14th	Hindi Week organized by CEERI & NCL.
9th-16th	RRL, Bhopal organized Hindi awareness week. Dr. D. Verma, Former V.C. Sagar University released Hindi magazine Sopan.
9th-10th	Two day seminar in Hindi on 'Water: Conservation, Purification and Harvesting' was conducted at NML.
10th	Symposium on "Recent advances in fungal bioagents and their societal benefits" was held at NBRI.
21st	Remembering G.N. Ramachandran: 50 years of Collagen Triple Helix. NCL in association with Chemical Research Society of India (CRS) and Indian pioneering scientific contributions of Prof. G.N. Ramachandran on the occasion of 50 years of structure elucidation of fibrous protein collagen. Prof. A.S. Kolaskar, Vice-Chancellor, University of Pune and a former student of Prof. Ramachandran spoke on the scientific achievements of Prof. Ramachandran.
24th	An exhibition depicting the activities and significant achievements of the Lucknow based CSIR Labs, viz, CDRI, CIMAP, ITRC and NBRI was organized by NBRI at its Eco-Education Centre and Botanic Garden. Mr. James Testa, Director, Editorial Development Department, Thomson ISI, Philadelphia, USA visited NISCAIR.
26th	CSIR Foundation Day: Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science & Technology and Ocean Development presented the 2004 CSIR Young Scientists Awards, CSIR Technology Awards. Bhatnagar Awards and CSIR Diamond Jubilee Technology Award were announced. Dr. A.S. Ganguly, Chairman, ICICI OneSource Limited, Mumbai delivered the Foundation Day Lectured entitled `CSIR-the challenge of renewal'. The Day was celebrated with great enthusiasm. Some important events in the laboratories were: CCMB: Open day was observed wherein 10275 persons including students, visited the laboratory.

CDRI: Prof. K.K. Talwar, Director, PGIMS, Chandigarh delivered the Foundation Day Lecture entitled `Why Indians are More Prone to Coronary Heart Diseases?'

CFRI: Shri S. P. Gun Chowdhury, winner of Green Oscar Award (UK) for the year 2003, Director, West Bengal Renewable Energy Agency (WBREA) and Special Secretary to the Department of Power, Govt. of West Bengal delivered foundation day lecture on "Energy Security in Rural India".

Prizes were distributed to children of CFTRI employees who had won prizes in several competitions organized on the occasion.

CIMAP: Prof. Kartar Singh, Director, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow was the chief guest who delivered a lecture on the 'alcohol and its effect on the human health'. On the occasion more than 300 school children & people from all walks of life visited CIMAP and went round the exhibition, plant school, conservatories and interacted with the scientists.

CSIO: Open day was observed. Prof. O.P. Bajpai, Director, National Institute of Technical Teachers' Training and Research, Chandigarh delivered a lecture on "Hyper-Spectral Imaging".

IHBT: Prof. B.B. Chattoo delivered the Foundation Day Lecture on `Genome Science & Food Security'. Dr. Jagmohan Singh, VC, CSKHPKV, Palampur was the Chief Guest. `Technology Adoption Award' was given to Shri Ravinder Jamwal of Kandwari. `Akash', a variety of lavender was released by IHBT. Award to meritorious students of weaker section was also given on the occasion.

IIP: Mr. S. Srinivasan Additional Secretary, Ministry of Petroleum & Natural Gas delivered CSIR Foundation Day lecture. He also released the Slogan of IIP "Creating Future Fuels".

IMT: Prof. M.K. Bhan, Secretary, Deptt. of Biotechnology delivered lecture on "Is our current model of science appropriate for societal development?".

NAL: CSIR Foundation Day lecture was delivered by Dr. B. N. Raghunandan, Dept of Aerospace, IISc. on "Rural Technology Development- Issues and Experience"

Dr. P. R. Vishwanath delivered a Business Lecture on "Advanced Flow Diagnostics and Applications"

The Parliamentary Standing Committee on Science and Technology and Environment and Forests visited NAL.

NCL: Prof. Sukh Dev, a former distinguished scientist of NCL and presently Visiting Professor, Dr. B.R. Ambedkar Centre for Biomedical research, University of Delhi delivered lecture "A Chemist's Journey through India's Biodiversity".

NEERI: Prof. V.S. Raju, Former Director IIT, Delhi delivered lecture on "Science & Technology of Human Effectiveness Attitudes Values & Self Development. On this occasion a video film on SARAS was shown to the audience.

NIO: Prof. G. Padmanaban, Director (Retd.), Indian Institute of Science, Bangalore delivered a lecture entitled `Growth of Biotechnology in India'. Open Day was also observed.

NML: Open day was observed, Essay competition held.

RRL-Bhopal: Journal of Rural Technology Released.

RRL-Jammu: Prof. P. Ramarao, Director, National Institute of Pharmaceutical Education & Research, Mohali delivered lecture on "G Protein coupled receptors in drug discovery". Dr. I. C. Chopra Memorial Awards for the years 2002 and 2003 were conferred to Prof. Manju Ray, Indian Association for the Cultivation of Science, Kolkata and Prof. P. Ramarao, Director, National Institute of Pharmaceutical Education & Research, Mohali respectively.

RRL- Thiruvanathapuram Open day observed

28th

Ms. Lucie Edwards, Hon'ble Canadian High Commissioner, inaugurated "Prakruthi; Fruits and

	Vegetable Processing and Training Centre," of CFTRI at Uppina Mole, Yelandur Taluk. The Centre set up with the support of Canadian Fund for Local Initiatives with an objective to promote entrepreneurs among the tribal of BR Hills region of Karnataka.
30th Sept. - 1st October	Two days International Policy Workshop on `Bamboo in Fisheries' was conducted at NIO. The Centre for Indian Bamboo Resource and Technology (CIBART) along with International Network for Bamboo and Rattan (INBAR) and Society for Indian Ocean Studies (SIOS) were the organizers of this workshop.

October, 2004

2nd -10th	Hindi Translation Training Programme organized by CEERI.
6th	RRL, Thiruvanathapuram celebrated its Foundation Day.
4th-8th	37th Shanti Swarup Bhatnagar Memorial Tournament (Zonal) held at CBRI.
8th	CCMB conducted a brainstorming meet on Technology Information Facilitation (TIF) programme with DSIR.
13th-15th	Biotech 2004, 2nd National Conference was organized by IGIB.
14th	Mr. Y.U. Geoffrey, DDG, Economic Development Centre and Mr. Pushpendra Rai, Deputy Director World Intellectual Property Division, Geneva, Switzerland visited NISCAIR.
15th	IHBT: Dr. M. K. Bhan, Secretary, DBT inaugurated the Bioresource Development Unit and Museum. Prof. V.L. Chopra, Member Planning Commission also presided over the function. The Unit has facilities for Remote Sensing and Geographic Information System (RS & GIS), Traditional Knowledge Digital Library (TKDL), chemical analysis and processing of novel compounds.
20th	CFTRI celebrated its foundation day. Prof. J. Shashidhara Prasad, VC, University of Mysore was the Chief Guest. Awards for best performance and contribution was distributed.

26th-29th	XXXVII Shanti Swarup Bhatnagar Memorial Tournament (Zonal) was held at NEERI. The tournament was inaugurated by Dr. R.A. Mashelkar, DG-CSIR. A total of 272 participants from 10 different CSIR Laboratories participated for seven sports events.
27th –29th	CPYLS-2004 – Scientific Awareness Programme for meritorious students was organized by CEERI.
28th-29th	Eighty top ranking students of Goa region attended CPYLS at NIO.
29th	Hansa VT HNX (of NAL) was ferried from Bangalore to Karnal Flying Club.
29th	NCL organized Symposium on "Recent Trends in Catalysis Research" in honour of Dr. Subramanian Sivasanker, head, Catalysis and Inorganic Chemistry Division on the eve of his superannuation.
29th-30th	The second National Interactive Meet (NIM-2004) was organized at CIMAP.
	CSIR Programme on Youth for Leadership in Science was organized at IMT.
30th	CSIO Foundation Day was celebrated by organising a lecture by Prof. Surendra Prasad, Deputy Director, IIT Delhi on 'Perspectives in Signal Processing'.

November, 2004

1st – 3rd	Occupational health problems in unorganized sector and their roadmap organized by ITRC.
1st-5th	NCL observed vigilance week to crate awareness among the staff members, the events like essay writing and debate contest were organized.
	National Vigilance Awareness Week observed at RRL, Jorhat
1st-6th	National Vigilance Awareness Week was observed at NML and NEERI.
2nd-6th	National Vigilance Awareness Week was observed by CFTRI. Mrs. Usha Mathur, Divisional Manager, South Western Railway, Mysore, addressed the staff on the occasion.

2nd-6th	RRL, Jammu in collaboration with ICS- UNIDO, Trieste, Italy organized a Regional Training Course on "Herbal Drug Industry for compliance to quality parameters"
4th	ITRC Foundation Day was celebrated.
6th	Two test cars of IIP were flagged off by Shri Narayan Dutt Tiwari, Hon'ble Chief Minister, Uttranchal.
8th -10th	Junior NOST Symposium. The first Junior-National Organic Symposium Trust (J-NOST) symposium was organized at NCL. More than fifty students, who are pursuing their research in organic chemistry in leading research laboratories including CSIR laboratories, IITs, IISc, Universities, and R&D Centres of industry, participated in the J-NOST symposium.
16th	Awareness Workshop of Armament Research Board (ARMREB), DRDO, New Delhi was organized by CEERI
18th-19th	National Symposium on Safety Assessment of Cosmetics organized by ITRC.
	The First National Seminar on Muga (Antheraea assama) Silkworm Biochemistry, Molecular Biology and Biotechnology to Improve Silk production was organized by RRL Jorhat.
24th -25th	CSMCRI: 94 outstanding students from GSEB, ICSE, CBSE and Union Territory of Diu, Daman Dadra and Nagar Haveli participated CPYLS along with one of their parents/guardians/ teachers.
25th	NML celebrated its 54th Foundation Day.
26th	CCMB celebrated its foundation day. Prof. Lewis Wolpert of University College of London, UK delivered the foundation day lecture.
27th	Prof. M.G.K. Menon, FRS, Dr. Vikram Sarabhai Distinguished Professor of the Indian Space Research Organization, Bangalore delivered Bachhawat memorial lecture- Annual Oration in the memory of late Prof. B.K. Bachhawat, a doyen among Indian biologists- on "Discovery" at IMT.

30th	CRRI: Bureau of Indian Standards carried out the renewal audit of the Institute and recommended the renewal of the licence for another three years as per IS/ ISO 9000:2000 requirements w.e.f. December 2004.
30th	Composite Airframe Parts of first Limited Series Production of Tejas Handed over to Mr. N.R. Mohanty, Chairman, HAL

December, 2004

2nd-3rd	CPYLS Programme organized at NCL.
4th-5th	NBRI organized a bright and colourful event of the year, i.e. Annual Chrysanthemum and Coleus show.
6th-7th	CSIR Programme on Youth for Leadership in Science (CPYLS) was organized at CSIO.
7th-9th	Joint Workshop on "Biodiversity Informatics: An Indo-US Initiative" was held at NCL.
	Third Indian National Conference on Harbour and Ocean Engineering was held at NIO.
13th	CDRI organized Science Awareness Programme-cum-Health Camp at Itaunja, Lucknow.
13th-15th	NIO organized a three days Conference on `Microbiology of the Tropical Seas'. About 150 delegates from different universities and institutes participated in the Conference.
14th	National Seminar on Prevention of Corrosion in Steel Structures (PCSS 04) was held at the NML.
15th	163rd meeting of GB was held. It approved financial support to industry under NMITLI scheme-policy directive for sanctioning loan; review of NMITLI project scheduled for completion; utilization of loan repayment for NMITLI scheme projects; deputation of scientists abroad-devolution of powers to Heads of national labs/ instts.; scheme for engagement of consultants for business development; proposal for construction of aircraft hangar (SARAS) and associated building at NWTC by NAL, Bangalore; review and ratification of Modernization of equipments and R&D facilities in the 9th Five Year Plan etc.

15th	A software tool suited for vaccine design called 'VaxiPred' was launched by IMTECH in collaboration with bioinformatics company BioMantra.
19th- 21st	Indo-US workshop on collaborations and Networking in Materials organized at NCL.
20th	Prof. Benjamin Lukman, DG and Mr. V. K. Mutreja, ICPE, Ljubljana, Slovania visited NISCAIR.
21st-22nd	RRL, Jammu organized CSIR programme on Youth for Leadership in Science wherein 89 students have participated.
27th	Inauguration of Lucknow Special Libraries consortium website – www.lucklibnet.com was done at CDRI.
27th-28th	58 students attendED CPYLS at RRL-Triv.
30th-31st	13 students participated CPYLS held at NEERI. January, 2005
3rd –5th	CGCRI: International Workshop on "Membranes and Membrane Reactors and Demonstration of Ceramic Membrane based Arsenic and Iron Removal Plants".
	NCL: Prof. Obaid Siddiqi, FRS, former Director, TIFR National Center for Biological Sciences, Bangalore delivered NCL Foundation Day lecture on "Sense of smell in the fruifly, *Drosophila melanogaster*".
13th-15th	National Conference of Good Laboratory Practice (GLP) was held at ITRC.
15th	NIO signed an agreement with Shreya Life Sciences, Mumbai for commercialization of two new anti-malarial compounds.
15th-31st	Oil & Gas Conservation Forthnight inaugurated by Shri N.D. Tiwari, Chief Minister (Uttranchal)
17th-18th	NBRI organized the Annual Rose and Gladiolus show.
	NML organized CSIR programme on Youth for Leadership in Science, wherein thirty-seven outstanding students from Bihar and Jharkhand attended the programme
18th -20th	CSMCRI organized 17th National Symposium on Catalysis.

19th-21st	Three days Inter Ridge Workshop entitled `Tectonic & Oceanic Processes along the Indian Ocean Ridge System (TOP-AIRs)' was organized at NIO. The workshop focused on the geological, geophysical, physical, chemical and biological processes at the Indian Ocean spreading centers and provided forum for exchange of ideas and results.
24th	IMTECH celebrated its 22nd Foundation Day.
28th	NIO celebrated its foundation day. A lecture entitled `Cosmic Illusions' was delivered by Prof. Jayant V. Narlikar, Emeritus Professor, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune.
30th -31st	13 students from Nagpur and Vidarbha region participated in CPYLS at NEERI.
31st	As a continuing effort of CIMAP to reach farmers and entrepreneurs in a big way "Harit-CIM-Utsav" with Kisan Mela was organized. Thousands of farmers and entrepreneurs from different parts of UP, Uttaranchal and other states participated in the fair. The participants were apprised of the latest varieties, technologies of MAPs besides quality control measures and marketing.

February, 2005

3rd	CECRI signed an MOU with Alagappa University, Karaikudi for the mutual benefits of R&D in the field of Electrochemistry and allied fields.
9th-13th	NAL's HANSA and SARAS aircrafts participated in AERO INDIA 2005.
10th-12th	Symposium on "Materials for Automotive Industry" and the 16th Annual General Meeting (AGM) of Materials Research Society of India (MRSI) was held at NCL.
17th	CDRI Celebrated its 54th Foundation Day.
17th-20th	XXXVII Shanti Swarup Bhatnagar Memorial Tournament (Indoor & Outdoor Finals) at ITRC.
22nd	A MoU signed between Institute of Chemistry & Chemical Technology, Russia & RRL-Bhopal to work jointly on utilization of solid industrial wastes.

26th -28th	National workshop on 'Heat Recovery Coke Ovens' (HRCOKE 2005) organized at CFRI.
28th	National Science Day.
	CIMAP: Prof. R.P. Singh, VC, Lucknow University delivered lecture on "High Technology materials from modified and unmodified polysachhasides".
	CSIO: Prof. M.L. Munjal, IISc., Bangalore delivered the Science day lecture on "Designing for Quietness".
	NAL: Science Day lecture was delivered by Dr. Javed Iqbal FASc, FNA. Dr. Reddy's Laboratories Ltd. Hyderabad on "Joys of Drug Design and Discovery in the era of Information Technology".
	NCL: Prof. P. N. Tandon, President, National Brain Research Centre Society, New Delhi delivered a special lecture on "Human Brain: An Incredible Chemical Factory".
	National Science Day, Dr. G.J. Sharma, RRL, Jorhat, Professor of Genetics and Radiation Biology delivered the NSD on the topic 'Free Radicals and Dietary Antioxidants.
	National Science Day observed at RRL, Bhopal

March, 2005

8th	National Conference on Nanoscience and Technology organized at NCL.
16th-17th	National Seminar on Awareness & Recent Advances in Science & Technology at RRL-Jorhat.
18th	RRL, Jorhat celebrated its 44th Foundation Day.
28th	CIMAP celebrated its Foundation Day.

Annexures

ANNEXURE - I

INTELLECTUAL PROPERTY FROM CSIR DURING 2004-05

	INDIA		FOREIGN		
	FILED	GRANTED	FILED	GRANTED	COPYRIGHTS FILED
CBRI	0	1	0	0	
CCMB	2	0	2	2	
CDRI	21	15	29	6	
CECRI	10	0	5	2	
CEERI	0	0	0	0	
CFRI	4	1	6	4	
CFTRI	59	31	44	19	
CGCRI	12	1	12	3	1
CIMAP	18	13	29	28	
CLRI	8	3	19	4	
CMERI	1	0	7	0	14
CMRI	18	0	0	0	4
CRRI	1	0	0	0	
CSIO	11	0	12	4	
CSIR(SCH)	14	1	15	7	
CSMCRI	19	4	48	13	
IGIB	15	3	21	7	7
IHBT	10	0	28	17	
IICB	4	9	6	9	
IICT	26	15	39	48	1
IIP	6	7	3	11	
IMT	3	2	0	2	
ITRC	2	0	0	0	11
NAL	1	1	1	1	1
NBRI	23	0	32	4	
NCL	61	35	44	32	
NEERI	2	1	1	0	1
NGRI	2	0	0	2	1
NIO	14	3	21	13	
NML	7	3	12	5	1
NPL	4	2	10	6	1
RRL(BHU)	5	1	2	1	
RRL(BP)	3	1	1	0	
RRL(J)	14	16	44	8	
RRL(JT)	9	4	0	1	
RRL(T)	9	2	7	13	1
SERC	0	0	0	0	
TOTAL	**418**	**175**	**500**	**272**	**44**

ANNEXURE - IA

FOREIGN PATENTS GRANTED TO CSIR DURING 2004-05

CCMB		
Universal primers to establish the identity of animal parts and products	Verma Sunil Kumar, Singh Lalji	ZA 2003/7489
Shikimate dehydrogenase as a garget for developing novel bactericides against plant pathogens	Geol AL, Lakshmi R, Sonti RV	US 6869601
CDRI		
Use of primaquine derivative n'-ethylidinotetra hydrofuran -2-one) - n'-(6-methyl-8- quinodinyl0 1-4-pentane diamine as gametocidel agent	Pratap Ram, Bhaduri Amiya Prasad, Thapliyal Harsh Pati, Puri Sunil Kumar,; Dutta Guru Prasad, Dwivedi Anil Kumar, Singh Satyawan, Srivastava Pratima, Pandey Vikash Chandra, Srivastava Sudhir, Singh Shio Kuma	EP 1055427 B1
Inclusion completes of a high potent opioid peptide, pharmaceutical compositions and method of treatment	Khanna Madhu, Haq Wahajul, Dwivedi Anil Kumar, Raghubir Ram, Srivastava Sudhir, Murthy, Puvvada Sri Ramchandra, Asthana, Onkar Prasad, Srivastava, Jagdish	US 6740639
Substituted 1,2,4-trioxanes as antimalarial agents and a process of producing the substituted 1,2,4-trioxanes	Singh Chandan, Puri Sunil Kumar	SI 84585
Substituted 1,2,4-trioxanes as antimalarial agents and a process of producing the substituted 1,2,4-trioxanes	Singh Chandan, Puri Sunil Kumar	VI 4230
Substituted 1,2,4-trioxanes useful as antimalarial agents and a process for the preparation thereof	Singh Chandan, Tiwari Pallvi, Puri Sunil Kumar	US 6737438
Substituted 1,2,4-trioxanes useful as antimalarial agents and a process for the preparation thereof	Singh Chandan, Tiwari Pallvi, Puri Sunil Kumar	ZA 2003/2453
CECRI		
Solid state thermal synthesis of lithium cobaltate	Ramasamy Chandrasekaran, Ariyanan Mani, Thiagarajan Vasudevan, Ramaiyer Gangadharan	US 6737037
Process for manufacture of proton conductive polymer gel	Pitchumani S, Dolli H, Rengaswamy NS, Raghavan M	US 6838525
CFRI		
Process for the production of low ash fuel	Sinha Paras Nath, Sengupta Partha, Bhattacharya Kali Sankar	AU 2001260589

Process for the synthesis of isonicotinic acid hydrazide	Ray Subhash Chandra; Nandi Lakshmi Narayan, Singh Baldev, Prasad Hiralal, Maharaj Sumant, Sarkar Prodyot Kumar, Dutta Pashupati, Roy Shyam Kishore	US 6734309
Process for the production of fly ash slurry	Rao Sukuru Ramakrishna; Ghosh Swapan Kumar; Basu Sibendra Kumar; Mall Baru	NZ 528519
Process for the production of fly ash slurry	Rao SK, Ghosh SK, Basu SK, Mall BK, Verma SK, Singh G, Mazumdar S	EP 1372874
CFTRI		
Process for the preparation of a high protein hydrolysate	Radha C, Kumar PR, Prakash V	NZ 528518
An improved process for the preparation of protein hydrolysate from legumes	Prakash V, Appu Rao AG, Harendranath R, Govindraj G, Radha C, Singh SA, Subba Rao BH, Shamanathaka Sastry MC, Joseph J.	LK 13159
Process for preparation of protein-hydrolysate from milk protein	Swamylingappa Bhagya, Joseph Johny, Murthy Kowsalya Shankara, Prakash Vishweshwariah, Sastry Mysore Cheluvaraya Shamanthaka, Kanya Tirumakudalu Chikkaraja Sindhu	LK 13160
An improved process for the preparation of protein hydrolysate from legumes	Prakash V, Appu Rao AG, Harendranath R, Govindraj G, Radha C, Singh SA, Subba Rao BH, Shamanathaka Sastry MC, Joseph J.	LK 13161
A high protein nutritive cereal based food composition and a process for the preparation of the food composition	Swamilingappa Bhagya, Rao Haridas Punaroor, Prakash Vishweshwariah	CN CN1177539C
Ready-to-dilute sugarcane juice beveragepowder and a process for preparing the same	Raghavan Bashyam, Ramalakshmi Kulathooran, Borse Babasaheb Bhaskarrao Ramesh, Mysore Nagarajarao, Prakash Vishweshwaraiah	US 6783785
A process for the preparation of an aldose reductase inhibitor	Sattur AP, Rao KC, Babu KN, Divakar S, Karanth NG, Shamala TR	US 6822003
Compound as cholinesterase inhibitor and its isolation from fungus sporotrichum species	Shivanandappa Thimmappa, Sattur Avinash Prahalad, Dummy Shereen, Divakar Soundar, Karanth Nayakana Katte Ganesh	US 6759552
Sugarcane juice spread and a process for preparing the same	Raghavan Bashyam, Ramalakshmi, Kulathooran, Borse Babasaheb Bhaskarrao, Ramesh Mysore Nagarajarao, Prakash Vishwesh-waraiah, Sulochanamma Guruguntla	US 6805895

A process for high protein coated cereal food and a product thereof	Bhattacharya Suvendu, Latha Rangasamy Baby, Ramesh Thotadamoole, Gopala Rao; Appu Rao Appu Rao, Prakash Vishweshwariah	US 6866880
Process for preparing ready-to-drink shelf stable sugarcane juice beverage	Singh I, Ramesh Mn, Borse BB, Ramalakshmi K, Raghavan B, Prakash V	US 6723367
Process for the preparation of a high protein hydrolysate	Radha C, Kumar RP, prakash V	ZA 2003/7566
A continous vibro fluidized bed roaster using flue gas	Kestur Venkatesh Murthy, Sankaram Thadathil Gangadharan Jayaprakashan, Raju Ezhil Murugan	US 6810794
A medium for clonal propagation of pandanus	Bhagyalakshmi Neelwarne, Rudrappa Thimmaraju, Narayan Mandayam Singara, Aswathanarayana Ravishankar Gokare	US 6849453
Process for separation and recovery of polyethylene glycol	Naveen Nagaraj, Chethana S, Ksms Raghavarao	US 6863828
A high energy high protein food product and a process for preparing the same	Singh, Sridevi Annapurna, Kanya Thirumakudalu, Chikkaraja Sindhu, Tiku Purnima	LK 13018
An improved process for the preparation of 2-acetyl-1-pyrroline, the basmati rice flavourent	Srinivas Pullabhatla, Gurudutt Kambadoor Nagarajarao	US 6723856
An improved process for the preparation of protein hydrolysate from legumes	Haridas A, Majumdar S	ZA 2003/6958
A process for the production of shelf stable improved flour from sorghum and pearl millet	Meera Manchanahalli, Ali Syed Z., Narasimha Hampapura V, Bhashyam Mandayam K, Srinivas Anathachar, Rao Baragi V , Rao Sathendra	EG 23394
CGCRI		
A process of making rare earth doped optical fibre	Sen Ranjan, Miss Chatterjee Minati, Naskar Milan Kanti, Pal Mrinmay, Paul Mukul Chandra, Bhadra Shyamlal Kumar, Da Kamal	US 6851281
Process for making rare earth doped optical fiber	Bandyopadhyay Tarun, Sen Ranjan, Bhadra Shyamal Kumar, Dasgupta Kamal, Paul Mukul Chandra	US 6751990
Process for making rare earth doped optical fiber	Bandyopadhyay T, Sen R, Bhadra SK, Dasgupta K, Paul MC	ZA 2003/5990

CIMAP		
Pharmaceutical composition containing cow urine distillate and an antibiotic	Khanuja Suman Preet Singh, Kumar Sushil, Shasany Ajit Kumar, Arya Jai Shankar, Darokar Mahendra Pandurang, Singh Monika, Sinha Prachi, Awasthi Soumya, Gupta Subhash Chandra, Gupta Vivek Kumar, Gupta Madan Mohan, Verma Ramkishore, Agarwal Sweta, Mansing Sunil Balkrishna	EP 1330253
Process for the preparation of arteethers from dihydroartemisinin	Jain Dharam Chand, Bhakuni Rajendra Singh, Saxena Sudhanshu, Kumar Sushil, Vishwakarma Ram Asrey	GB GB2360517
Formulation comprising thymol useful in the treatment of drug resistant bacterial infections	Khanuja Suman Preet Singh, Srivastava Suchi, Shasney Ajit Kumar, Darokar Mahendra Pandurang, Kumar Tiruppadiripuliyur Ranganathan Santha, Agarwal Krishna Kumar, Ahmed Ateeque, Patra Nirmal Kumar, Sinha Prachi, Dhawan Sunita, Saikia Dharmendra, Kumar Sushil	RU 2245719
Process for the preparation of 10-deacetylbaccatin III	Chattopadhyay SK, Agarwal SK, Khanuja SPS	EP 1298128
Process for isolation of a hepatoprotective agent silymarin from the seeds of the plant silybum marianum	Kahol Atul Prakash, Singh Kiran Lata, Tandon Sudeep, Kumar Sushil	DE 10016449
Process for the production of (-) 3,4-divanillyl tetrahydrofuran	Chattopadhyay Sk, Srivastava S, Tripathi V	EP 1245570
Menthyl benzoate formulations for external UV protection	Khanuja Suman Preet Singh, Agarwal Krishna Kumar, Kumar Tiruppadiripuliyur Ranganathan Santha, Ahmad Atique, Shasany, Ajit Kumar, Darokar Mahendra Pandurang, Kumar SU	US 6831100
Mosquito repellent composition and process for preparation of the same	Kumar Dinesh, Shukla Yogendra Nath, Tiwari Shikhia, Bansal Ravi Prakash, Kumar Sushil	CN ZL 00801425.6
Formulation useful as a nitrification and urease inhibitor and a method of producing the same	Patra Dharani Dhar, Kiran Usha, Anwar Mohammed, Chand Kukhmal, Kumar Sushil	CA 2338454
A method for the screening of mycolic acid biosynthesis inhibitors	Khanuja SPS, Srivastava S, Kumar TRS, Shasany AK, Darokar MP, Awasthi S	US 6833249
Formulation and method for increasing the essential oil content in aromatic crops	Kalra Alok, Katiyar Neetu, Kumar Sushil, Khanuja Suman Preet Singh	US 6720289

Extracting pure hepatoprotective agent phyllanthin in high yield from phyllanthus amarus, by pulverizing and macerating dried leaves, percolating with organic solvent, defatting, chromatographing and crystallizing	Chaudhuri Prabir Kumar, Bagchi Gurudas, Srivastava Rashmi, Kumar Sushil	DE 10014674
Process for the isolation of compound scopolatin useful as nitric oxide synthesis inhibitor	Jain Dharam Chand, Pant Neerja, Gupta Madan Mohan, Bhakuni Rajendra Singh, Verma Ramkishor, Tandon Sudeep, Gupta Shiv Kumar, Tewari Amit, Kahol Atul Prakash, Kumar Sushil	CN ZL00108330.9
An improved process for the isolation of santonin	Jain Dharam, Saxena Sudhanshu, Shawl Abdul Sami, Bindra Rattan Lal, Kumar Sushil	DE 10014670 B4
Opiumless and alkaloid-free non-narcotic opium poppy (papaver somniferum) variety "sujata" abstract	Sharma Jawahar Ram, Lal Raj Kishori, Gupta Ajai Prakash, Misra Hari Om, Pant Vasudha, Chandra Ram, Rashid Mohd	US 6730838
Anti – fungal formulation active against a broad spectrum of dermatophytoses	Shahi Sushil Kumar, Shukla Amritesh Chandra, Dikshit Anupam, Bajaj Ashok Kumar, Singh Anil Kumar, Kumar Sushil	GB 2360705 B
Process for the production of a biologically active phenolic coumpound (+) catechin	Chattopadhyay Sunil Kumar, Banerjee Suchitra, Agarwal Shipra, Kulshreshtha Manish, Sharma Ram Prakash, Mehta Vijay Kumar, Kumar Sushil	GB 2360516
Nitrile glycoside useful as a bioenhancer of drugs and nutrients, process of its isolation from moringa oleifera	Khanuja Suman Preet Singh, Arya Jai Shanker, Tiruppadiripuliyur Ranganathan Santha Kumar, Saikia Dharmendra, Kaur Harpreet, Singh Monika, Gupta Subhash Chandra	US 6858588
Formulation comprising thymol useful in the treatment of drug resistant bacterial infections	Khanuja Suman Preet Singh, Srivastava Suchi, Shasney Ajit Kumar, Darokar Mahendra Pandurang, Kumar Tiruppadiripuliyur Ranganathan Santha, Agarwal Krishna Kumar, Ahmed Ateeque, Patra Nirmal Kumar, Sinha Prachi, Dhawan Sunita, Saikia Dharmendra, Kumar Sushil	US 6824795
Antibiotic pharmaceutical composition with lysergol as bio-enhancer and method of treatment	Khanuja Suman Preet Singh, Arya Jai Shankar, Srivastava Santosh Kumar, Shasany Ajit Kumar, Kumar Tiruppadiripuliyur Ranganathan, Darokar Mahendra Pandurang, Kumar Sushil	ZA 2003/2270

Antibiotic pharmaceutical composition with lysergol as bio-enhancer and method of treatment	Khanuja Suman Preet Singh, Arya Jai Shankar, Srivastava Santosh Kumar, Shasany Ajit Kumar, Kumar Tiruppadiripuliyur Ranganathan, Darokar Mahendra Pandurang, Kumar Sushil	EP 1370263
Formulation comprising thymol useful in the treatment of drug resistant bacterial infections	Khanuja Suman Preet Singh, Srivastava Suchi, Shasney Ajit Kumar, Darokar Mahendra Pandurang, Kumar Tiruppadiripuliyur Ranganathan Santha, Agarwal Krishna Kumar, Ahmed Ateeque, Patra Nirmal Kumar, Sinha Prachi, Dhawan Sunita, Saikia Dharmendra, Kumar Sushil	ZA 2002/7674
Anti-microbial composition and method for producing the same	Khanuja Suman Preet Singh, Srivastava Suchi, Kumar Tiruppadiripuliyur Ranganathan Santha, Shasany Ajit Kumar, Jain Dharam Chand, Darokar Mahendrapandurang, Saikia Dharmendra, Kumar Sushil	RU 2241457
Preparation of an extract rich in bascosides from the herb bacopa monniera	Kahol Atul Prakash, Singh Tarun, Tandon Sundeep, Gupta Madan Mohan, Khanuja Suman Preet Singh	US 6833143
Pharmaceutical composition containing cow urine distillate and an antibiotic	Khanuja Suman Preet Singh, Kumar Sushil, Shasany Ajit Kumar, Arya Jai Shankar, Darokar Mahendra Pandurang, Singh Monika, Sinha Prachi, Awasthi Soumya, Gupta Subhash Chandra, Gupta Vivek Kumar, Gupta Madan Mohan, Verma Ramkishore, Agarwal Sweta, Mansing Sunil Balkrishna	ZA 2003/2276
Single pot conversion of artemisinin into arteether	Bhakuni Rajendra Singh; Tewari Amit; Singh Tarun; Khanuja Suman PS	US 6750356
Composition and process for preparing disinfectants comprising artin spicata var. Viridis and their use	Khanuja Suman Preet Singh, Darokar Mahendra Pandurang, Santhakumar Tirupadiripuliyur Ranganathan, Shasany Ajit Kumar, Aggrawal Krishna Kumar	US 6767876
Vaishnavi, a high yielding self-pollinated cymbopogon artini	Patra Nirmal Kumar; Kumar Sushil, Kalra Alok; Singh Herikesh Bahadur, Singh Hemendra Pratap, Singh Ved Ram, Tanveer Hasan, Mengi Nareshwar	US 6831214

CLRI		
An improved logic device	Chandrakumar N	JP 3540935
EPR imaging device using microwave bridge translator	Narayanan Chandrakumar, Kassey Victor Babu, Visalakshi Vijayaragavan	FR 2813671
EPR imaging device using microwave bridge translator	Narayanan Chandrakumar, Kassey Victor Babu, Visalakshi Vijayaragavan	GB GB2366387
Electronic paramagnetic resonance imaging device using high amplitude modulator	Narayanan Chandrakumar, Kassey Victor Babu, Visalakshi Vijayaragavan	GB GB2366386
CSIO		
Fiber optic point temperature sensor	Jain Subhash Chander, Singh Nahar, Poddar Gopal Chandra, Talwar Rajneesh, Bansal Ashu Kumar, Bajpai Ram Prakash	US 6856714
An improved antiglare device for automobile useful during night driving	Chhabra DS, Rao PK, Sharma BD, Gupta SK, Dodd DS, Singh V, Sharma S	AU 774644
Fiber optic temperature switching immersion probe	Singh N, Jain SC, Aggarwal AK	US 6726360
Improved semiautomatic pick & place machine for assembly components	Narasimham VML, Bhatnagar R, Sharma BD, Shravanakumar RR, Mediratta AK	ZA 2003/2234
CSIR (SCH)		
Process for preparing pyridinium fluorochromate (vi)	Chaudhuri MK, Dehury SK, Bora U, Nath J, Choudary BM, Kantam ML	US 6852859
Coloured nanolithography on glass and plastic substrates	Chowdhury Devasish, Paul Anumita, Chattopadhyay Arun	US 6833162
Transgenic plants with enhanced chlorophyll content and salt tolerance	Pandey Girdhar Kumar, Reddy Vanga Siva, Deswal Renu, Bhattacharya Alok, Sopory Sudhir Kumar	US 6791009
Process for the isolation of a major harmful oxidant from cigarette smoke	Chatterjee Indu Bhusan	US 6782891
A new solid state thermal method for the synthesis of lithium hexafluoro phosphate lipf6 as battery electrolyte	Subramanian A, Vasudevan T, Gangadharan R	US 6824754
A solid state method for the synthesis of lithium metaarsenate (liaso2)	Subramanian A, Vasudevan T, Gangadharan R	US 6849246
Isolation, characterization and mechanism of action of a new	Chatterjee LB	CA 5294765

hazardous component of cigarette smoke: prevention by ascorbic acid		
CSMCRI		
An improved process for cultivation of algae	Reddy Radhakrishn Chennur; Mairh Om Prakash, Kumar Guru Rajakrishna, Eswaran Kuruppanan, Subba Rao Peddi Venkata, Mody Kalpana Haresh, Ghosh Pushpito Kumar	US 6858430
An improved process for the removal of calcium ions from the brine by marine cyanobacteria	Mishra S, Ghosh PK, Gandhi MR, Bhatt AM, Chauhan SA	US 6812001
Recovery of common salt and marine chemicals from brine	Vohra Rajinder N, GhoshPushpito Kumar, Mohandas; Vadakke Puthoor, Joshi Himanshu Labhshanker, Deraiya Hasina Hajibhai	US 6776972
A process for the production of precipitated calcium carbonate from calcium carbonate rich by-product generated in inductrial processes	Jasra Rakesh Vir, Oza Pravinchan dra Mahasukhray, Somani Rajesh Shantilal, Chunnawala Jatin Rameshchandra, Sheth Mrunal Vinodbhai, Thakkar Vikram Vinodrai, Badheka Yogiraj Mansukhlal, Ayyer Jayalekshmy, Patel Virendra Bhikabhai,	US 6790424
Preparation of non-hazardous brominating reagents	Vohra Rajinder Nath, Ghosh Pushpito Kumar, Gandhi Maheshkumar Ramniklal, Joshi Himanshu Labhshanker, Deraiya Hasina Hajibhai, Dave Rohit Harshadray,	US 6740253
A process for purification of calcium carbonate rich by-product generated in industrial processes	Jasra Rakesh Vir, Oza Pravinchandra Mahasukhray, Somani Rajesh Shantilal, Chunnawala Jatin Rameshchandra, Sheth Mrinal Vinodbhai, Thakkar Vikram Vinodrai, Badheka Yogi Mansukhlal, Ayyer Jayalekshmi, Patel Virendra Bhikhabhai	US 6761864
Clay based catalytic process for the preparation of acylated aromatic ethers	Jasra Rakesh Vir, Sengodagounder Muthusamy, Badheka Yogiraj Mansukhlal	US 6730814
Process for preparing 2,4,46-tetrabromo-2,5-cyclohexadienone	Bedekar Ashutosh Vasant, Ramachanraiah Gadde, Ghosh Pushpito Kumar	US 6838582
Device for estimation of brine density	Ghosh Pushpito Kumar, Majeethia Kishor Manmohan Das, Gandhi	US 6865942

	Mahesh Ramniklal, Parmar Jamnadas Naranbhai, Bhatt Ajoy Murlidhar, Chauhan Shantilal Amrital, Mohandas Vadakke Puthoor, Hamidani Abdulhamid Usmanbhai Hamidani	
An improved electro-chemical method for oxidation of bromide to bromide	Ramachandraiah G, Ghosh PK, Susarla VKS, Vaghela SS	US 6811679
Process for generation of preceipitated calcium carbonate from calcium	Jasra Rakesh Vir, Oza Pravinchandra Mahasukhray, Somani Rajesh Shantilal, Chunnawala Jatin Rameshchandra, Sheth Mrunal Vinodbhai, Thakkar Vikram Vinodrai, Badheka Yogiraj Mansukhlal, Ayyer Jayalekshmy, Patel Virendra Bhikabhai,	EP 1440037 B1
Process for the preparation of a molecular lieve adsorbent for selectively adsorbing nitrogen and argon from a gaseous mixture with oxygen	Sebastian Jince, Jasra RV	SG 106851
Eco-friendly method of preparation of high purity tetrabromobisphenol-a	Ramachandraiah Gadde, Ghosh Pushpito Kumar, Mehta Aditya Shantilal, Pandya Rajesh Popatlal, Jethva Ashok Dahyabhai, Vaghela Sanjay Shambhubhai, Misra Sudhindra Nath	RU 2247105
IGIB		
process for removal of total dissolved solids (tds) from pulp and paper effluents using mixed bacterial consortia	Kumar R, Tiku DK, Sharma P	US 6846666
A method for identification of mutation in synaptogyrin 1 gene for detection of pre-deposition to schizophrenia	Brahmachari SK, Ranjana, Chitra, Salim Q, Jain S	US 6764824
Immobilized microbial consortium useful for rapid and reliable bod estimation	Kumar Rita, Sharma Alka, Rastogi Shikha, Makhijani Santosh Dayaram, Manoharan A	GB 2360788B
Immobilized microbial consortium for the treatment of phenolic waste-water from petroleum refineries	Kumar Rita, Sharma Alka, Kumar Archana	GB GB2360787
A microbial composition and a process useful for the neutralisation of alkaline waste-waters	Kumar R, Kumar A, Sharma A, Gangal SV, Makhijani SD	US 6846483
Rapid method for enzyme-linked immunosorbent assay	Nahar Pradip, Bora Utpal, Sharma Gainda Lal	RU 2249218

A computer based method for identifying conserved invariant peptide motifs	Brahmachari Kumar Samir, Dash Debasis	RU 2249044
IHBT		
Method for producing chiral dihydrotagetone, and its conversion to chiral 5-isobutyl-3-methyl-4,5-dihydro-2 (3h)-furanone	Sinha AK, Joshi BP, Dogra R	US 6833475
Process for the preparation of substituted trans-cinnamaldehyde, a natural yellow dye, from phenylpropane derivatives	Sinha AK, Joshi BP, Dogra R	FR 01 03984
Process for the preparation of substituted trans-cinnamaldehyde, a natural yellow dye, from phenylpropane derivatives	Sinha AK, Joshi BP, Dogra R	GB 2373252
Process for the preparation of substituted trans-cinnamaldehyde, a natural yellow dye, from phenylpropane derivatives	Sinha AK, Joshi BP, Dogra R	TA 195651
Method for producing chiral dihydrotagetone, and its conversion to chiral 5-isobutyl-3-methyl-4,5-dihydro-2(3h)-furanone	Sinha AK, Joshi BP, Dogra R	AU 780476
A process for the production of herbal wine (palam belle) from ripe fruits of pyrus pashia	Singh HP, Singh B, Dhadwal VS	NZ 517600
Process for the preparation of herbal wines from himalayan berries Sterile laminar airflow device	Singh Harsh Pratap, Singh Brajinder, Dhadwal Varinder Singh Thakur Rajesh, Sood Anil, Ahuja Paramvir Singh	US 6793957 SG 88039
Method for producing chiral dihydrotagetone, and its conversion to chiral 5-isobutyl-3-methyl-4,5-dihydro-2(3h)-furanone	Sinha AK, Joshi BP, Dogra R	SN 2187344
Gladiolus hybrid plant 'grace'	Dhyani D, Mukherjee D	US PP14979
Gladiolus hybrid plant `palampur delight` -	Dhyani Devendra, Mukherjee Debasish	US PP15080
Gladiolus hybrid plant 'palampur pride'	Dhyani D, Mukherjee D	US PP14980
Gladiolus hybrid plant 'the saint'	Dhyani D, Mukherjee D	US PP15626
Use of tea leaf extract for inhibiting microbial tranformant	Sandal Indra, Bhattacharya Amita, Gulati Ashu, Desikachar Srigiripuram Ravindranath, Ahuja Paramvir Singh	LK 13019
A continous type multipurpose tea shoot sorter	Desikachar RS, Singh KK	LK 13020

Simple portable mini distillation apparatus for the production of essential oils and hydrosols	Babu Garikapati D Kiran, Ahuja Paramvir Singh, Kaul Vijay Kumar, Singh Virendra	
A process for the production of herbal wine (palam belle) from ripe fruits of pyrus pashia	Singh HP, Singh B, Dhadwal VS	KE KE188
IICB		
Antimonocytic activity of betel leaf extract	Bandyopathyay Santu, Pal Bikash, Bhattacharya Samir, Ray Mitali, Roy Keshab Chandra	GB 2383753
A herbal composition for treating cd33+ acute and chronic myeloid leukemia and a method thereof	Bandyopathyay Santu, Pal Bikash, Bhattacharya Samir, Ray Mitali, Roy Keshab Chandra	US 6852344
Herbal composition of blend of active components prepared from murrya koenigii and piper betle useful for blocking of 5 lipoxygenase activity leading to the inhibition of leukotriene synthesis, suppression of interleukin-4 production, and enhancement of GA	Bandyopadhyay Santu, Roy Keshab Chandra, Roy Mitali, Pal Bikash Chandra, Bhadra Ranjan, Das Krishna, Bhattacharya Samir	US 6773728
Herbal composition for treating asthma	Bhadra Ranjan, Pal Bikash Chandra, Das Krishna, Bhattacharaya Samir	US 6746694
A process for the preparation of an extract from human placenta containing glycos phingolipids and endothelin-like constituent peptides useful for the treatment of vitiligo	Bhadra R, Pal P, Roy R, Datta AK,	EP 3538745
Process for the preparation of technicetium- 99m diethylene triamine penta acetic acid diester	Chatterjee Mita, Sen Karabi, Banerjee Some Nath	EP 953360
Process for the preparation of technicetium - 99m diethylene triamine penta acetic acid diester	Chatterjee Mita, Sen Karabi, Banerjee Some Nath	JP 3566536
A process for the preparation of new patent nontoxic lipopolysaccharide (LPS) useful for preventing endotoxemia or sepsis	Bhadra Ranjan, Nayak Abhijit, Bandyopadhyay Pataki Charan, Basu Sumanta	JP 3595966
Herbal formulation of a combination of piper betel and murrya koenigii extracts for blocking 5 lipoxygenase activity	Bandyopadhyay Santu, Roy Keshab Chandra, Roy Mitali, Pal Bikash Chandra, Bhadra Ranjan, Das Krishna, Bhattacharaya Samir	EP EP 1414475
IICT		
A novel ecofriendly process for the preparation of acyl lessocenes	Choudary Boyapati Manoranjan, Reddy Konatham Saidi, Kantam;	IT 1268501

	Mannepalli Lakshmi, Raghavan Kondapuram Vijaya	
Stereoselective preparation of 3-hydroxy-3-phenylpro-pionitrile	Ahmed Kamal, Bhasker Khanna Gollapalli, Rao Maddamsetty Venkateswara, Raghavan Kondapuram Vijaya	GB 2387597
Process for the preparation of acylferrocenes	Choudhary Boyapati Manoranjan, Reddy Konatham Saidi, Lakshmi Mannepalli, Raghavan Kondapuram Vijaya	CH CN116674C
Process for the preparation of acylferrocenes	Choudhary Boyapati Manoranjan, Reddy Konatham Saidi, Lakshmi Mannepalli, Raghavan Kondapuram Vijaya	EP 1268501 B1
Process for the preparation of acylferrocenes	Choudhary Boyapati Manoranjan, Reddy Konatham Saidi, Lakshmi Mannepalli, Raghavan Kondapuram Vijaya	JP 3574805
Process for preparation of malononitrile	Bandyopadhyay Ananda Kumar, Aziz Khathija, Likhar Pravin Raybaji, Choudary Boyapati Manoranjan	EP EP1184369B1
Preparation of new layered double hydroxides exchanged with osmate for asymmetric dihydroxylation of olefins to vicinal diols	Choudary Boyapati Manoranjan, Chowdari Naidu Sreenivasa, Kantam Mannepalli Lakshmi, Raghavan Kondapuramvijaya,	EP 1209142 B1
Process for the preparation of amine oxides	KV Raghavan et. al	EP 1209148 B1
Process for the production of nitroarenes with high paraselectivity from monosubstituted aromatic hydrocarbons using alumino-silicates as cataltsts	Choudary BM, Sateesh M, Kantam ML, Rao KK, Prasad KVR, Rahgavan KV	EP 1004570 B1
Process for the preparation of 2-chloro-5-methylpyridine-3-carbaldehyde	Chinaraju Bhimapaka, Rao Vaidya Jayathirtha, Raghavan Kondapuram Vijaya	US 6737529
1-(aryloxy) propionoyl-2-arylsulfonyl hydrazines, process for preparation thereof and use thereof as hypoglycemic agents	Thallapall Ramalingam, Yadavalli Venkata Durga Nageswar, Sistla Ramakrishna, Rao Adari Bhaskar, Diwan Prakash Vamanrao, Yadav Jhillu Singh, Raghavan Kon	US 6730704
A process for the preparation of b-keto aliphatic acid ester useful as therapeutic agent	Jetty A, Akkewar DM, Raghavan KV	US 6838083
Process for the preparation of amine oxides	Kantan L et al.	EP EP1213280 B1

An improved process for the preparation of zsm-5 catalyst	Kulkarni SJ, Srinivasu P, Narender N, Raghavan KV	US 6800272
Multifunctional catalyst useful in the synthesis of chiral vicinal diols and process for the preparation thereof, and process for the preparation of chiral vicinal diols using said multifunctional catalysts	Choudary Boyapati Manoranjan, Chowdari Naidu Sreenivasa, Madhi Sateesh, Kantam Mannepalli Lakshmi	US 6780810
Vitamin b12 --biodegradable micro particulate conjugate carrier systems for peroral delivery of drugs, therapeutic peptides/proteins and vaccines	Chalasani Kishore Babu, Diwan Vamanrao, Raghavan Kondapuram Vijaya, Russell-Jones Gregory John, Jain Sanjain Kumar, Rao Kollipara Koteshawar	GB 2374010
A process for the alkylation of dihydroxy benzene with tertiary butyl alcohol using solid acid and polyaniline sulfate catalysts	Narayanan Sankarasubbier, Srinivasan Palaniappan, Murthy Katravulapalli Veera VE	FR 2822822
A process for the alkylation of dihydroxy benzene with tertiary butyl alcohol using solid acid and polyaniline sulfate catalysts	Narayanan Sankarasubbier, Srinivasan Palaniappan, Murthy Katravulapalli Veera Ve	GB GB2378441
Process for the preparation of acyl aromatic ethers	Kantam Mannepalli Lakshmi, Sateesh Mutyala, Choudary Boyapati Manoranjan, Prakash Billakantiveda, Raghavan Kondapuram Vijaya	EP 1149818 B1
Process for the preparation of acyl aromatic ethers	Kantam Mannepalli Lakshmi, Sateesh Mutyala, Choudary Boyapati Manoranjan Prakash, Billakantiveda, Raghavan Kondapuram Vijaya	JP 3532824
Process for the preparation of tetra bromobisphenol-A	Kantam Mannepalli Lakshmi, Jeevaratnam Katuri, Choudary Boyapati Manoranjan, Reddy Chinta Reddy Venkat, Raghavan Kondapuramvijaya, Sivaji Lanka Venkata, Someshwar Thumma	JP 3532825
Process for the preparation of 4'-isobutylacetophenone	Choudary Boyapati Manoranjan, Sateesh Mutyala, Kantam Mannepalli Lakshmi, Ranganath Kulluri Venkatasri, Raghaven Kondapuram Vijaya	EP 1138662
Alkylxanthates and use of alkylxanthates in the integrated pest management	Rao Janapala Venkateshwara, Venkateswaralu Yenamandra, Raghavan Kondapuram Vijaya	EP 1373238 B1
A novel method for chromatographic finger printing and standardization of single medicines and formulations	Dadala Vijaya Kumar, Raghavan Kondapuram Vijaya	KR 42088

A novel method for chromatographic finger printing and standardization of single medicines and formulations	Dadala Vijaya Kumar, Raghavan Kondapuram Vijaya	ZA 2003/2435
Process for the preparation of vinylpyridine from picoline over modified zeolites	Kulkarni Shivanand Janardan, Madhavi Gangapuram, Viswanathan Venkataraman	US 6727365
A process for the preparation of 1,1,1,2 - tetra fluoroethane	Rao Jampani Madhusudana, Pamulaparthy Shanthan Rao, Attaluri Siva Prasad, Narasaiah Banda, Kuppusamy Radhakrishnan, Veeramachaneni Vijayakumar	GB 2375974
Pyrene-linked pyrrolo[2,1-c][1,4] benzodiazepine hybrids useful as anti-cancer agents	Kamal Ahmed, Gujjar Ramesh, Poddutoori Ramulu, Olepu Srinivas	US 6800622
Process for preparing substituted coumarins Process for the preparation of (-) -epicatechin from a new natural source namely dichrostachys cinerea	Palaninappan S, Rao VJ, Saravanan C, Chandreshekhar R Rao Janaswamy Madhusudana, Rao Rao Jagadeeshwar, Yadav Jhillu Singh, Raghavan Kondapuram Vijaya	US 6716996 US 6841687
Antioxidant from natural source	Rao Janaswamy Madhusudana, Rao Rao Jagadeeshwar, Tiwari Ashok Kumar, Yadav Jhillu Singh, Raghavan Kondapuram Vijaya	US 6781002
Diaryl butane as antioxidant from a natural source	Rao JM, Tiwari AK, Kumar US, Yadav JS, Raghavan KS	EP EP 1411909 B1
A process for preparation of esters using polyaniline salts as novel catalysts	Palaniappan S, Sairam M	GB 2381788 B
Preparation of new layered double hydroxides exchanged with diisopropylamide for C-C bond forming reaction	Choudary BM, Ravinder A, Kantam ML, Reddy RV,Bharathi B	US 6812186
Process for the preparation of 2 -nitrothiophene selectively from thiophene using metal exchanged clay catalysts	Choudary BM,Kantam ML, Ramprasad KV, Sri Ranganath KV	US 6794521
A synergistic anti-malarial formulation	Dutta Guru Prakash, Jain Dharm Chand	AU 777841
An ecofriendly process for the preparation of dinitramidic acid and salts by metal ion exchanged clay catalysts	Choudary BM, Kantam ML, Ratnam KJ, Vijayakumar K, Sridhar C, Venkatachalam S, Santhosh G, Ramaswamy R, Ninan KN, Sastri	EP 1344748
An ecofriendly process for the preparation of dinitramidic acid and salts by metal ion exchanged clay catalysts	Choudary BM, Kantam ML, Ratnam KJ, Vijayakumar K, Sridhar C, Venkatachalam S, Santhosh G, Ramaswamy R, Ninan KN, Sastri	US 6787119

Selective liquid phase air oxidation of toluene catalysed by composite catalytic system	Kantham Mannepalli Lakshmi, Sreekanth Pentlavalli, Rao Kottapalli Koteshwara, Kumar Thella Prathap, Rao Bhavnari Purna C, Choudary Boyapati Mano	US 6743952
Process for the preparation of nanocrystalline zeolite beta	Rao KK, Rao BPC, Choudary BM, Kantam ML, Raghavan KV	US 6827924
Process for synthesis of bis-(substituted-4-quinolyl) disulphides	Meshram Harshadas Mitaram, Kokku Premalatha, Ayyagiri Venkata Madhavi, Begari Eshwaraiah, Yadav Jhillu Singh	US 6777553
Process for direct preparation of 5-alkoxy and 5-acyloxy analogues of campthothecin	Das Biswanath, Madhusudhan P, Srinivas KVNS	US 6872829
Supported osmates, process for preparation thereof, and a process for the preparation of chiral vicinal diols using supported osmate catalyst	Choudary Boyapati Manoranjan, Chowdari Naidu Sreenivasa, Kantam Mannepalli Lakshmi, Raghavan Kondapuram Vijaya	US 6815566
Process for the preparation of polyaniline salts	Palaniappan S, Amarnath CA	AU 2002242943
A novel chromatographic finger pringing of herbal medicines & formulation	Dadala Vijaya Kumar, Raghavan Kondapuram Vijaya	EA 4663
A process for the preparation of b-keto aliphatic acid ester useful as therapeutic agent	Jetty A, Akkewar DM, Raghavan KV	US 6838268
Process for the transesterification of keto-esters with alcohol using polyaniline salts as catalyst	Palaniappan S, Chandrasekhar R	US 6743942
IICT+CDRI		
New herbal composition for treating gastric ulcer	Rao JM, Tiwari AK, Kumar US, Sastry BS, Yadav JS, Raghavan KV, Dubey MP, Palit G, Balla DN, Dixit M, Varier PMK, Muraleed	US 6855347
IIP		
Process for sweetening of lpg, light petroleum distillates by liquid-liquid extraction using metal phthalocyanine sulphonamide catalyst	Sain B, Puri SN, Das G, Balodi BP, Kumar S, Kumar A, Bhatia VK, Kapoor VK, Rai GP, Rao TSRP	GB GB2373790
Process for the fixed bed sweetening of petroleum distillates using halogenated metal phthalocyanine as a catalyst	Sain B, Puri S, Das, G, Balodi BP, Kumar S, Kumar A, Kapoor VK, Bhatia VK, Rao TSRP, Rai GP	FR 2818282
Process for the fixed bed sweetening of petroleum distillates using halogenated metal phthalocyanine as a catalyst	Sain B, Puri S, Das, G, Balodi BP, Kumar S, Kumar A, Kapoor VK, Bhatia VK, Rao TSRP, Rai GP	GB GB2371556

Process for the fixed bed sweetening of petroleum distillates using halogenated metal phthalocyanine as a catalyst	Agrawal Brij Bahadur, Puri Som Nath, Das Gautam, Sain Bir, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Gupta Pushpa Prakas	US 6755964
Process for the preparation of a catalyst useful for liquid-liquid sweetening lpg and light petroleum distillates	Sain Bir, Puri Som Nath, Das Gautam, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Kapoor Virendra Kumar, Bhatia Virendra Kumar	FR 2816854
Process for the preparation of a catalyst useful for liquid-liquid sweetening lpg and light petroleum distillates	Sain Bir, Puri Som Nath, Das Gautam, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Kapoor Virendra Kumar, Bhatia Virendra Kumar	GB GB2371300
Process for the preparation of a catalyst useful for liquid-liquid sweetening lpg and light petroleum distillates	Sain Bir, Puri Som Nath, Das Gautam, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Kapoor Virendra Kumar, Bhatia Virendra Kumar	US 6740619
Process for the preparation of a novel catalyst useful for sweetening of sour petroleum distillates	Agrawal Brij Bahadur, Puri Som Nath, Das Gautam, Sain Bir, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Gupta Pushpa, Prakas	FR 104388
Process for the preparation of a novel catalyst useful for sweetening of sour petroleum distillates	Agrawal Brij Bahadur, Puri Som Nath, Das Gautam, Sain Bir, Balodi Bhagwati Prasad, Kumar Sunil, Kumar Anil, Gupta Pushpa, Prakas	GB GB2372501
Process for preparing vanadyl pyrophosphate catalyst Process for sweetening of lpg, light petroleum distillates by liquid-liquid extraction using metal phthalocyanine sulphonamide catalyst	Datta Arunabha, Dasgupta Soumen, Agarwal Monika Sain B, Puri SN, Das G, Balodi BP, Kumar S, Kumar A, Bhatia VK, Kapoor VK, Rai GP, Rao TSRP	US 6774081 FR 2822837
IMTECH		
Bacteriophage, a process for the isolation thereof, and a universal growth medium useful in the process thereof	Agrawal Pushpa, Soni Vishal	US 6787360
Process for the preparation of a vaccine for the treatment of tuberculosis and other intracellular infections diseases and the vaccine produced by the process	Agrewala Javed Naim, Sharma Naresh	US 6783765
NAL		
A light weight helicopter	Pai Bhaskar Ramchandra	GB 23384224

NBRI		
A synergistic bioinoculant composition comprising bacterial strains of accession Nos. NRRL B-30486, NRRL B-30487 and NRRL B-30488 and a method of producing said composition thereof	Nautiyal SC, Mehta S, Singh HB, Pushpangadan P	ZA 2003/2288
A process for preparation of herbal colours useful for cosmaceutical applications	Pushpangadan Palpu, Mehrotra Shanta, Rawat Ajay Kumar Singh, Khatoon Sayyada, Govindarajan Raghavan	GB 2374284
Tissue culture process for producing a large number of viable cotton plants in vitro	Tuli R, Srivastava AK, Gupta SK	CN ZL97103003.0
A bioinoculant composition comprising bacterial strains of b.subtiles or b. lentimorbus from cow's milk	Nautiyal SC, Mehta S, Singh HB, Pushpangadan P	ZW 11/2003
NCL		
Process for vapor phase nitration of benzene using nitric acid over molybdenum silica catalyst	Dongare Mohan Keraba, Patil Pratap Tukaram, Malshe Kusum Madhukar	US 6791000
1,1-bis(4-aminophenyl)-3-alkylcyclohexanes, method for their preparations	Shingte RD, Wadgaonkar PP	US 6790993
Process for the production of hydroquinone and quinones from phenol	Dewkar Gajanan Kundalik, Thakur Vinay Vijayraj, Pardhy Sanjeevani Amrit, Sudalai Arumugam, Devotta Sukumar	US 6872857
A process for the removal of heavy metals by actinomycetes	Laxman RS, More SV, Shahapure GD, Tamhankar SS, Seetaramarao B	ZA 2003/2502
A new catalytic process for regiospecific chlorination of alkanes, alkenes and arenes	Kundalik Dewkar Gajanan, Thakur Vinay Vijayraj, Pardhy Sanjeevani Amrit, Sudalai Arumugam, Devotta Sukumar	US 6825383
An improved process for the preparation of pure high quality 3,3',4,4' -tetraminobiphenyl	Maner Asif, Sudhir Bavikar, Sudalai Arumugam, Sivaram Swaminathan	US 6835854
Polymerizable macromer and preparation thereof	Kulkarni MG, Khandare JJ	US 6822064
Copolymers and preparation thereof	Kulkarni MG, Khandare JJ	US 6825308
A method for the improvement of gas-solid contacting in a bubbling fluidized bed reactor	Choudhary VR, Choudhary TV	US 6846932

A process for the preparation of a megnesium halide supported metallocene catalyst	Sensarma Soumen, Sivaram Swaminathan	EP 878484
Process for the preparation of novel diol-functionalized uv absorbers	Thanki Paragkumar Nathalal, Singh Raj Pal	US 6756499
Escherichia coli having accession no. Pta 1579 and its use to produce polyhydroxybutyrate	Mahishi LH, Tripathi G, Ramchander TVN, Rawal Shuban Kishen	US 6756222
Process for the preparation of polyesters	Kelkar Ashutosh Anant, Kulkarni Shrikant Madhukar, Chaudhari Raghunath Vitthal	EP 1229064 B1
Vinylic hindered amine light stabilizers	Desai Shrojal Mohitkumar, Singh Raj Pal	US 6737528
Process for producing polycondensable macromonomer	Ramanathan Lalgudi Srinivasan, Sivaram Swaminathan	EP 982334
Conductive polymer blend and a process for the preparation thereof	Jyoti Prakash Jog, Kulkarni Shrikant Madhukar, Priya L, Chaudhari Raghunath Vitthal	US 6800221
Process for the preparation of ultrafiltration membranes of polyacrylonitrile, using malic acid as an additive	Kulkarni Sudhir Sharadchandra, Shinde Madhuri Himmatrao, Musale Deepak Anandrao	US 6858141
Process for the preparation of polymeric absorbents	Lele Ashish Kishor, Varghese Shyni, Badiger Manohar Virupax, Mashelkar; Raghunath Anant	US 6794467
Process for the preparation of metal sulfide nanoparticles	Mukherjee Priyabrata, Mandal Deendayal, Ahmad Absar, Sastry	US 6783963
An improved process for the conversion of aliphatic alcohols to carboxylic acid	Chaudhari RV, Joshi SS, Kelkar AA, Divekar SS	US 6858753
Process for the preparation of optically active azabicyclo heptanone derivatives	Joshi Rohini Ramesh, Prabhune Asmita Ashutosh, Joshi Ramesh Anna, Gurjar Mukund Keshav	US 6780635
An improved process for the preparation of meso-substituted dipyrromethanes	Naik RH, Joshi PL	US 6852864
Method and apparatus for online identification of safe operation and advance detection of unsafe operation of a system or process	Kumar Viruthiamparambath Ravi, Kulkarni Bhaskar Dattatraya, Ghosh Anandamohan	US 6826513
Process for the synthesis of of enantiomerically pure cyclohexylphenyl glycolic acid	Kumar Pradeep, Fernandes Rodney Agustinho, Gupta Prii	US 6825378
Process of aromatic carboxyl compound with carboxyl group	Choudhary Vasant Ramachandran, Narkhede Vijay Sopan, Indurkar Jayant Ravichandra	US 6828463

Process for the preparation of 4-nitro-o-xylene	Dongare MK, Patil PT, Malshe KM	US 6825388
Process for the preparation of ethyl 3-ethoxy-4-ethoxycarbonyl-phenylacetate	Kalkote Uttam Ramrao, Gurjar Mukund Kesao, Joshi Shreerang Vidyadhar, Kadam Suresh Mahadev, Naik Sanjay Janardhan	US 6818786
Thermoprecipitating polymer containing enzyme specific ligands, process for the preparation thereof, and use thereof for the separation of enzymes	Vaidya Alankar Arun, Lele Bhalchandra Shripad, Kulkarni Mohan Gopalkrishna, Mashelkar Raghunath Anant	US 6867268
Antiozonant cum antioxidant, process for preparation	Desai Shrojal Mohitkumar, Solanky Shailendra Singh, Singh Raj Pal	US 6770785
An improved process of enantiomerically pure-3 phenyl -3 hydroxy propylamine	Kumar P, Pandy RK	US 6838581
Alkalothermophilic bacillus that produces a protease inhibitor	Dash Chandravanu, Phadtare Sangita Uday, Ahmad Absar, Deshpande Vasanti Vishnu, Rao Mala Balchandra	US 6846664
NCL+CLRI		
Process for the preparation of alkaline protease	Laxman Ryali Seeta, More Snehal Vijay, Rele Meenakshi Vilas, Rao Bommaraju Seeta Rama, Jogdand Vithal Venkatrao, Rao Mala Balachandra, Deshpan	US 6777219
NGRI		
Moving surface electromagnetic induction device for deeper depth exploration (scale model studies)	Gupta OP, Nageshwararao	US 6720771
Method of short term forecasting of moderate size earthquakes	Mandal Prantik, Rastogi Bal Krishna, Chadha Rajender Kumar, Satyanarayana Hari Venkata Subrahmanya, Sarma C. Surya Prakash, Kumar Narendra, Satyamurthy C	US 6728640
NIO		
A controlled thruster-driven profiler for coastal waters	Desa ES, Pascoal Amds, Mehra P, Naik GP, Desa Bae, Madhan Rajachandran	US 6786087
An improved system for calibration of pressure transducers	Joseph A, Kumar V, Prabhudesai S, Mehra P, Desa E, Nagvekar Sm	US 6848292
A novel system for seafloor classification susing artificial neural network (ann) hybrid layout with the use of unprocessed multi-beam backscatter data	Chakraborty B, Kodagali V, Baracho J, Joseph A	US 6763303

In vitro production of amoebocytes from tachypleus gigas in leibovitz culture medium	Bhonde Ramesh Ramchandra, Chatterji; Anil	US 6790659
Pressure housing for in-water pressure based systems	Desa Ehrlich, Naik Gajanan Purushottam, Joseph Antony, Desa Elgar Stephen, Mehra Prakash, Kumar Vijay, Desai Shivanand Prabhu, Nagvekar Surekha Mahesh	GB 2390163 B
`Pseudomonas stutzeri` strain and process for preparation of xylanase	Bhosle Narayan Baburao, Giriyan Asha	US 6833259
A tide staff system	Joseph A, Prabhudesai S, Tengali S, Desa E, Mehra P, Sukerkar A, Kumar V, Monteiro R	US 6802219
Biologically active aqueous fraction of an extract obtained from a mangrove plant salvadora persica l	Goswami Usha, Fernandes Nazarine	US 6753021
Indian green mussel (perna viridis) as a source of anti-hiv activity	Mitra Debasis, Chatterji Anil	US 6770302
Natural fluorescent dye obtained from a marine invertebrate, compositions containing the said dye and their uses	Usha G, Anutosh G	GB GB237388
Composition containing novel compound corniculatonin having antifungi properties and a process for preparing the same	Wahidullah Solimabi, Bhosak Siddharth Hariba, D'souza Maria Lisette De Lumen	US 6777004
Method of determining the volume scattering function of ocean wateres in the backward direction using a satellite ocean color sensor	Chakraborty B, Kodagali V, Baracho J, Joseph A	US 6868361
Composition for treating white spot syndrome virus (wssv) infected tiger shrimp penaeus monodon and a process for preparation thereof	Desai Ulhas Manohar, Achuthankutty Chittur Thelakkat, Sreepada Rayadurga Anantha	PE 3867
NML		
Process for recovery of nickel from spent catalyst	Sahu Kamala Kanta, Pandey Banshi Dhar, Chand Prem	US 6733564
Process for the preparation of nanosized iron oxide by biomimetic route	Sinha Arvind, Chakraborty Jui, Das Samar, Das Swapan K, Rao Venkatesh, Rao Patcha R	US 6800271
Process for the production of ceramic tiles	Das Swapan Kumar, Singh Karun Kant, Kumar Sanjay, Das Uma Sunker	US 6743383
Process for the production of neodymium-iron-boron permanent magnet alloy powder	Rao Patcha Ramachandra, Rao Venkatesh, Singh Arvind	US 6855186

Process for the production of ceramic tiles	Das Swapan Kumar, Singh Karun Kant, Kumar Sanjay, Das Uma Sunker	AU 2002249548
NPL		
Reusable heat pack, method of manufacture thereof, mixture for use in a reusable heatpack and process for the preparation thereof	Sharma CP, Sharma RK, Kant C, Sarkar AK	AU 771018
Compensated sulphonated polyaniline and a process for the preparation thereof	Koul Saraswati, Dhawan Sundeep Kumar, Chandra Subhas, Chandra Ramesh	JP 3592991
A process for the preparation of solid precursor material useful for the electrochromic coatings	Deepa, Agnihotri Suhasini A, Ramachandran Ramadevi, Varshney Pradeep, Sharma Nidhi	GB GB2359304
Lead iron tungstate capacitive transducer, relaxor material therefor and method of manufacture of said relaxor material	Jain Kamlesh Kumar, Kumar Vinay, Kashyap Subhash Chand	US 6715358
Reusable heat pack, method of manufacture thereof, mixture for use in a reusable heatpack and process for the preparation thereof	Sharma CP, Sharma RK, Kant C, Sarkar AK	EP 1245207 B1
Compensated sulphonated polyaniline and a process for the preparation thereof	Koul Saraswati, Dhawan Sundeep Kumar, Chandra Subhas, Chandra Ramesh	EP EP1118631B1
RRL (BHU)		
Process for manufacturing of high iron hydraulic cement clinker	Bansidhar Nayak, Misra Vibhuti Narayan	US 6752865
RRL (JM)		
Drought tolerant strain of cymbopogon rich in geraniol and geranyl acetate designated as cymbopogon rljcci	Shahi AK, Sharma SN, Pal S, Chandra S, Dutt P, Balyan SS, Bhan MK, Taneja SC, Raina RK, Verma V, Verma V, Zahoor S, Kaul	US PP15595
Process for the synthesis of trans-alkenoic acids, use thereof	Gupta Vishwa Nath, Bhardwaj Vikram, Singh Bhupinder, Chandan Bal Krishan, Suri Krishan Avtar, Satti Naresh Kumar, Suri Om Parkash, Handa Sukhdev Swami	US 6852759
8-(c-.beta.-d-glucopyranosyl)-7, 3', 4'-trihydroxyflavone, process of isolation thereof, pharmaceutical composition and method for the treatment of diabetes	Maurya Rakesh, Handa Sukhdev Swami, Singh Rajinder	US 6777392
8-(C-ß-D-GLUCOPYRANOSYL)-7,3?, 4?-TRIHYDROXYFLAVONE	Maurya Rakesh, Handa Sukhdev Swami, Singh Rajinder	EP EP1381619B1

(+)-1-bisabolone isolated from cymbopogon flexuosus and antibacterial activity thereof	Taneja Subhash Chandra, Shahi Ashok Kumar, Verma Vijeshwar, Sethi Vijay Kumar, Andotra Samar Singh, Hashmi Abid Zaffar, Dutt Prabhu, Bakshi Sanotosh KumarI	US 6787674
A process for the isolation of extract from argyrolobium roseum and its antidiabetic composition	Gupta Om Prakash, Ahmad Zabeer, Bhagat Asha, Gupta Kuldeep Kumar, Handa Sukhdev Swami	US 6869625
Synergistic tissue culture media formulation for in vitro regeneration of swertia chirata ham	Ahuja A, Koul S, Kaul BL, Verma NK, Kaul MK, Raina RK, Qazi GN	US 6855547
Synergistic tissue culture media formulation for in vitro regeneration of swertia chirata ham	Ahuja A, Koul S, Kaul BL, Verma NK, Kaul MK, Raina RK, Qazi GN	ZA 2004/4059
RRL (JT)		
A process for the preparation of hydrogen peroxide from hydrogen and oxygen	Brothakur N	US 6761874
A set of novel microwave dielectric ceramic compositions xmo-yla2o3-ztio2(m=sr,ca; x:y:z=1:2:4, 2:2:5, 1:2;5 or 1:4:9) and devices comprising the same	Sebastian MT, Santha NI, Jawahar In	US 6800577
Single step process for the synthesis of nanoparticles of ceramic oxide powders	James Jose. Jose Rajan, John Asha Mary, Koshy Jacob	US 6835367
Anti-diabetic agent obtained from the plant humboldtia decurrens and a process for preparing the same	Rao Janaswamy Madhusudana, Sumathykutty Mangattu Achutankunju, Nair Gopalan Vijay, Damodaran Alathur Damodaran, Rathinam Kodandaraman, Sivakumar Rajagopal, Das KOT	AU 2001242730
Liquid crystalline polymer films of polymers of having azobenzene mesogenic groups in cross linked network structures, process for the preparation thereof, polymers and novel monomers having azobenzene mesogens	Saminathan Muthusamy, Pillai Chennakkattu Krishna Sadasivan,	US 6765079
Process for the preparation of high grade synthetic rutile and pig iron	Das PNNM, Bhat KH, Janaki MEK, Sasibhushanan S, Mukherjee P, Mohanty BCR, Ray HS	AU 770237
Melt processible liquid crystalline terpolyesters and process for the preparation thereof	Vijayanathan Veena, Prasad Vadakkethonippurathu Sivankutty Nair, Pillai Chennakkattu Krishna Sadasivan	GB GB2360778

Single step process for the synthesis of nanoparticles of ceramic oxide powders	James Jose, Jose Rajan, John Asha Mary, Koshy Jacob	US 6761866
Heavier halogen atom substituted squaraine based dyes, process for the preparation thereof and use thereof as sensitizers for photodynamic, therapeutical and industrial applications	Danaboyina Ramaiah, Kalliat Thazhathveetil Arun, Das Suresh	US 6770787
Process for the preparation of novel ceramic substrate ba2 dymo5.5 (m=zr, sn and hf), for bi-cuprate superconductors and a process for the preparation of phase pure superconducting bi(2223) and bi(2223)-ag thick films on these newly developed substrates	Koshy Jacob, Kurian Jose, Sajith Poo Kodan, Kumar Krishnan Sudersan, Jose Rajan, John Asha Mary, Damodaran Alathur Damodaran	JP 3554910
Device for treatment of wastewater	Haridas Ajit	ZA 2003/2233
Squaraine based dyes and process for preparation thereof	Das Suresh, Kakkudiyil George Thomas, Pillai Biju Vasudevan, Unni Santosh, Velate Suresh	DE 10196853
Biological filter for the purification of waste gases	Haridas Ajit, Majumdar Swachchha	EP EP 1438120 B1
RRL (TVM) + DST		
Melt processible thermotropic liquid crystalline terpolyesters and process for the preparation thereof	Prasad Vadakkethonippurathu Sivankuttynair, Pillai Chennakkattu Krishna Sadasivan, Ravindranathan Marayil	GB GB2360777

ANNEXURE - II

TOP PAPERS WITH IMPACT FACTOR (IF) > 5 PUBLISHED BY CSIR

LAB	TITLE/ AUTHOR	JOURNAL	AFFL	IF
CCMB	Aggarwal-RK	NATURE	2004, Vol 428, Iss 6982, pp 467-467	30.979
CCMB	Pal Bhadra-M	SCIENCE	2004, Vol 303, Iss 5658, pp 669-672	29.162
RRLTVM	Roy-JJ	CHEM REV	2004, Vol 104, Iss 9, pp 3705-3721	21.036
RRLTVM	Nair-V	ACCOUNTS CHEM RES	2004, Vol 37, Iss 1, pp 21-30	15.000
NCL	Pandey-G	ACCOUNTS CHEM RES	2004, Vol 37, Iss 3, pp 201-210	15.000
CCMB	Sankara-narayanan-R	NATURE STRUC MOL BIOL	2004, Vol 11, Iss 9, pp 894-900	11.579
NCL	Shankar SS	Nat Mater	2004, vol. 3, ISS 7, pp 482-488	10.778
NCL	Aharoni-A	PLANT CELL	2004, Vol 16, Iss 11, pp 3110-3131	10.679
IICT	Garcia-A	BLOOD	2004, Vol 103, pp 2088-2095	10.120
IICB	Bandyopadhyay-G	BLOOD	2004, Vol 104, Iss 8, pp 2514-2522	10.120
CDRI	Tamilvanan	PROG LIPID RES	2004, Vol 43, pp 489-533	10.000
IMTECH	Issac-B	GENOME RES	2004, Vol 14, Iss 9, pp 1756-1766	9.635
RRLTVM	George-SJ	ANGEW CHEM INT EDIT	2004, Vol 43, Iss 26, pp 3422-3425	8.427
RRLTVM	Nair-V	ANGEW CHEM INT EDIT	2004, Vol 43, Iss 39, pp 5130-5135	8.427
IICT	Sharma-GVM	ANGEW CHEM INT EDIT	2004, Vol 43, Iss 30, pp 3961-3965	8.427
IICT	Choudary-BM	ANGEW CHEM INT EDIT	2004, Vol 44(2),pp 322-325	8.427
CLRI	Vijayaraghavan-R	ANGEW CHEM INT EDIT	2004, Vol 43, Iss 40, pp 5363-5366	8.427
CCMB	Shivaswamy-S	MOL CELL BIOL	2004, Vol 24, Iss 9, pp 3596-3606	8.142
NCL	Ratnasamy-P	ADV CATAL	2004, Vol 48, pp 1-169	7.889
CDRI	Srivastava	MED RES REV	2004, Vol 25, pp 66-92	7.788
CDRI	Tripathi-RP	MED RES REV	2004, Vol 25, pp 93-131.	7.788
RRLTVM	Yesodha-SK	PROG POL YM SCI	2004, Vol 29, Iss 1, pp 45-74	7.759

CSMCRI	Bhattacharya-A	PROG POLYM SCI	2004, Vol 29, Iss 8, pp 767-814	7.759
CMRI	Zhang-S	PROG POLYM SCI	2003, Vol 28, Iss 11, pp 1517-1538	7.759
IGIB	Ragothaman-M	ANN NEUROL	2004, Vol 55, Iss 1, pp 130-133	7.717
CCMB	Bajpai-R	DEVELOPMENT	2004, Vol 131, Iss 5, pp 1007-1016	7.663
CCMB	Reddy-TV	DEVELOPMENT	2003, Vol 130, Iss 24, pp 5975-5987	7.663
CCMB	Pallavi-SK	DEVELOPMENT	2003, Vol 130, Iss 20, pp 4931-4941	7.663
IMTECH	Singh-P	TRENDS BIOTECHNOL	2004, Vol 22, Iss 3, pp 142-146	7.517
CLRI	Thanikaivelan-P	TRENDS BIOTECHNOL	2004, Vol 22, Iss 4, pp 181-188	7.517
CLRI	Viswanathan-V	DIABETES CARE	2004, Vol 27, Iss 2, pp 474-477	7.501
NCL	Selvakanan-PR	Advan Mater	2004, Vol. 16, Iss 12, pp 966-971	7.305
CCMB	Dhawan-J	J CELL SCI	2004, Vol 117, Iss 17, pp 3735-3748	7.250
CCMB	Bharathi-V	J CELL SCI	2004, Vol 117, Iss 10, pp 1911-1922	7.250
CCMB	Mitra-R	FASEB J	2004, Vol 18, Iss 12, pp U770-U786	7.172
IICB	Sen-N	CELL DEATH DIFFER	2004, Vol 11, Iss 8, pp 924-936	7.008
NCL	Desai-SM	ADV POLYM SCI	2004, Vol 169, pp 231-293	6.955
IMTECH	Cameotra	CURR OPIN MICROBIOL	2004, Vol 7, pp 262-266	6.869
CFTRI	Pramod-SN	J ALLERGY CLIN IMMUNOL	2004, Vol 113, Iss 1, pp 171-173	6.831
IICB	Das-A	TRENDS IN PARASITOLOGY	2004, Vol 20, Iss 8, pp 381-387	6.788
CDRI	Dube-A	TRENDS PARASITOL	2004, Vol 20, Iss 8, pp 358-360	6.788
IMTECH	Kaur-H	BIOINFORMATICS	2004, Vol 20, Iss 16, pp 2751-2758	6.701
IMTECH	Sharma-D	BIOINFORMATICS	2004, Vol 20, Iss 9, pp 1405-1412	6.701
IMTECH	Bhasin-M	BIOINFORMATICS	2004, Vol 20, Iss 3, pp 421-423	6.701
IGIB	Sharma-R	BIOINFORMATICS	2004, Vol 20, No 7, pp 1074-80	6.701
IGIB	Grover-D	BIOINFORMATICS	2004, Vol 20,6, pp 813-7	6.701
IGIB	Sachdeva-G	BIOINFORMATICS	2004, SEP 16	6.701

IGIB	Pandey-N	BIOINFORMATICS	2004, Vol 20, Iss 17, pp 2904-2910	6.701
IGIB	Prakash-T	BIOINFORMATICS	2004, Vol 20, Iss 16, pp 2886-2888	6.701
NCL	Dandekar-DH	NUCLEIC ACIDS RES	2004, Vol 32, Iss 4, pp 1270-1278	6.575
IMTECH	Bhasin-M	NUCLEIC ACIDS RES	2004, Vol 32, pp W383-W389	6.575
IMTECH	Bhasin-M	NUCLEIC ACIDS RES	2004, Vol 32, pp W414-W419	6.575
IMTECH	Singh-B	NUCLEIC ACIDS RES	2004, Vol 32, pp W559-W561	6.575
IGIB	Kumar-P	NUCLEIC ACIDS RES	2004, Vol 32,10, pp E80	6.575
IGIB	Singh-SR	NUCLEIC ACIDS RES	2004 Jan 2;32(1):201-10	6.575
CDRI	Varshney-U	NUCLEIC ACIDS RES	2004, Vol 32, Iss 3, pp 1018-1027	6.575
RRLTVM	Arunkumar-E	J AM CHEM SOC	2004, Vol 126, Iss 21, pp 6590-6598	6.516
RRLTVM	Herrikhuyzen-JV	J AM CHEM SOC	2004, Vol 126, pp10021-10027	6.516
RRLTVM	Kamat-PV	J AM CHEM SOC	2004, Vol 126,pp 10757-10762	6.516
NCL	Gourishankar-A	J AM CHEM SOC	2004, Vol 126, Iss 41, pp 13186-13187	6.516
IICT	Choudary-BM	J AM CHEM SOC	2004, Vol 126, Iss 8, pp 2292-2293	6.516
IICT	Choudary-BM	J AM CHEM SOC	2004, Vol 126, Iss 11, pp 3396-3397	6.516
IICT	Chandrasekhar-S	J AM CHEM SOC	2004, Vol 126, Iss 42, pp 13586-13587	6.516
IICT	Choudary-BM	J AM CHEM SOC	2004, Vol 126(21), pp 6833	6.516
IICT	Vairamani-M	J AM CHEM SOC	2003, Vol 125(1),pp 42-43	6.516
IGIB	Ganguli-M	J AM CHEM SOC	2004, Vol 126, Iss 1, pp 26-27	6.516
CDRI	Naryan-S	ONCOGENE	2004, Vol 23, pp 5880-89	6.495
RRLJAM	Singh-J	J BIOL CHEM	2004, Vol 279, Iss 37p 38969-38977	6.482
NCL	Vathipadiekal-V	J BIOL CHEM	2004, Vol 279, Iss 45, pp 47024-47033	6.482
IMTECH	Tiwari-S	J BIOL CHEM	2004, Vol 279, Iss 42, pp 43595-43603	6.482
IMTECH	Bhasin-M	J BIOL CHEM	2004, Vol 279, Iss 22, pp 23262-23266	6.482
IICB	Bhatta charyya-SN	J BIOL CHEM	2004, Vol 279, Iss 12, pp 11259-11263	6.482
IGIB	Saini-AK	J BIOL CHEM	2004, Vol 279, Iss 48, pp 50142-50149	6.482

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CFTRI	Kumar-P	J BIOL CHEM	2004, Vol 279, Iss 29, pp 30425-30432	6.482
CDRI	Asthana-N,	J BIOL CHEM	2004, Vol 279, pp 55042-50	6.482
CDRI	Srivastava-KK	J BIOL CHEM	2004, Vol 279, pp 29911-20	6.482
CCMB	Jeromin-A	J BIOL CHEM	2004, Vol 279, Iss 26, pp 27158-27167	6.482
CCMB	Shivakrupa-R	J BIOL CHEM	2003, Vol 278, Iss 52, pp 52188-52194	6.482
CCMB	Akhtar-MW	J BIOL CHEM	2004, Vol 279 (53), pp.55760-55769	6.482
IICT	Singh-RS	CHEM BIOL	2004, Vol 11, Iss 5, pp 713-723	6.129
IICT	Majeti-BK	CHEM BIOL	2004, Vol 11, Iss 4, pp 427-437	6.129
CCMB	Joshi-MB	MOL BIOL EVOL	2004, Vol 21, Iss 3, pp 454-462	6.050
IGIB	Verma-R	BIOL PSYCHIAT	2004, Vol 55, Iss 2, pp 196-199	6.039
NBRI	Baba-K	PLANT J	2004, Vol 38, Iss 1, pp 38-48	5.914
CCMB	Chandak-GR	GUT	2004, Vol 53, Iss 5, pp 723-728	5.883
IICT	Garcia-A	PROTEOMICS	2004, Vol 4, pp 656-668	5.766
IICT	Nagaveni-V	ANAL CHEM	2004, Vol 76, Iss 13, pp 3505-3509	5.250
IICB	Pal-A	ANAL CHEM	2004, Vol 76, Iss 14, pp 4237-4240	5.250
IICB	Pal-A	ANAL CHEM	2004, Vol 76, Iss 1, pp 98-104	5.250
CCMB	Qamra-R	J MOL BIOL	2004, Vol 342, Iss 2, pp 605-617	5.239
CCMB	Acharya-P	J MOL BIOL	2004, Vol 341, Iss 5, pp 1271-1281	5.239
NCL	Vaidya-SR	J Virological Methods	2004, Vol. 119, Iss 1, pp 7-9	5.225
CCMB	Khurana-R	ENDOCRINOLOGY	2004, Vol 145, Iss 12, pp 5465-5470	5.063

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ANNEXURE - V

LIST OF NETWORKED PROJECTS WITH NODAL LABS

1. Spearheading small civilian aircraft design, development & manufacture (NAL)
2. Exploration and Exploitation of Microbial Wealth of India for novel compounds and biotransformation process (IMT)
3. Molecular biology of selected pathogens for developing drugs targets (CDRI)
4. Study of Mesozoic sediments for hydrocarbon exploration (NGRI)
5. Pollution monitoring mitigation systems and devices (NEERI)
6. Asthmatic and allergic disorders mitigation mission (IICB)
7. Newer scientific herbal preparations for global positioning (RRL-JAMMU)
8. Special Electron Tube Technologies for large scale applications (CEERI)
9. Environment friendly Leather Processing Technology (CLRI)
10. Comprehensive Traditional Knowledge Digital Documentation Library (NISCAIR)
11. Catering to Specialised Aerospace Materials (NAL)
12. Developing Cells & Tissue Engineering (CCMB)
13. Toxicogenomics of polymorphism in Indian population to industrial chemicals for development of biomarkers (ITRC)
14. Designing animals and plants as bio-reactors for proteins & other products (CIMAP)
15. Development of Catalysis & Catalysts (NCL)
16. Developing Green Technologies for Organic Chemicals (IICT)
17. Acquisition of Oceanographic Research Vessel (ORV) for Oceanographic Research (NIO)
18. Impact of anthropogenic perturbations oceanographic atmospheric Processes in and around India in the context of global change (NIO)
19. Development of Key Technologies for Photonics and Opto Electronics (CGCRI)
20. Developing capabilities & facilities for Microelectrochemical systems (Mems) and Sensors (CEERI)
21. Coal Characterisation & Resource Quality Assessment (CFRI)
22. Developing New Generation Fuels & Lubricants (IIP)
23. Positioning Indian nutraceuticals and neutrigenomics in a global platform (CFTRI)
24. Setting up a world class drug research institute (CDRI)
25. Predictive medicine using repeat and single nucleotide polymorphisms (IGIB)
26. Drug target development using in-silico biology (IGIB)
27. Animal models and animal substitute technologies (CDRI)

28. Developing New Building Construction Materials (CBRI)
29. Mathematical Modelling and Computer Simulation (C-MMACS)
30. Technologies for Standardization of Bioresources for and from Leather (CLRI)
31. Custom tailored special materials (CGCRI)
32. Capacity building for Coastal placer mineral mining (CMRI)
33. Upgradation of SI Base Units, National Standards of Measurements & Apex Calibration Facilities (NPL)
34. High Science & Technology for National Aerospace programmes (NAL)
35. Medicinal plant chemotypes for enhanced marker and value added compounds (CIMAP)
36. Globally competitive chemicals processes and products (IICT)
37. Development of Novel Polymeric Materials (NCL)
38. Development of Techniques and Methodologies for Exploration, Assessment and Management of Ground Water in hard rock areas (NGRI)
39. Tectonic and oceanic processes along Indian Ridge System and back arc basins (NIO)
40. Electronics for societal purposes (CSIO)
41. Industrial Waste Minimization and Clean up (NEERI)
42. Coal Preparation for quality enhancement (CFRI)
43. Natural, nature identical or similar biomolecules (CFTRI)
44. Infectious diseases handling storage and Research Facilities (CCMB)
45. Design analysis and health assessment of Special Structures including bridges (SERC)
46. New and Improved Road Technologies (CRRI)
47. National Science Digital Library (NSDL) (NISCAIR)
48. Consortium Access to Electronic Journals (NISCAIR)
49. Establishing Genetically Modified Foods Referal Facility (CFTRI)
50. Establishing Advanced facility for safety evaluation of genetically modified/engineered drugs (CCMB)
51. Developing technology packages for disaster prevention and management in underground coalifields (CMRI)
52. Biomineral processing for extraction of metal values from ores and concentrates (RRL-BHUB.)
53. Developing capabilities in Advanced Manufacturing Technology (CMERI)
54. Technology for Engineering Critical Assessment (TECA) (NML)
55. Discovery, Development and commercialization of New Bioactives and Traditional preparations (CSIRHQ.)

ANNEXURE - VI

EXTRACT OF CAG REPORT

CHAPTER X: COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

10.1 Unfruitful expenditure on procurement of Liquid Nitrogen pIant ' Regional Research: laboratory, Thiruvananthapuram procured one Nitrogen generator and one liquefier in August 1998 at a cost of Rs21.29 lakh from a UK based firm. However, the firm supplied the system with a water cooled facility instead of air cooling facility for which the order was placed by RRL. The system has not been 'installed so far and is lying unused for the last more than five years.

Regional Research Laboratory (RRL), Thiruvananthapuram, a constituent laboratory of Council of Scientific and Industrial Research, placed a purchase order on a UK based firm in March 1998 for the supply of a Nitrogen Generator and a liquefier at a cost of UK Pound 28,600 (equivalent to Rs 20.84 lakh). The equipment, required for the production of liquid nitrogen, was received in August 1998. RRL paid Rs 21.29Iakh, for it including freight and bank charges in September 1998.

The Indian agent of the firm informed RRL in September 1998 that though the purchase order was placed for a system with air cooling facility, the system that arrived at RRL was a water cooling system and that this error had happened at the shipping point in the factory. The Indian agent suggested that the water cooling system be operated, stressing that both the systems would perform well to the specifications and their cost was almost the same. He also offered to supply a water chiller free of cost. Alternatively, the agent offered to get the air cooled system from another destination which would be a complex situation and would involve additional shipping charges and also delay of a minimum of 90 days. RRL responded in November 1998 insisting on the supply of the air-cooled system for which purchase order was placed. Though the firm assured that they would supply the system as per order by January 2000, the same was not supplied by them. Thereafter, in a meeting with the Indian agent of the firm held in May 2000, RRL agreed to accept the water cooling system supplied by the firm.

The Indian agent tried to install the equipment in April, July and August 2001 without success. In April 2001 the agent could not install the system due to some problem in a cable connecting the compressor. He again checked the system in July 2001 and reported that the water pump and the chiller compressor were made defective by wrong electrical connections given by RRL. During his visit in August 2001. he found that though the system was working, it was not producing liquid nitrogen. The UK based firm refused in February 2002 to assist RRL in the matter any further.

RRL took up the matter with the High Commission of India in London in October 2003 and June 2004 to persuade the firm for commissioning the system, but the system had not been commissioned as of July 2004. It was further observed that the purchase order placed by RRL in March 1998 did not 'contain any arbitration clause in case of a dispute, with the result that RRL had no means of enforcing the contract.

Thus, the system procured at a cost of Rs 21.29 lakh was lying uninstalled and unused for. more than five years with possible implication on the serviceability of the equipment. RRL had procured 10996 litres of liquid nitrogen during November 1998 to June 2003 at Rs 5.89 lakh which could have been avoided had the system been installed.

The matter was referred to the Council in June 2004, 'who did not reply as of November 2004.

10.2 Non-installation of Fermentation System

Regional Research Laboratory amended the terms and conditions quoted by the firm while placing order for the procurement of a Fermentation System without obtaining their confirmation. As a result, the firm refused to complete the installation, resulting in the system which was procured at a cost of Rs 13.08 lakh lying unused for more than four years.

The Regional Research Laboratory (RRL), Bhubaneshwar, a unit of Council of Scientific and Industrial Research, placed an order in March 1999 at a cost of Rs 13 lakh on a firm based at Kolkata, for supply of fermentation system comprising 50 litres capacity recycling fermentor and 100 litres capacity non-cycling batch type fermentor. The system was required to build capacity in the area of larger scale fermentation studies for bio-fuel application.

The order was placed on the basis of quotation received in December 1998 from the firm. The firm had offered guarantee for a period of 14 months from the date of delivery/dispatch or 12 months from the date of commissioning/ demonstration whichever was earlier. While placing the order in March 1999, RRL incorporated a guarantee clause for a period of 24 months and also introduced a clause for performance bank guarantee of 10 *per cent* of the order value during the period of guarantee. Immediately after receipt of the order, the firm in April 1999 requested RRL to amend the terms and conditions of the purchase order. which were not as per their quotation. RRL did not respond to the firm' s request. In May 1999 a two-member team of RRL visited the works of the firm for inspection and found the fermentor ready for dispatch. On the assurance given by the team members which went for inspection that the amendment would be issued, the firm delivered the system in June 1999. RRL released Rs 13.08 1akh. which was 90 *per cent* of the order value plus other charges in the same month. Though RRL was aware of the requirement of a Constant Voltage Transformer (CVT), it did not arrange for the same before installation. The representative of the firm who visited RRL in July 1999 could not install the system in the absence of CVT. After a lapse of more than six months, RRL in January 2000 placed an order for procurement of CVT costing Rs 0.45 lakh which was received in April 2000. However, the firm refused to complete the installation of the system as RRL had not amended the conditions of the purchase order deleting the performance, bank guarantee clause.

In view of the delay in installing/ commissioning of the system, Director, RRL constituted a three'-member Committee in September 2002 to suggest suitable measures to expedite the'" installation of the system. The Committee in December 2002 suggested. to give a final chance to the representative of the firm for completion of the installation work, failing which legal action could be initiated. However, as of July 2004,'neither the system was commissioned nor any legal action had been initiated against the firm.

RRL stated in July 2004 that its vigilance had called for the documents for examination for initiation of legal action against the firm. It further stated that due to non-installation of the system it had not been possible to conduct larger scale fermentation.

RRL failed to ensure installation of the system even after five years and after incurring an expenditure of Rs 13.08 lakh. Absence of the system hampered research. There is also serious doubt about the serviceability of the system as it has been lying uninstalled for long. The matter was referred to the Council in June 2004. who did not reply as of November 2004.

ANNEXURE - VII

Prime Minister's Speech at the CSIR Society Meeting

July 26, 2004 New Delhi

Distinguished Members of the CSIR Society, Ladies and Gentlemen.

1. It gives me great pleasure to be with you at this meeting of the Society. As many of you know, I have taken keen interest in the development of science & technology and scientific and industrial research in our country. I would like to reassure you at the very outset that these areas will remain subjects of high priority for me and our government.

2. I will be seeking your advice and support with respect to policies and programmes in the area of science and technology and would appreciate your coming forward with practical ideas that we should give high priority to.

3. I would like to congratulate CSIR for the remarkable transformation into a performance driven and user focused organistion. The entire CSIR family deserves to be complimented for achieving this feat. It is particularly gratifying to see, from Dr. Mashelkar's presentation, the accolades it has received from the business, the scientific community, and also the international management experts on this transformation. I am also happy to hear that the CSIR's next phase of transformation will be driven by the recommendations made thorough the Kelkar Committee that was set up for the purpose.

4. CSIR is very fortunate to have Shri Kapil Sibal as the Minister of State for Science and Technology and also as the Vice-President of CSIR. Knowing his dynamism and vision, I am sure the process of the next phase of transformation of CSIR will be completed within the foreseeable future. As the President of CSIR Society, I would like to extend my very best wishes for a glorious journey ahead for the CSIR family.

5. I am happy to see that CSIR is flying higher and further. I was particularly happy to get the news of the successful maiden flight of SARAS on 29th May, this year. This aircraft has been indigenously designed and built by our own scientists and engineers. We are proud of this feat. SARAS to me is not just an aircraft, it is a symbol of India's determination to use its technological prowess to create products that will be not only globally competitive but will also benefit the country at large. I am sure SARAS will herald the dawn of civil aviation industry in India. Going further, I hope SARAS would become a 'brand name' for small aircrafts world over.

6. This CSIR Society meeting is taking place almost three months after our new Government has been in place. The Government has already announced the Common Minimum Programme (CMP) of the United Progressive Alliance on 27th May, 2004. As you will see, science and technology has been given a place of pride in this programme. I would like to begin by emphasizing the new direction that science and technology has to take in future to make a greater difference to the lives of the Indian people.

7. CMP envisages that the UPA Government will follow the policies and introduce programmes that will strengthen India's vast science and technology infrastructure. We have also stressed that science and technology development and application missions will be launched in key areas covering both 'global leadership' and 'local transformation'. I am happy to see from Dr. Mashelkar's presentation that CSIR's programmes have focused on not only attaining 'global leadership' but also on issues which have deep 'local relevance'.

8. Our S&T system can play a decisive role only when it advances the well being of all sections of society, not just a privileged few. It must play the bigger role of creating wealth for all, not just a selected few. A theme that is close to my heart is on 'making technologies work for the poor and the underprivileged'. In other words, can we develop technologies, which will ameliorate the poverty, create jobs, remove the disease burden of the poor, and improve the overall quality of life?

9. Let us take a special issue of the disease burden of the poor. We have emphasized in CMP that UPA Government will take all steps to ensure availability of life saving drugs at reasonable prices. As was pointed out by Dr. Mashelkar, the costs of development of new drugs have been soaring and, therefore, India must find out alternative paths for drug development. CSIR has had a track record of developing drugs for diseases of the poor including, Malaria, AIDS, etc. It should continue its efforts further not only on innovative process chemistry but development of entirely new drugs. The new IPR regime is going to put pressure on the Indian drug industry to develop new drugs. CSIR should be a willing and active partner with Indian industry in this endeavour and especially focus on the diseases of the poor.

10. CSIR could do a lot in other sectors too. For example, CMP has focused on the housing for the weaker sections in rural areas. Can we look at the use of new technologies for creating affordable housing for the poor? We have just witnessed the heart rendering scenes when around 100 young children perished in Kumbakonam in Tamil Nadu. Can we not look at alternative technologies that will create safer fire proof structures, which are cost effective and affordable at the same time? I am familiar with the good work that CSIR had done in Navodaya Vidyalaya in the past. However, I would like to see a CSIR that is sensitive to the happening around, such as in Kumbakonam, and respond with speed and determination so that such tragedies do not occur.

11. Water is becoming a precious commodity. I understand that in one of the early meetings of Scientific Advisory Committee to Prime Minister (SAC-PM), Rajiv Gandhi had said 'John Kennedy set up a mission to send a man on the moon. To me the equivalent mission is to take drinking water to 186000 villages in India'. Rajiv Gandhi Mission was set up to achieve this objective. However, we are far away from fulfilling this dream of Rajivji. The scenes of women carrying water over a distance of a few kilometers is still common. Can we not bring in new technologies to fulfil this mission? I am acutely aware of the fact that new technologies can do so much but nothing can be achieved without good delivery mechanisms. Technologists must integrate their efforts fully into such delivery mechanisms by partnering with other Ministries and Departments.

12. Several of CSIR's core competencies can be used effectively to solve India's water related problems. The Government has declared its intention to establish desalination plants all along the Coromandel Coast starting with Chennai. I understand that CSIR has a great deal of expertise in desalination technologies. I would like to see CSIR work in a true 'Team India' fashion to provide all possible technological assistance so that we can meet these targets set up in CMP.

13. While addressing the conference of Chief Ministers on poverty alleviation and rural prosperity through Panchayat Raj that was held on 29th June, 2004, I had suggested that our strategy for the rural development must be fashioned to unleash the productivity potential of our agriculture and its allied activities. I had stressed that technological possibilities to break new grounds in increasing productive capacity of small farms and small businesses need to be fully harnessed. We want to focus on employment intensive schemes in small scale industry. We have decided to free this sector from Inspector Raj giving them full credit of technological and marketing support. I would kike to see such technology being provided by CSIR.

14. I had also said that decentralized power in terms of local electricity generation and use can make the Gandhian vision of decentralized production not only an ethical idea but also a viable economic option. CSIR should develop and deliver such technologies so that we can achieve this objective.

15. There is a new big opportunity in terms of the herbal wealth of people in tribal areas, which can greatly benefit from the attention now given by business to Non Timber Wood Products. Dr. Mashelkar's presentation on CSIR's 'bioactives network programme' by exploiting India's herbal wealth has demonstrated that value added therapeutics can be made through this approach. Here is a possibility of the herbal wealth of the people in tribal areas leading to the creation of economic wealth for the people. CSIR needs to redouble this effort, which can bring in a new societal transformation.

16. It was Pandit Jawaharlal Nehru, who had realized the crucial role of science and technology in nation building in post-independent India. He had once said 'it is an inherent obligation of a great country like India with its traditions of scholarship and original thinking and its great cultural heritage to participate fully in the march of science, which is probably mankind's greatest enterprise today'. I wish to assure the eminent members of the CSIR Society that this Government we will do its best to see that the Indian participation in this great march of science is supported most enthusiastically and vigorously.

17. The Government will not shy away from investing in science and technology research and development provided what we do improves the quality of life of our people and makes our country move self-reliant. Equally our focus must be on making our industry more globally competitive.

I wish the society well in its work.

Thank you

CSIR Society Meeting

The speech by MOS (IC) (S&T & OD) on 26th July, 2004

1. Hon'ble Prime Minister, a warm welcome to you. It is a matter of pride for us that you are the President of the CSIR Society. In the short span of two months that this Government has been in power, you have set new paradigms - giving India a new vision through the Common Minimum Program. The good of the common man is central to all that our Government stands for. You have given the common man hope for the future. We look forward to your guidance to the CSIR family. We would like the CSIR to be instrumental in realizing the aspirations of the people of India.

2. I will also like to extend a warm welcome to my good friend and the Hon'ble Finance Minister, Mr. Chidambaram. I also welcome all the eminent members of the Society.

3. I am proud and fortune to be the Vice-President of CSIR. I have been working with Dr. Mashelkar and his team closely. I have been visiting CSIR laboratories and meeting young members of this unique family. I am happy to notice the commitment and passion with which members of the family view their responsibilities. This makes me feel optimistic about the future of CSIR.

4. The exemplary leadership provided by Dr. Mashelkar has transformed the CSIR into a unique entity that is truly making a difference to the lives of ordinary Indians. Perhaps the common man is not be aware of this extraordinary contribution. When a farmer uses a Swaraj or Sonalika tractor, he does not know that it is designed by CMERI. When a mother gives Amul baby food to her child, she does not know that the product is developed by CFTRI. When a doctor prescribes E-MAL to a patient suffering from cerebral Malaria, he does not realise the role of CDRI. When a paternity dispute is solved by using DNA finger printing technique, little does one realise that it was pioneered in India by CCMB. When 650 million voters receive indelible ink marks, they hardly realise that the original technology was developed by NPL. All this represents pathbreaking activities of CSIR laboratories.

   One of our first endeavours, therefore, is to make people aware of what CSIR is all about. As CSIR's proud Vice-President, I would like to communicate with people - not only to showcase CSIR's achievements but the contributions of the scientific fraternity in my Ministry to the developmental goals that we are committed to realise. That is why every month, I meet the press not just to inform but also be open to public audit. We will also explore other means of communication with the people. We must communicate both with the urban elite and the rural poor.

5. Over the last two months, we have introspected. We are not asking what the nation can do for CSIR, but what we in CSIR can do for the nation. The CMP has been studied in depth by the CSIR family. Each CSIR laboratory has had detailed brain storming to see what it can contribute to the CMP. On 20th and 21st August, I and all the Directors of CSIR are meeting

in Bangalore to draw out a detailed plan on what CSIR can do in critical sectors of water, health, energy, environment, housing and so on. It will not only be a 'Team CSIR' effort - it will be a 'Team India' effort. Let me cite one example. Our FM, following the declaration in the CMP, announced the intention of setting up desalination plants for drinking water around the Coromandel Coast. Bhabha Atomic Research Centre (BARC) and CSIR's CSMCRI have had several meetings to make a technology offering to fulfill this objective - both have complementary strengths in desalination technology. By the end of August, we will have lined up a few major initiatives with detailed implementation plans that we would like to present to our Hon'ble Prime Minister.

6. CSIR's transformation in the decade of nineties is admired worldwide. Dr. Mashelkar in his presentation will give you a glimpse of this. Recently, my friend and senior colleague, Mr. Sharad Pawer has been having consultations with some of us to see as to how we can help him restructure, reform and revitalise ICAR by using our own successful experiments in CSIR. We will be delighted to help, of course, in every possible way. But we will go beyond that. I have had a discussion with Dr. Swaminathan. We are now working on a plan to mitigate the distress of farmers by forging a partnership between ICAR, CSIR, DST, DBT and others.

7. We believe that CSIR has yet to achieve its real potential. We must do that quickly. We attempted to address this question by setting up a Committee under Dr. Kelkar, with eminent economists, scientists and administrators as its members. The Committee has submitted its report. A presentation was made to me by the Kelkar Committee. It findings are revealing and encouraging. Many of its recommendations are topical, timely and, if implemented, would propel CSIR to become a vibrant prime mover of the National Innovation system. I intend to help and guide CSIR to implement the Kelkar Committee report .

8. Finally, let me recollect with pride the maiden flight of SARAS that took place on 29th May 2004. The entire nation was proud of 'TEAM SARAS'. They deserve our congratulations.

9. I once again thank the Hon'ble Prime Minister for his gracious presence today. I now invite Dr. Mashelkar to make his presentation on the ongoing journey of the CSIR. I believe that its activities will kindle hope in future generations.

CSIR ESTABLISHMENTS

CBRI	Central Building Research Institute, Roorkee -247 667
CCMB	Centre for Cellular and Molecular Biology, Hyderabad-500 007
CDRI	Central Drug Research Institute, Lucknow -226 001, cdriindia.org
CECRI	Central Electrochemical Research Institute, Karaikudi -623 006
CEERI	Central Electronics Engineering Research Institute, Pilani -333 031
CFRI	Central Fuel Research Institute, Dhanbad -828 108
CFTRI	Central Food Technological Research Institute, Mysore-570 020
CGCRI	Central Glass and Ceramic Research Institute, Kolkata -700 032
CIMAP	Central Institute of Medicinal & Aromatic Plants, Lucknow -226 015
CLRI	Central Leather Research Institute, Madras -600 020
CMERI	Central Mechanical Engineering Research Institute, Durgapur -713 209
CMRI	Central Mining Research Institute, Dhanbad -826 001
CRRI	Central Road Research Institute, New Delhi -110 020
CSIO	Central Scientific Instruments Organisation, Chandigarh -160 030,
CSMCRI	Central Salt & Marine Chemicals Research Institute, Bhavnagar -364 002,
IGIB	Institute of Genomics & Integrative Biology, Delhi -110 007
IHBT	Institute of Himalayan Bioresource Technology, Palampur -176 061 (HP),
IICB	Indian Institute of Chemical Biology Jadavpur, Calcutta -700 032
IICT	Indian Institute of Chemical Technology, Hyderabad -500 007
IIP	Indian Institute of Petroleum, Dehradun -248 005
IMT	Institute of Microbial Technology, Chandigarh -160 036
ITRC	Industrial Toxicology Research Centre, Lucknow -226 001
NAL	National Aerospace Laboratories Bangalore -560 017
NBRI	National Botanical Research Institute, Lucknow -226 001
NCL	National Chemical Laboratory, Pune -411 008
NEERI	National Environmental Engineering Resarch Institute, Nagpur -440 020
NGRI	National Geophysical Research Institute, Hyderabad -500 007
NIO	National Institute of Oceanography, Goa -403 004
NISCAIR	National Institute of Science Communication And Information Resources , New Delhi-110012
NISTADS	National Institute of Science Technology and Development Studies, New Delhi-110012
NML	National Metallurgical Laboratory, Jamshedpur-831 007
NPL	National Physical Laboratory, New Delhi -110 012
RRL-BHO	Regional Research Laboratory, Bhopal -462 026
RRL-BHU	Regional Research Laboratory, Bhubaneshwar -751 013
RRL-JAM	Regional Research Laboratory, Jammu Tawi -180 001
RRL-JOR	Regional Research Laboratory, Jorhat -785 006
RRL-TRI	Regional Research Laboratory, Thiruvananthapuram -695 019
SERC	Structural Engineering Research Centre, Chennai -600 113