



CSIR

Making Pathways
Into New Frontiers



Council of Scientific & Industrial Research (CSIR)

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Council of Scientific & Industrial Research (CSIR), India



CSIR @ Frontiers of Science with a Human Face

Passion...

Innovation...

Compassion...

For Inclusive Growth

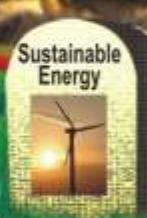
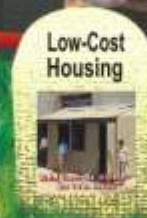
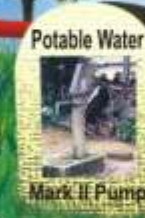
Competitive Industrial Growth

Sustainable Inclusive Growth

High Science & Innovation
CSIR
Expressway



Technology of the Future



Taking Rapid Strides Under Able Leadership...



"It is science alone that can solve the problems of hunger and poverty, of insanitation.... of vast resources running to waste..... Who indeed could afford to ignore science today?"

Jawahar Lal Nehru
First Prime Minister of India



"The challenge before Indian S&T is, therefore, to generate high technology, creating wealth and prestige for India, while also ensuring that this technology improves the lives of the poor. I compliment CSIR Society for some of their recent breakthroughs in advanced scientific areas that have the potential to meet the basic needs of our people".

Dr. Manmohan Singh
President, CSIR
& Hon'ble Prime Minister of India
CSIR Society Meeting 2005



CSIR is as relevant today to a resurgent India as it was to the newly independent country struggling to establish itself in the comity of nations. CSIR has transformed itself to meet the demands of changing times and as such has emerged revitalized with each challenge successfully overcome. Today it is a dynamic organization with an enviable lineage and portfolio of products/technologies that have led to an appreciable betterment in the quality of life for the people of India.

Pawan Kumar Bansal
Vice President, CSIR
& Hon'ble Union Minister of Science & Technology,
Earth Sciences and Minister of Parliamentary Affairs



CSIR is poised to catalyze synergy between the might and speed of the private sector on one hand and the incredible R&D infrastructure and intellectual manpower of the Government on the other to channelize effective transfer of the benefits of science to the poorest of the poor while receiving international accolades for its cutting edge science.

Prof. Samir K. Brahmachari
Director General, CSIR
& Secretary, Department of
Scientific & Industrial Research

CSIR - Touching Lives in a Million Forms

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CSIR: Over 60 Years of Science



Council of Scientific and Industrial Research (CSIR), established in 1942, is an autonomous Society whose President is the Prime Minister of India. An ensemble of 37 state-of-the-art institutes, today, CSIR is amongst the foremost scientific and industrial research organizations in the world. CSIR expertise and experience is embodied in its ~ 4,600 Scientists and 8,000 scientific and technical support personnel apart from ~ 7000 research students. Over the years, this unique organization has served as a springboard for scientific and technological activities in a wide variety of S&T domains. It has helped India usher in a scientific milieu, creating and nurturing talent in science, innovation and technology.

Mission

"To provide scientific industrial research & development that maximizes the economic, environmental and societal benefits for the people of India."

Key Sectors of Knowledge & Technology Generation

- Biological Sciences
- Engineering Sciences
- Information Sciences
- Chemical Sciences
- Leather & Environmental Sciences
- Physical & Earth Sciences

Key Facts

- One of the largest public-funded R&D organizations
- The highest international patent holders from India (about 1800 patents)
- About 4000 research papers (SCI) annually
- Over 300 contract R&D technology licensing agreements

Financial Snapshot

- Annual budgetary support of about Rs. 2000 crore
- Revenues from external sources of about Rs. 350 crore

Partnering with Industry

Over the last decade, CSIR partnered with more than 5000 industries in India and abroad. These include:

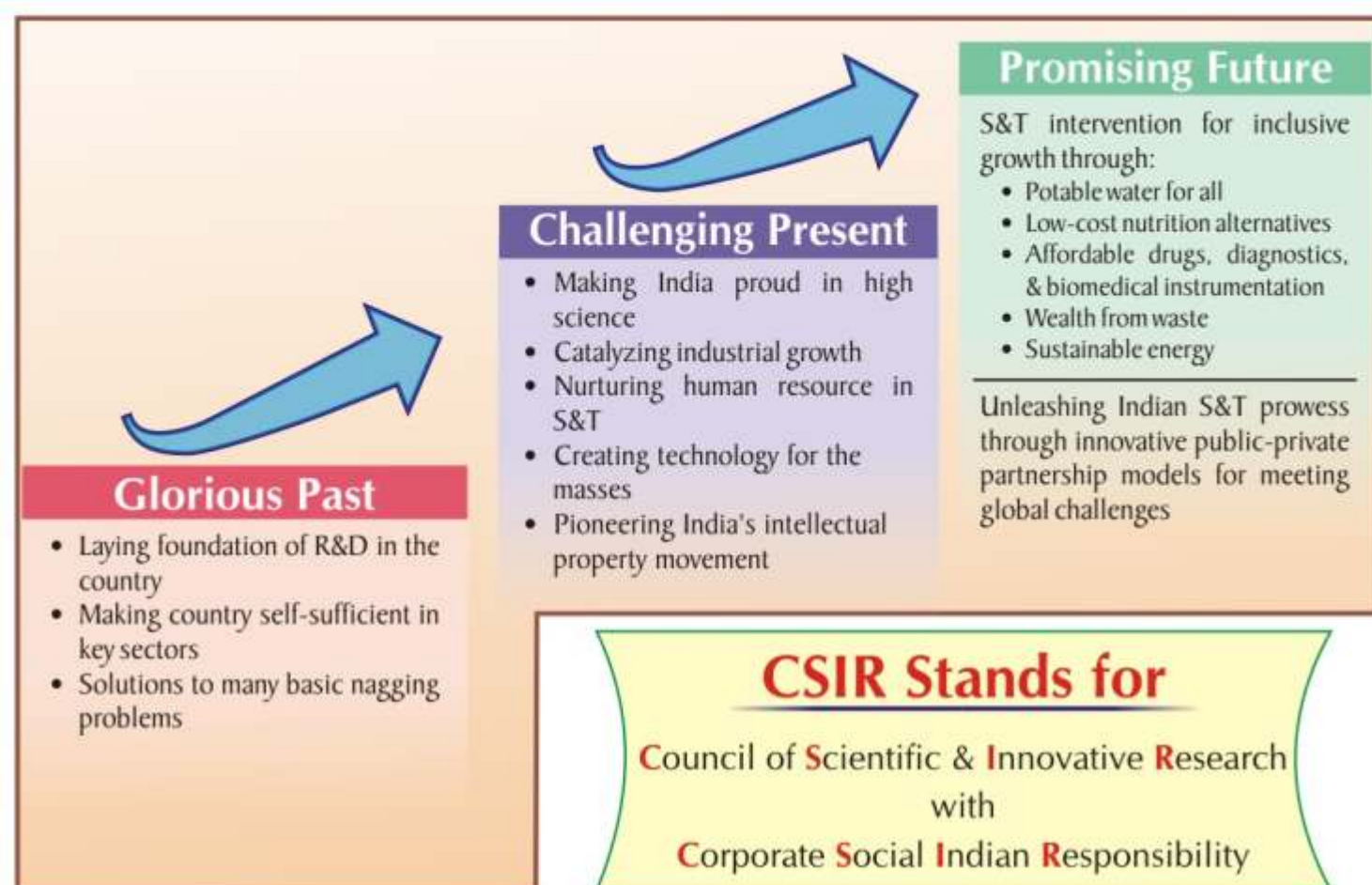
Indian

- ONGC
- CIPLA
- Ranbaxy Laboratories
- Reliance Industries Limited
- Tata Motors
- TCS & many more

Abroad

- Boeing Corp (US)
- Alcoa (US)
- Du Pont (US)
- FMC Corp (US)
- General Electric (US)
- Novo Nordisk (Denmark)
- Smithkline Beecham (US)
- & many more

CSIR Adapting to Changing Needs



Strategy & Execution



Over 60 Years of Innovation



Up to 1960s

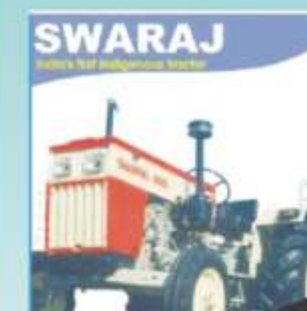


During general elections, nearly 600 million people wear a CSIR mark on their fingers. The Indelible ink used to mark the fingernail of a voter during general elections is a time-tested gift of CSIR to the spirit of democracy. Developed in 1952, it was first produced in-campus. Subsequently, Industry has been manufacturing the Ink. It is also exported to Sri Lanka, Indonesia, Turkey and other democracies. Even today, CSIR receives substantial royalty through NRDC.

During 1960s, all the baby milk food was imported. India's request to multinationals for setting up manufacturing facility was turned down on the pretext that India did not have enough cow's milk and that buffalo milk has too much fat. CSIR stepped in to develop a process to manufacture baby food from buffalo milk with excellent digestibility and handed it over to the Kaira Milk Producers Cooperative Ltd. This was the beginning of the 'white revolution' of the next decades.



1970s



Independent India had to fill its granaries to feed its millions. Green revolution was on the way, but the fledgling nation needed both manpower and machines for the agricultural sector. CSIR made an impressive debut with SWARAJ, a 20 hp tractor. Punjab Tractors Limited, a PSU, began manufacturing and selling the tractors in 1974. The SWARAJ tractor helped usher in mechanised agriculture. Today, nearly one million Swaraj tractors till the Indian soil. Next generation tractor, 'Sonalika' launched in 2000 has been generating a revenue of Rs. 1400 crores per annum. Now, it also proudly displays the CSIR logo.



The Green Revolution initiated in the late 1960s depended heavily on hybrid seeds on one hand and pest protection on the other. Responding to the need of the hour, CSIR mounted an integrated programme to develop cost-effective processes for the manufacture of essential pesticides. Over 70 per cent of the new pesticide production at one time was based on CSIR know-how. Today, CSIR has moved forward in developing genetically modified pest-resistant technology for agriculture.



Safe Drinking Water



- Ground water prospecting
- Simple to complex technologies to remove bacteria, viruses and chemicals
- Removing excess flouride by "Nalgonda technique"
- Novel rain water harvesting schemes

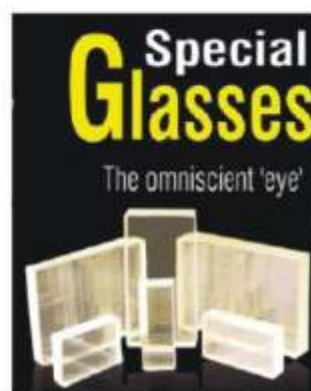
Today, CSIR is making efforts to provide low-cost potable water for all, using state-of-the-art technologies

1980s



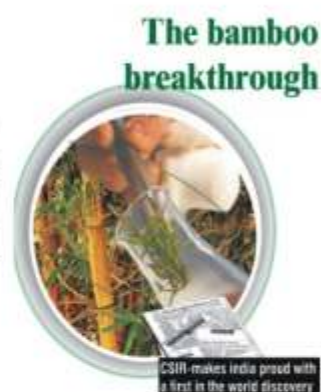
In the 1980s, India was starved of computer power. Supercomputers from the west were either too expensive or not sold to India. CSIR therefore decided to connect several sequential computers in parallel to get supercomputing power. Flosolver, India's first parallel computer was built in 1986. Flosolver's success triggered other successful parallel computing projects in the country such as PARAM. These denial-driven innovations led *Washington Post* to remark, "And Angry India does It!!" Now, CSIR has dedicated 128-node supercomputer and software for monsoon prediction.

Technology for optical glasses was guarded the worldover. However, CSIR took up the gauntlet and established its first glass manufacturing unit. Since then, CSIR has developed about 400 different types of special glasses including radiation shielding glasses to provide protection from harmful radiation.



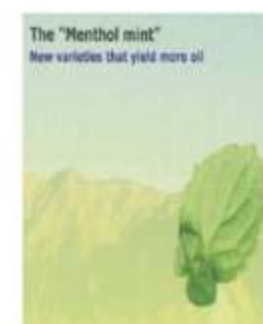
Kangra, a district of Himachal Pradesh, is known globally for its green tea. However, over the years, the plantations and production had been showing a decline. CSIR therefore devised techniques to revive and rejuvenate the plantations. Agro and harvesty practices were developed to suit locale specific conditions that greatly enhanced the production of premium tea.

Bamboo flowers only once during its lifetime and that too just once in seven to a hundred years, depending on the species. In 1990, CSIR scientists created history when they made bamboo flowering possible within weeks by using tissue culture technologies. This astonishing breakthrough made news all over the world with the *New York Time* reporting the success on its front page, making it the first-ever for Indian science.



Indian coals differ greatly in quality. CSIR technologies have helped enrich poor grade coal for efficient use, with twenty-two coal washeries in India upgrading over 29 million tons of coal. These have helped to get high value, low sulphur coals for use in steel industry and thermal power plants and thus reduced dependence on expensive and scarce prime coking or imported coals. CSIR's clean coal technology research is more relevant today for IGCC with sky-rocketing oil prices in the global market.

1990s



Farmers in the Terai regions of the Himalayas are now minting money with oil-yielding mint plants. Nearly 400,000 hectares of land is being used to cultivate the Kosi, Himalaya and Sambhav varieties of mint (*Menthol sinensis*) developed by CSIR. These pest-resistant and high oil-yielding varieties have been adopted by 20,000 farmers and have generated 40,000,000 man-days of employment. India is a global leader today in menthol mint production mainly due to CSIR's sustained efforts in developing high-yielding varieties.



When the first draft of the 3.2 billion bases of the human genome sequence was unraveled in 2000, the opportunities to harvest this information for future health care became immediately visible to CSIR. GenoMed, a knowledge alliance, the first of its kind was forged with an Indian pharma company with the highest knowledge fee in the history of CSIR. This pioneering public-private partnership was the first to realize the benefits from human research genome in the form of affordable healthcare for people in India. This led to other new public-private partnership models like The Centre for Genomic Applications (TCGA) in catalyzing genomics research in India.



- Uses indigenous probes to identify specific DNA sequences.
- Used for establishing paternity and plant variety identification.
- Basmati database for IPR protection.
- Wildlife management.

Catalyzing Change

Catalysts are at the heart of a trillion dollar industry. Multinational cartels have dominated this fiercely protected sector. In a remarkable display of Indian prowess, CSIR successfully reversed the technology transfer process. The cheaper, safer, longer-lasting Zeolite technology was transferred out of India...to Multinationals!



During the 1990s, the leather industry was facing a storm. The High Court had ordered seven hundred tanneries to close down as these were considered highly polluting. CSIR stepped in and 270 closed tanneries were revived and 250,000 jobs were saved. Spread across 17 states nationwide, the Leather Technology Mission launched by CSIR had 170 programmes with about 60 NGO's joining hands. Today, CSIR is nurturing specialized human resource for the leather industry not only in India but also abroad.

... and the legacy continues



Biology & Biotechnology —



CSIR conducts research in frontier and multidisciplinary areas of modern biology and translates these concepts into commercially viable technologies.

Significant Developments

- Pioneered DNA fingerprinting in the country
- Cybrids facility for the study of neurodegenerative diseases, with special reference to Parkinson's disease—Created for the first time in this part of the world
- Advanced facility for safety evaluation of genetically engineered drugs
- Isolation of active compounds from native plants for the treatment of chronic myeloid leukemia and peptic ulcer
- The genotype 'CIM-Arogya' of *Artemisia annua* for higher artemisinin yield
- Use of recombinant viruses harbouring an RNAi construct as sensor to screen the function of each open reading frame (ORF) of viral genome
- An efficient method to isolate and prepare large quantities of RNAsin—An enzyme inhibitor from discarded human placenta



Nurturing Life

Genetic Landscape of India: Canvas for Disease Gene Exploration

Human Genetics (2005), J Genetics (2008)

Success of a Network Project
Two publications with more than 150 authors
CSIR-led Indian Genome Variation Consortium (2003-2008)

- 55 Populations
- ~ 1000 genes linked with complex diseases and drug response

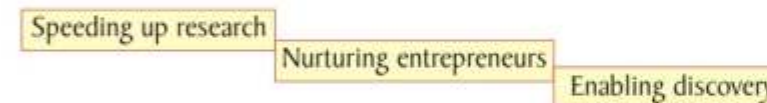
- Cardiovascular Disorders
- Metabolic Syndrome
- Diabetes
- Infectious Disorders
- High Altitude Disorders
- Asthma
- Cancer
- Neurological Disorders
- Eye Disorders
- Hematological Disorders



Public-Private Partnership

TCGA

The Centre for Genomic Application (TCGA), the first ever public-private partnership project providing life sciences service in India, is a collaborative project of IGIB/CSIR and Institute of Molecular Medicine and is partially supported by DST to create and operate core shared facility for genomics and proteomics to assist development of predictive markers for preventive and curative medicine. The vision of TCGA encompasses:



IICT-Evolva Partnership

Another public-private partnership involving IICT, Hyderabad and Evolva Biotech, Singapore, is aimed at enabling drug discovery research focused at cardiovascular, cancer and immunomodulatory segments—The first of its kind in biotech-SME segment in India. Evolva uses genetic chemistry technology while IICT specializes in creating NCEs. Evolva would screen IICT compounds and take them forward through different stages of drug discovery.

Thrust Areas

- Commercially viable products/technologies by carrying out research in genomics and biomolecules
- rDNA technology, proteomics, protein engineering, drug development, biomarkers, nanobiotechnology, DNA and immuno diagnostics
- Synthetic chemistry, in-silico biology, structural biology, molecular biology, toxicology, fermentation technology, analytical biochemistry and environmental sciences
- Bioprospecting, novel agro-technologies, transgenic crops and conserving biodiversity

IMTECH-NOSTRUM Partnership

IMTECH, Chandigarh and NOSTRUM Pharmaceuticals LLC, Edison NJ, USA, have partnered to develop a novel thrombolytic with improved target specificity.



Health Care – Affordable for All



Some CSIR drugs in the market

The Indian drugs and pharmaceuticals industry excelled in process chemistry of known drugs, but hardly created any new drugs. CSIR showed the way through world class research facilities and knowledge base enabling drug development. Eleven of the fourteen new drugs developed in India are from CSIR.

Significant Developments

- Technology for early detection of diseases including cancer and visceral leishmaniasis
- Biomarker for Asthma using repeat and single nucleotide polymorphisms
- Anti-malarial drugs–Elubaquine and Arteether, now exported to over 48 countries
- Technology for oral delivery of insulin and Hepatitis B vaccine
- “Geno cluster”: A software tool for facilitating new drug discovery
- The molecule CENTCHROMON–A non-steroidal contraceptive, being marketed as Saheli
- Five state-of-the-art Biological Safety Lab (BSL) facilities for pathogen studies, drug discovery and development



Single plant based herbal drug as hepatoprotective against alcoholic and viral cirrhosis

Health Care–Concept to Reality



Artificial Hip Joint: Both joints replaced simultaneously at AIIMS, New Delhi

Health Care: Discovery to Development

| Disease/Molecule | Status |
|------------------|---|
| Psoriasis | <ul style="list-style-type: none"> • First herbal formulation to clear IND • Phase I & II completed • Currently in Phase III • IND filed with USFDA |
| Tuberculosis | <ul style="list-style-type: none"> • Phase I completed: Moving into Phase II |
| Arthritis | <ul style="list-style-type: none"> • Large scale multi-centric Phase III clinical studies completed • Comparable to Celecoxib and Glucosamine with better safety profile |
| Diabetes | <ul style="list-style-type: none"> • Limited multi-centric Phase III clinical studies completed |
| Lysostaphin | <ul style="list-style-type: none"> • Phase I completed: Moving into Phase II |



Artificial Eye Ball (With synchronous movement)



Kit for detection of eye infection



Streptokinase: Power of Novelty, IPR & PPP

Thrust Areas

- World class drug research institute
- Stem cell research facility for regenerative medicine
- Diabetes Mellitus–New drug discovery R&D, molecular mechanisms and genetic factors
- Nano material and nano devices in health and diseases
- New drug development programme for parasitic diseases and microbial infections
- Diagnostics and target based molecular medicines against allergy, bronchial asthma and chronic obstructive pulmonary disease
- Novel target-based anticancer therapeutics
- Comparative genomics and biology of non-coding RNA in the human genome
- Open source drug discovery



Diabetic Foot Ulcer

Burn Injury

Affordable Drugs

For AIDS victims worldwide, the only source of succour is the anti-HIV cocktail. CSIR developed alternative and cheaper processes for the manufacture of these drugs and transferred the technology to CIPLA, who introduced this drug in India and other Third World countries at a fraction of the original price. CIPLA's aggressive pricing policy not only forced the multinational competitors to reduce their drug prices, but also opened up the issue of affordable life-saving medicines to the poor at a global level, leading finally to the Doha Declaration.



Agro & Food — Food for Thought



Banana: End-to-end R&D intervention
Top: High yielding varieties of medicinal and aromatic plants

CSIR has been playing a significant role in the advancement of agriculture and food processing sectors by developing globally competitive pre- and post-harvest technologies for optimal production and devising necessary machinery besides enhancing the science of nutraceuticals.



Significant Developments

- Shelf-stable food products that are storable without refrigeration
- Palm oil processing plant (2.5 tonnes FFB/hr)
- Low-cost dhal substitutes
- Fresh ginger oil
- Oryzanol from rice bran oil soapstock
- Natural food colours
- Enzymatic degumming of rice bran oil
- Novel phospholipids from soya lecithin
- Vegetable salt
- Tea wine
- Biodegradable wrapping material for packing fruits, vegetables and processed foods
- Food irradiation facilities and other infrastructural facilities for food safety
- *Gracilaria edulis* cultivation know-how for Agar in Andaman & Nicobar Islands
- Early maturing disease and pest-resistant menthol mint (*Mentha arvensis*) varieties: Himalaya and Kosi



Spirulina production and products thereof already available in the market



Ready-to-eat nutritional supplement for children

Energy Foods

Low-cost but nutritionally rich foods, such as weaning foods, based on proteins isolated from edible oilseed meals are very popular amongst the nutritionally and economically vulnerable sections of India and other developing nations. Energy food, Indian multipurpose food, bal ahar, miltone and protein foods of this kind have been extensively employed in nutrition intervention, disaster relief and social welfare projects right across the nation.



India has developed its own GM technology to protect cotton from pests

Thrust Areas

- Transgenic crop plants for resistance to insect pests
- Niche food processing technologies for outreach of cost-effective, safe, hygienic, nutritious food to the targeted population
- Genetically-modified foods referral facility



Palm oil mill processing plant at Goa



Chemicals — The Formula for Success



Improved process for Heptafluoropropane (FM-200)

CSIR has developed end-to-end knowledge base in the area of chemicals. It enjoys an obvious and immense credibility with the chemical industry, especially in the areas of agrochemicals, catalysts, speciality chemicals and chemical intermediates.



Commercial scale eco-friendly enzymatic pilot degumming plants

Significant Developments

- Process for manufacture of hydrofluorocarbons
- Catalytic process for the manufacture of epichlorohydrin from allyl chloride
- Thin film composites, reverse osmosis membranes and units
- Conversion of methane and methanol into gasoline
- Conversion of methane into Syn gas
- Process for THPE that has helped break monopoly
- Biodegradable film system from seaweed polysaccharides
- Process for high volume fibre composite sheets and mouldings based on coir
- Electroactive polymers
- Micro and nano-structured polymeric materials
- Porous polyethylene implants
- Environment-friendly process for mononitrotoluene
- Trifunctional catalyst
- Green route to anti-depressants
- Process for converting epoxides like ethylene oxide, propylene oxide, styrene oxide and carbon dioxide to cyclic carbonates
- Process for production of carbon dioxide neutral transport fuels from biomass
- Process for biodegradable polylactic acid from biomass
- Ultrafiltration membrane for water purification

Thrust Areas

- Interfacing of chemical and biological capabilities of CSIR
- Centre of excellence for lipid research
- Conducting polymer paints and coatings for corrosion protection
- Agrochemicals and integrated pest management
- Specialized inorganic materials for diverse applications



First Community Solar-based RO plant of 700 litres per hour capacity installed in Sambhar Lake of area of Rajasthan



View of 3000 tpa epichlorohydrin plant – First plant of its kind in the world. Commissioned in Thailand



Leather – Reviving Industry through

Green Technologies



CSIR is closely partnering with Industry to help it emerge as a major global player in leather R&D. It has been spearheading the movement for use of biotechnology in the sector, in fashion forecasting and for developing foot-care solutions.

Significant Developments

- Paradigm shift in leather processing–From chemical to bioprocessing
- Established Indian presence in the fashion world of leather through Mod Europ Congress
- Provider of environment-friendly processes/technologies to leather Industry
- Standardization of bio-products (lipase and protease) for leather processing
- Commercialization of collagen products for health care applications
- Three-step tanning methodology towards zero wastewater discharge in leather processing

Zero Emission Initiative

A major network programme on "Environment-friendly leather processing technology". Enabled several technologies for end-of-pipe treatment and for safe disposal of treated wastewaters compliant with regulations on total dissolved solids.

"It is estimated that Rs 9 crores worth of raw hide is annually exported from India, ... not only a material, but also an intellectual drain." – Mahatama Gandhi (1934)

- 1997–Environmentally secure technologies for tannery sector
- 2,50,000 jobs saved • 400 tanneries revived • Rs. 300 crore export regained
- 2007–Processing of leather–From chemical to bioprocessing
- Global technology leadership gained • Export currently Rs. 14,000 crores
- About 60 per cent of the Indian leather industry is manned by CLRI alumni

Collagen-based Biomaterials



12 children at Burns Ward of General Hospital obtained treatment for burns using Collagen dressing

Fashion Forecasting of Leather



Thrust Areas

- Zero emission research initiatives
- Design centre for leather products
- Bioprocessing of leather



Ecology & Environment — Nurturing Nature



CSIR has been a major contributor for evolving national policies for environmental management and building up competencies for judicious resource management.

Significant Developments

- Contribution in preparation of Fourth Assessment Report of International Panel on Climate Change, which won Nobel Prize for Peace in 2007
- Air quality, inventorization and modeling for management strategies in some of the major cities of the country
- Technologies for removal of arsenic, iron, fluoride and salinity in drinking water
- Biosensor for rapid and reliable analysis of biological oxygen demand
- Common effluent treatment plants
- Technologies for industrial waste management and recycling, including the process of utilizing paper industry waste recycling to produce formaldehyde
- Devices and processes for recycling of wastes from petrochemical, leather, and textile industry



CSIR helps turn dead assets into productive land

Resource rich India has one-seventh of its land barren. This includes mine dumps, saline lands and fly ash dumps. CSIR helped in

- Remediation of ecosystem degraded due to metals at several locations, using biotechnological approaches
- Conversion of eroded lands into valuable assets through cultivation of non-traditional, oil-bearing plants
- Reclamation of more than 250 hectares of deserted salt pans by planting over 6 lakh saplings in Gujarat
- Conversion of a coal mine spoil dump in Padmapur into a water body for aquaculture
- Metamorphosis of a manganese mine spoil dump into lush green forest at Gumgaon, Nagpur

Thrust Areas

- Low-cost instruments and techniques for monitoring toxic pollutants
- Techno-economically feasible ways of waste minimization
- Impact on coastal ecosystem due to the transportation of nitrogenous fertilizers from agricultural fields to the oceans

Technologies for rainwater harvesting and artificial recharge



Ghatiya Watershed in Ujjain district of Madhya Pradesh for creation of sustainable groundwater development for agriculture



Earth Sciences – Oceans to Ionosphere



CSIR carries out application-oriented research on earth resources and natural hazards assessment. CSIR efforts have helped in understanding the processes that influence climatic extreme events besides identifying land and offshore regions for resources. CSIR scientists also investigate disasters and suggest ways to minimize the damage thereof.

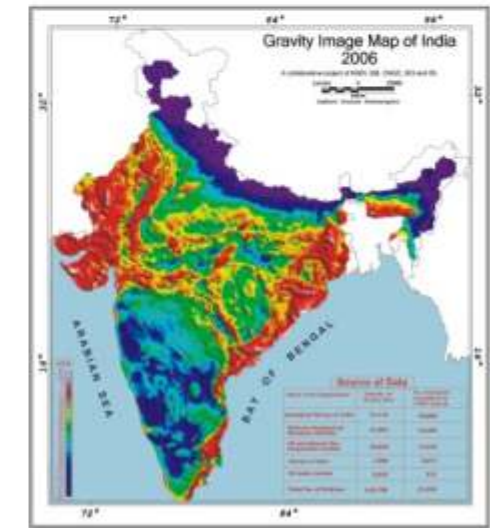
Significant Developments

- Palaeomagnetic studies of Gondwana land indicate that India forms a tectonic trio with Madagascar and Seychelles in the Rodina Supercontinent at around 750 Ma ago
- First ever geochemical baseline maps in Cauvery basin for environmental management
- Demarcation of regions of thick sediments in three blocks for hydrocarbon deposits in the Narmada Cambay region
- New criterion for monsoon breaks and the role of the equatorial Indian Ocean in the monsoon active-break cycles
- Neural network model for long-range forecasting of monsoon rainfall
- Modular ocean model for ocean state forecasting
- Prediction and early warning of tropical cyclones
- Commercialiable fog forecasting platform
- VSAT network [WAN] for online monitoring of the seismicity of north-east India

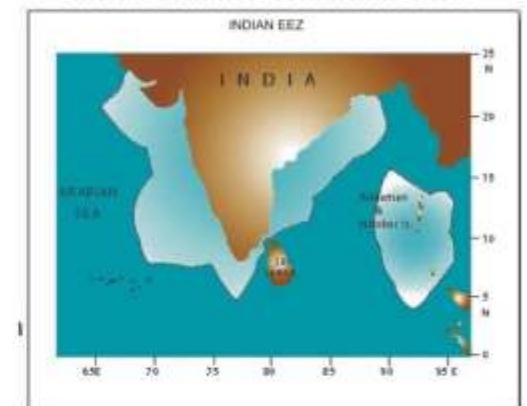
CSIR–Brings Succour to Disaster Victims

Be it a ravaging cyclone or home shattering earthquakes, CSIR is the first to help the affected:

- 1991–When an earthquake shook Uttarkashi, CSIR built temporary quake-proof shelters
- 1993–CSIR-designed pre-cast slabs, planks and joists helped provide shelter in just 4 months to 30,000 families affected by Latur earthquake
- 1999–Cyclone ravaged Orissa found CSIR rushing to provide safe drinking water in the worst affected district, producing 40,000 litres of water every day
- 2001–When the worst ever earthquake hit Gujarat, CSIR scientists rushed 30,000 packets of high nutrition food with traditional taste. When salt pans hit by earthquake turned out brown salt, CSIR scientists provided technology to manufacture good quality salt
- 2004–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. CSIR undertook the largest production of instant food by its R&D lab and provided 55 tonnes of food equivalent to nearly 1,80,000 meals. CSIR also provided drinking water through reverse osmosis and electro dialysis techniques in various tsunami hit areas, including Nagapattinam and Andaman & Nicobar Islands
- 2008– Flood ravaged Bihar found CSIR rushing to provide sweet drinking water in the worst affected district Madhepura, producing over 40,000 litres of water every 10 hours



Indian Exclusive Continental Shelf



Indian Legal Continental Shelf: Contribution of NGRI, NIO and others under the programme of the Ministry of Earth Sciences has doubled India's legal continental shelf (1.1 million sq km in the Bay of Bengal and Arabian Sea)

Thrust Areas

- Indian lithosphere with a focus on major Earth processes and resources
- Forecasting system for the waters around India
- Seismic hazard-risk evaluation and earthquake precursor-related studies



Electronics & Instrumentation – Control, Guidance & Monitoring



Thrust Areas

- Smart systems
- Technological solutions for societal applications
- Very high power, high efficiency and very high frequency microwave tubes
- Sophisticated facility for fabrication of light emitting diodes (LEDs) devices for solid-state lighting applications
- Photonics for communication, sensor and laser technology



6MeV Medical Linear Accelerator-JV1



Portable Reading Machine for the Blind

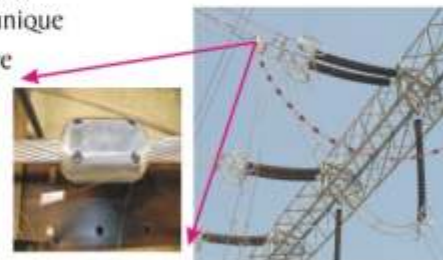


Radio Frequency Quadrupole Linear Accelerator for Cyclotron: India is the sixth country in the world to achieve this feat


CSIR has been assisting the electronics industry in technology absorption, upgradation and diversification. It also provides technical support for specific needs towards product development across diverse sectors, including healthcare and communication.

Significant Developments

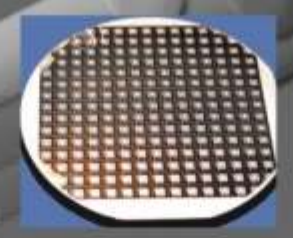
- High dielectric constant materials for metal oxide semiconductor devices
- Silicon carbide Schottky diodes—First in the country
- Low-cost and fast response polymeric thin film sensors to detect the presence of microbes in food and toxic gases in mines
- Cost-effective medical equipment: Biosensors, Medical Linac, & many more
- Geoscientific instruments including intelligent seismic data recorder and analyzer, snow depth and snow surface measuring probes, etc
- Pressure sensors and acoustic sensor using MEMS technology
- A paper dirt speck analyzer by using image-processing technique
- An indigenous online optical fibre based temperature sensors for online monitoring of temperature of the high voltage transmission lines
- Portable oscillation monitoring system to help monitor, record the horizontal and vertical acceleration of the railway vehicles
- Low-cost power quality analyzer for commercial applications
- Electronic instrumentation for traditional industries, like sugar, tea, paper & pulp etc.



FBG Sensor mounted on a simulated HT (High Tension) line



Packaged single acoustic sensor chip



Fabricated 4" Silicon Wafer containing acoustic sensor chips

More than 300 MEMS acoustic sensor chips have been delivered to VSSC. These sensors have qualified all user tests and are replacing imported sensors, in ISRO launch vehicles

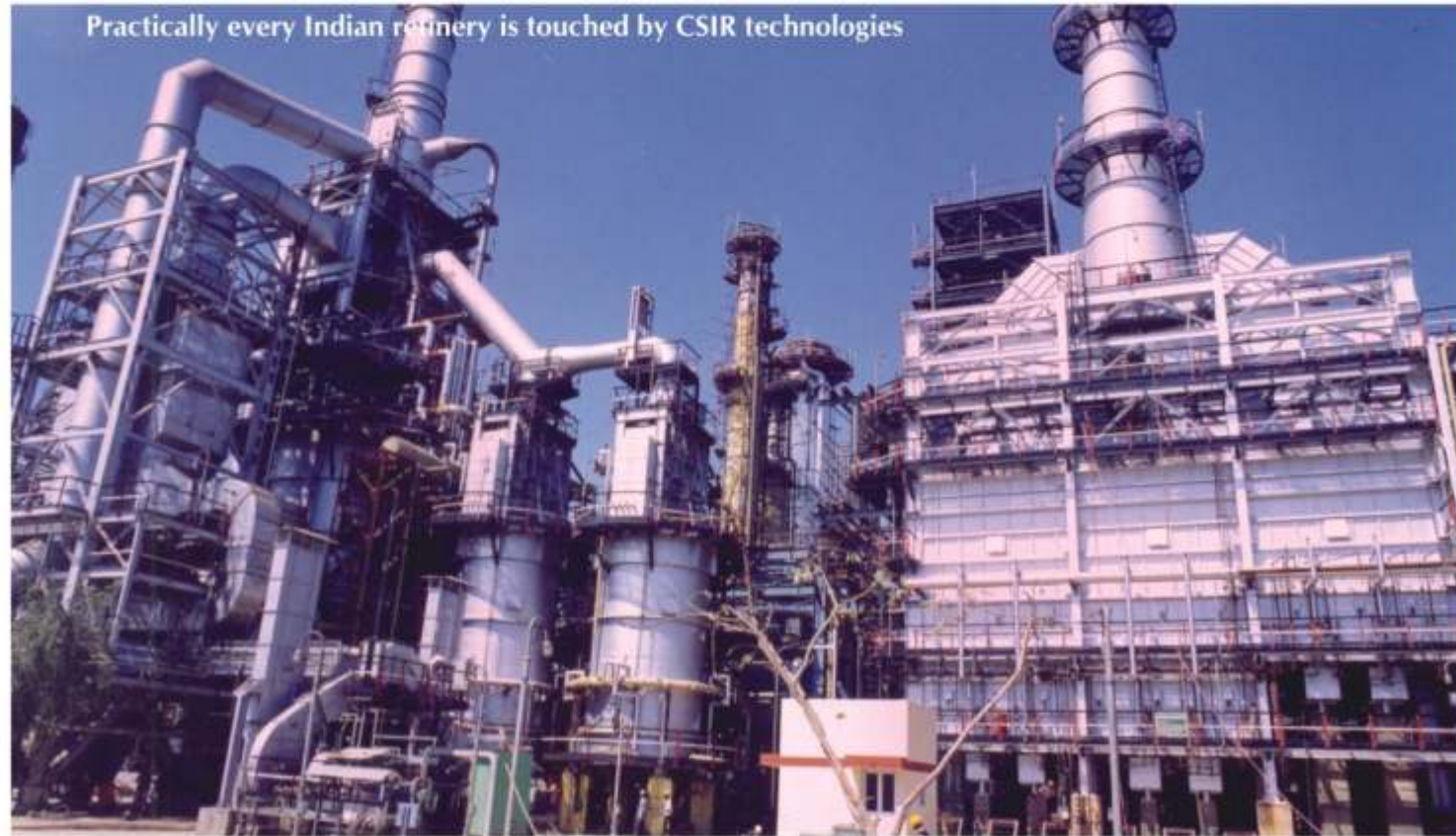
The Guardian of Indian Standard Time

Caretaker of the country's measurement standards

Every second a beep can be heard of the short wave band frequency on the radio. This beep is a stirring affirmation of CSIR's diligence and omnipresence as India's standards bearer. CSIR is the caretaker of all Indian measurement standards in kilograms, metres, seconds or decibels. Such precision standards and measurements, traceable to international standards, allow the Indian industry to be globally competitive.



Energy – From Fossil Fuels to Renewable Energy Sources



CSIR - Master in Refining Technology

Practically every Indian refinery has been touched by CSIR technologies. CSIR's diverse technologies, from solvent extraction to catalysts, have made nation-wide impact on millions of tonnes of refined petroleum products. India's centennial refinery at Digboi was rejuvenated using modern molecular distillation technology.



20,000 tpa plant established at Digboi for recovery of value added products from 'tank bottoms'



NMP Lube Extraction Plant

CSIR lays emphasis on the development of refining processes to produce new generation fuels and lubricants besides formulating unique blending techniques for hitherto unlinked resources.

Significant Developments

- Advanced catalyst for mercaptans removal
- Conversion of light naphtha to LPG and gasoline
- Biodiesel production using heterogeneous catalyst
- Liquid fuels and ethanol from biomass including starch and sugar
- Biodegradable lubricants from vegetable oils
- Adsorptive desulphurisation of FCC naphtha
- Oxidative desulfurization of diesel
- Process for conversion of methane and methanol into gasoline through non-oxidative activation
- Reforming of coal-based methane/natural gas to produce Syn gas
- Thermally stable cation-exchange membrane for fuel cell applications
- Self-assembled monolayers of an organic molecule to prepare cathodes for lithium batteries

Hydrogen Energy Initiative

Hydrogen economy provides an attractive alternative for ensuring the future energy security of a country like India. CSIR has launched a comprehensive R&D effort that focuses on fundamental research as well as applications involving materials, catalysts and electrochemistry relevant to hydrogen energy production, storage and use.

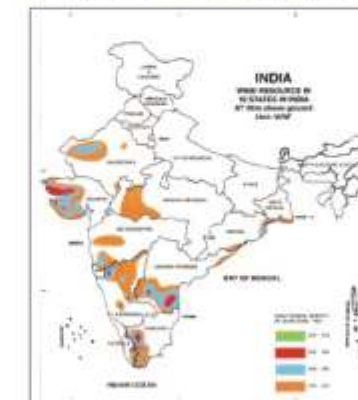


Self-supported 300 W Polymer Electrolyte Fuel Cell System

Thrust Areas

- Advanced refining technologies
- Biofuels, biodiesel and biolubricants
- Clean coal technologies
- Geothermal energy
- Li-ion batteries
- Functional polymers for OLED applications
- Solid-state photovoltaics and LEDs

Other CSIR Efforts in Sustainable Energy



Wind Density Map of India



Wind Mill: Low wind velocity, suitable for India



Aerospace – Soaring High



Saras in flight

"SARAS to me is not just an aircraft, it is a symbol of India's determination to use its technological prowess ..."
 - Prime Minister's speech at the CSIR Society Meeting held on July 26, 2004, New Delhi

CSIR activities in the area of aerospace have helped the country achieve significant progress besides building up national technology strengths in the areas of civil aircraft design and development.

In the 1960s well before India's plans to launch vehicles and missiles began unfolding, CSIR established a trisonic wind tunnel to catalyze aerospace R&D. Many Indian aerospace vehicles, from satellite launchers to aircraft, have 'graduated' out of this wind tunnel.



In the 1990s, CSIR designed and developed HANSA, India's first all-composite aircraft. This two-seater trainer aircraft's maiden flight was in 1993. About 10 HANSA aircraft have already taken to the Indian skies.

CSIR is now spearheading a programme for the development of a 14-seater, multi-role aircraft, SARAS. Its prototypes PT1 and PT2 have successfully completed several test flights—Heralding an era of civil aviation industry in the country.

Significant Developments

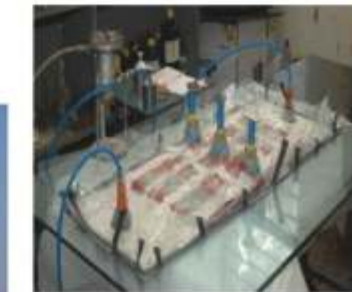
- Novel ceramic barrier lining material and process for rocket thrusters
- State-of-the-art transmissometer DRISHTI, a visual range assessor for providing information on runway visibility during fog, rain, snow or sand storm to both pilot and Air Traffic Services Unit. Installed on INS Hansa, INS Garuda and at Cochin and Lucknow Airports
- National Test Facility for rolling element bearings
- Windows compatible visualization and animation software for incident and accident analyses of aircraft
- Cost-effective rapid resin injection moulding technology for fabricating nose radomes of fighter aircraft
- Low-cost Vacuum Enhanced Resin Infusion Technology (VERITY) for advanced components manufacturing, leading to reduction of weight up to 10 per cent
- Nano-coated mirrors for passive infra-red sensor



NALVAS showing the capability for aircraft models with ILS operation



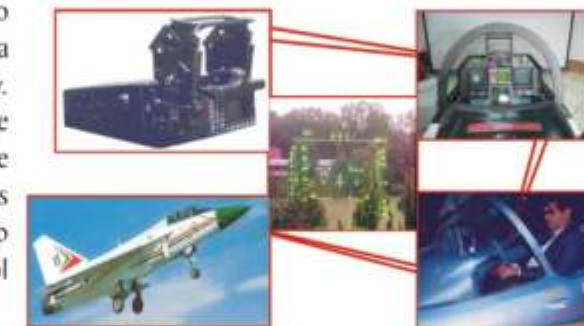
Drishti-Flight safety for low visibility and short runway landings



Vacuum Enhanced Resin Infusion Technology

Helping India build a Modern Fighter Aircraft

When the Light Combat Aircraft (LCA) soared into the skies for the first time in January 2001, it was a proud and exhilarating moment for the whole country. The LCA is 'light' largely because of CSIR's innovative development of composite airworthy parts. When the 'unstable' LCA engages in 'combat', the pilot carries out his split second maneuvers using the head-up cockpit display and the sophisticated control software – both developed by CSIR with its partners.



Thrust Areas

- Cutting edge technologies in aerospace sciences
- Regional aircraft especially suited for developing economies
- Centre of Excellence in Flight Mechanics And Control (CEFMAC)



Mining, Minerals & Materials – More from Less



Extinguishing mine fires using water mist



Trapped miners locator

TiN coated HSS drill bits

Nanostructured coatings that exhibit high hardness (>40 GPa), oxidation resistance, toughness, and corrosion and wear resistance.

CSIR plays a significant role in the development of special materials for specialized industrial sector and all aspects of mining operations, exploration and processing of minerals.

Significant Developments

- Microwave-assisted combustion synthesis of magnetic alloys: Nanoparticles and nanowires
- Beneficiation of iron ore using Floatex Density Separator
- Self-cleaning coatings on glass
- Production of plasma spray grade powder by jet-wheel impact atomization
- Bioactive integrated orbital implants to achieve better cosmetics and rehabilitation of an ophthalmic patient
- Fullerene-doped glasses with good optical limiting properties
- Magnetic non-destructive evaluation system for microstructural degradation of components at elevated temperatures
- HAP-coated dental implants
- ADI technology for crankshafts for Indica V2 diesel car
- Light-weight composites for personal armour applications
- Technology Enabling Centre for manufacturing natural fibre composites

Thrust Areas

- Advanced structural material: Light-weight metals and alloys and ceramics and composites
- Electronic materials
- Nano- materials
- New process: Extraction and material development and manufacturing
- Flexible manufacturing
- Efficient harvesting of minerals and materials: Energy and non-energy minerals/materials
- Bio-medical materials

Synthetic Hydroxyapatite Bone Graft for Dental Surgery (NANO SIZED)

SYBOGRAF

Packet Size: 200-300 micros
Confirms to ASTM F1185-02

4x0.5gm vials

Always use the test and if pack is damaged, have under control storage conditions. For complete use instructions, refer enclosed package insert.

Lot No: 80P 7/103
Mfg Date: OCT. 2007
Exp Date: SEP. 2010
SRP No: 2000.00

EUGRAF: Nano material application in healthcare

Non toxic (lead free) shielding materials fabricated using industrial wastes for attenuating X-ray and Gamma radiation



Mirrors for video imaging inside a nuclear reactor



Housing & Construction – Utilizing Wastes, Saving Energy



Shake Table with synchronous and asynchronous operation at the advanced seismic testing and research laboratory, SERC, Chennai

CSIR lays special emphasis on the development of alternate construction materials utilizing waste and economizing on energy.

Significant Developments

- Comprehensive methodology for transport planning of metros
- Technologies for performance assessment of in-service and distressed bridge instrumentation
- Strategies for disaster mitigation including repair, strengthening and reconstruction of damaged houses
- Aerodynamically shaped cyclone shelters
- Seismic qualification studies of gate valves, control valves with actuators for use in nuclear power plants
- Stress analysis and design guidelines for ensuring safety of gas pipelines for ONGC and GAIL
- Low-cost housing in areas affected by natural disasters
- Self-compacting concrete technology
- Natural fibre composite door shutters
- Energy saving buildings
- Remote health monitoring of civil structures

Road to Development

When it comes to construction of road, all roads lead to CSIR, the fountainhead of planning, designing and devising road construction techniques and technologies that deploy locally available materials, skills and infrastructure. Be it the desert sands of Rajasthan or the rain forests of Assam; the icy terrain of Kashmir or the Expressways of Mumbai–CSIR came up with solutions irrespective of the challenges.



Landslide and Rockfall Site on Mumbai-Pune Expressway–CSIR provided remedial measures to prevent rockfalls in this region.



Fly ash based building materials



Photoview of composite door shutters

Thrust Areas

- Value-added new construction materials from agro-industrial waste
- Advanced analysis and design methods for steel frames, multistoried buildings, etc
- Cutting edge road infrastructure with reference to construction materials



Tower testing - A national facility



Rural Development – Ensuring Inclusive Growth



Terafil water filter



CSIR developed Bullock-operated RO plant appeared as a lead story in *NewScientist*

Independent India had to fill its granaries to feed its millions. Green revolution was on the way, but needed a lot of men and machines for agriculture. CSIR entered at this stage to usher in mechanized agriculture.

Rural development has been a vital mission for CSIR. In the pursuit of strengthening the nation from the grass-root level, CSIR has undertaken several R&D programmes on water purification techniques, aromatic plant cultivation and processing, building materials and traditional ceramic products utilizing locale-specific endowments.

Significant Developments

- Swaraj—India's first indigenous tractor to facilitate mechanized agriculture. Sonalika provides the new tractor design for India's changing farm needs
- Value addition through post-harvest technologies like essential oil/menthol production
- Cheapest water purification technology including teracotta purification disc, portable arsenic detection kit, ultrapore membrane-based purifiers for removing virus and bacteria
- Over 365 technologies passed on to the rural masses through publications, training sessions, etc
- Construction of around 30,000 dwelling units using cost-effective construction technologies
- Reverse osmosis plants for desalination in Andaman & Nicobar Islands, Gujarat, Rajasthan, and Tamil Nadu
- New cultivation techniques and high-yielding varieties
- Technological upgradation of the skills of rural artisans and entrepreneurs

Thrust Areas

- Facilitate knowledge access to remote areas through question banks, help books etc to enable the people to contribute to national development
- Initiatives to access, source, supply and store safe drinking water
- Food processing and preservation
- Health
- Low-cost housing
- Non-farm industrial products



Instant houses for disaster victims



India Mark II Pump

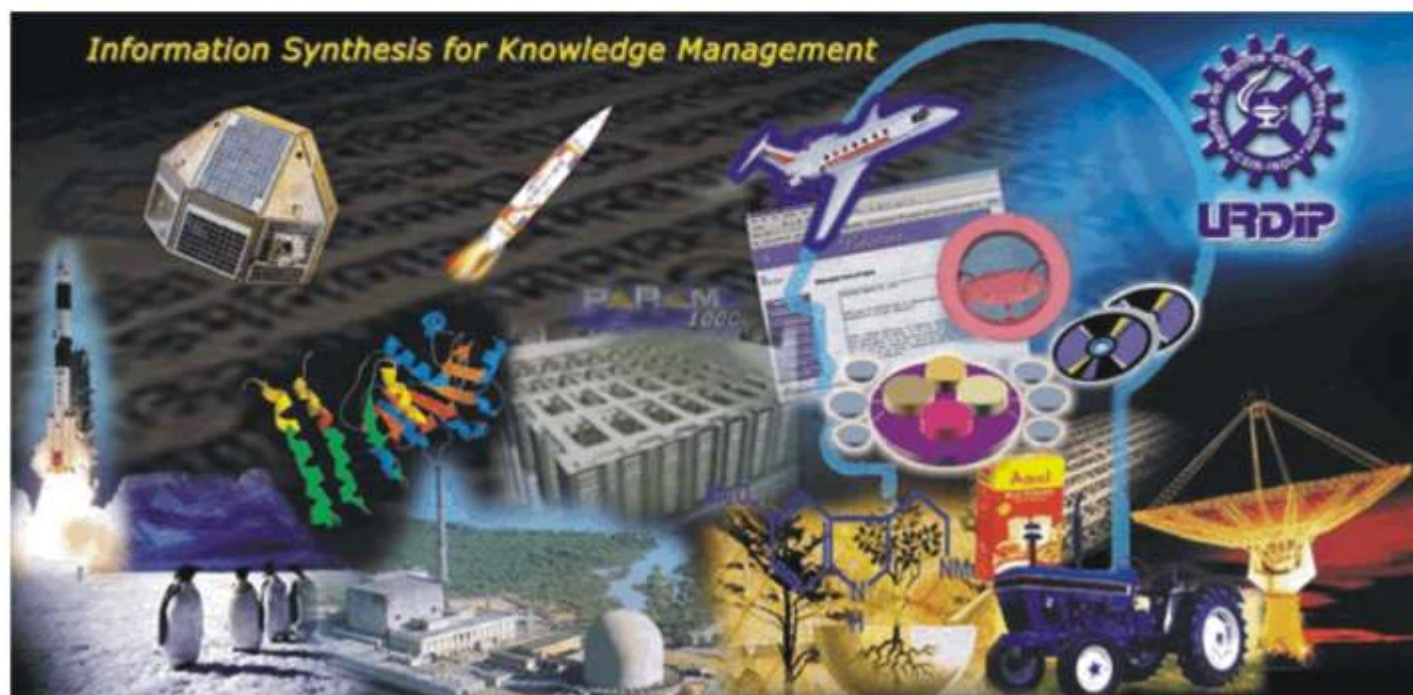
Water being the basic necessity for survival, the Government of India was looking for a simple pump that would work even in electricity-less villages. It had to be simple, easy-to-operate and maintain. CSIR provided the solution with the 'India Mark II Pump'. Made of non-corrosive, non-metallic parts, the low-cost pump has become an inseparable part of rural India. An estimated 30 lakh pumps are helping quench the thirst of Indians and several third world nations.



Mark II Pump



Information Dissemination



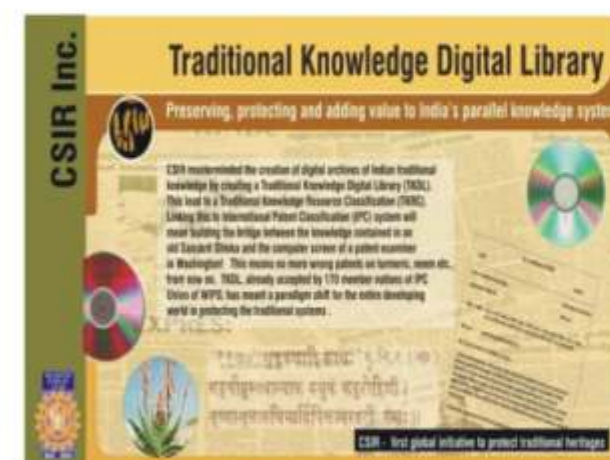
CSIR has evolved strategies to derive the benefits of digital revolution from the rich data and information base generated and to convert the dispersed and non-digital databases to merchandisable information products.

Significant Developments

- Software capable of decoding protein sequences in genetic materials of all living organisms
- Software using 'autotrace and digitize' methodology for digitizing aeromagnetic data
- E-journal consortium

Thrust Areas

- Traditional knowledge digital documentation in five international languages
- Popularization of science using modern communication channels



IT Intervention enabling Affordable Health

Report generation system for controlling malaria—Operational in Arunachal Pradesh

Expert system for identification of different vector species to minimize the outbreak of diseases—Technology transferred to Assam, Mizoram, and Manipur

Cluster analysis technique for prioritization of endemic villages for the control of vector-borne disease to reduce mortality and morbidity

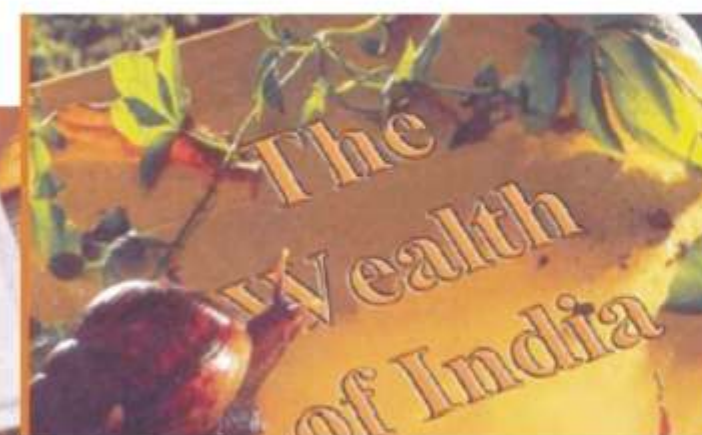
Web-based Filariasis Visualization Monitoring System for early monitoring of filariasis



S&T Journals published by NISCAIR, CSIR, New Delhi

Wealth of India

One of the first initiatives of CSIR after its establishment was to begin documenting the rich natural resources available in India. The effort culminated in the 'Wealth of India', a 20-volume authoritative reference material. The first volume was published a year after Indian Independence. The treatise has proved invaluable as an information source for economically important plants, animals, minerals and their applications.





International S&T Networking



Global challenges such as intensified techno-economic globalization, the rise of new global S&T players and changing geography of science reinforce the case for a strategic approach to international networking in S&T from a CSIR perspective.

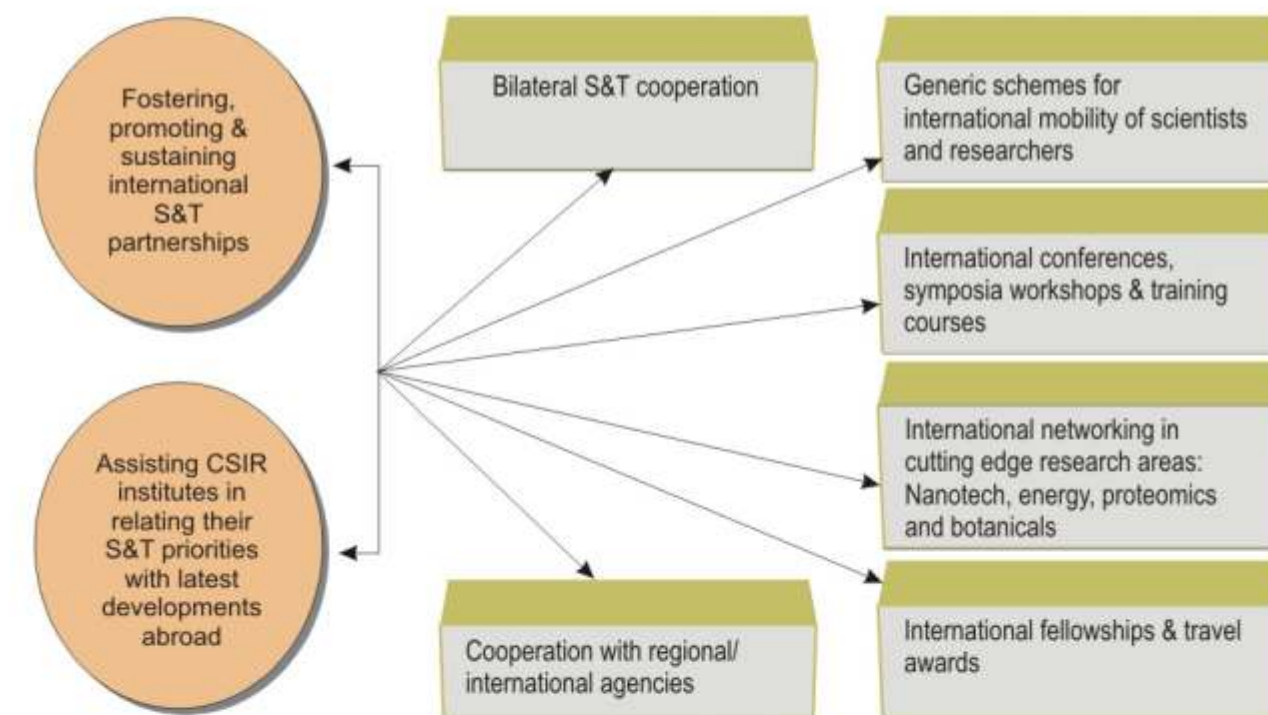
In its strategic approach, CSIR has mounted intensive efforts for: (a) Creating global networking by launching cutting edge research programmes in thematic areas, viz., nanotechnology, proteomics, energy and botanicals; (b) Creating avenues and opportunities through generic schemes for international mobility of researchers aimed at complementing and supplementing ongoing national networked research efforts, and (c) Intensifying bilateral R&D partnerships for knowledge sharing.

CSIR's Global Networking



Significant Achievements

- Global networking with all major R&D organizations of the world including Global Research Alliance (GRA)
- CSIR emerged as the most preferred international partner for UK, catalyzing external cash flow of over Rs. 12 crore in UKIERI Projects (2006)
- Setting up of Joint Research Centres with international partnership on Groundwater at NGRI and Weather & Climate Research at CMMACS/NIO and Sustainable Chemistry at IICT
- Creating critical mass through human resource development–training/fellowship opportunities at global centres of excellence – about 900 man months annually
- CSIR's global benchmarking–More than 400 scientists presenting their research papers at major international conferences abroad every year



CSIR Vision

Prosperity for all: Need for sharing and caring.

CSIR Mission

IPR-protected international S&T cooperation and knowledge partnership for global good.



New Millennium Indian Technology Leadership Initiative — A Public-Private Partnership Programme



CSIR implements, on behalf of the Government of India, a far-sighted programme named New Millennium Indian Technology Leadership Initiative (NMITLI) in Public-Private-Partnership (PPP) mode. The programme looks beyond today's technology and thus seeks to build, capture and retain for India leadership position in niche areas by synergizing best competencies of public-funded R&D institutions, academia and private industry. The strategy adopted for NMITLI is to obtain an inverse risk-investment profile, i.e., low-investment-high-risk technology areas (with global leadership potential) with investments increasing as developments take place and projects move up on the innovation curve with reduction in risks. The programme has set the tone for technology leadership for the country in select areas and has in the process become a role model for running R&D support programme in PPP mode.

NMITLI Status

- Project types:
 - Nationally Evolved Projects
 - Industry Oriented Projects
- 57 path-setting projects
- 80 Industry partners
- 270 R&D institutions
- Budget: Rs. 500 crores

NMITLI Special Features

- Proactive
- National consultation and churning
- Sharply focused projects
- Invitation to the best
- Tight monitoring and foreclosure
- Soft loan to Industry partners
- Grant to institutes

Significant Developments

- A less toxic novel molecule for treatment of TB, which works through combination therapy and clears infection in animal models within two months. The molecule is moving into Phase II clinical studies
- A plant-based oral herbal formulation for the treatment of Psoriasis, which is in Phase III clinical studies
- A novel recombinant biotherapeutic molecule 'Lysostaphin' for treatment of *Staphylococcus aureus* infection. It is in Phase II studies
- Low-cost decentralized diagnostic kit, a macrochip based on nucleic acid amplification technology for early detection of eye infections caused by major pathogens
- Software for bioinformatics, Biosuite—a multipurpose tool for genome analysis; Genocluster, consisting of gene predicting software, Proteome Calculator and tool for predicting virulent proteins
- A PC based high-end 3D visualization platform named Darshee, developed for computational biology
- Low-cost computing platforms SofComp and Mobilis
- A powerful I28 processor supercomputer with communication devices customized for weather and meteorological predictions and related applications
- New plant varieties of Mentha named 'Indus' and 'Madhuras'
- Technology packages for environment-friendly bioprocessing route for ambient preservation of skin/hide, enzyme only dehairing and defleshing associated with leather industry
- Technology for conversion of bagasse to cellulose triacetate
- Fermentation-based technology (40 litres scale up) for production of docosahexanoic acid, a vital nutrient for infants and aged
- Pilot plants for production of highly pure lactic acid from sugarcane juice and separation of bagasse



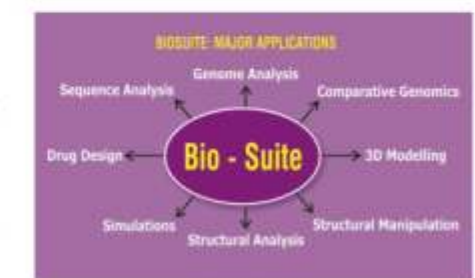
Treatment for Psoriasis



Separation of Bagasse: Pilot plant



Pilot plant for lactic acid downstream processing





National S&T Human Resource Development

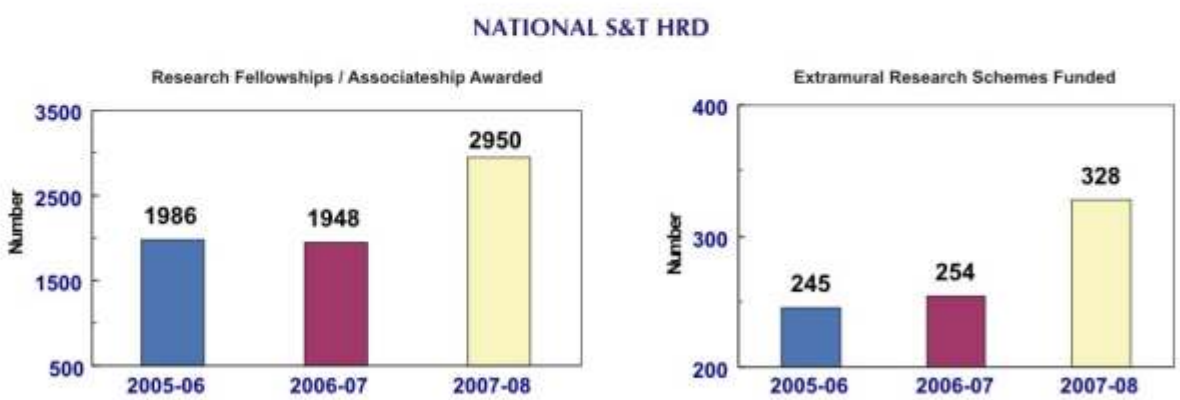


CSIR-AIST
 CSIR-AIST is a recently established educational wing of CSIR aimed at developing cutting edge transdisciplinary S&T manpower.

CSIR has been providing yeoman services to foster, sustain and upgrade stock of highly specialized scientists, engineers and technologists in diverse disciplines of science and technology in the country.

- Supporting 7000 research scholars at any given time for doctoral research in S&T throughout the country
- Supporting scientific and academic community for state-of-the-art R&D through 700 research schemes at any given time
- Temporary placement of scientists under Scientist's Pool Scheme
- Promoting creative and innovative thinking among school students
- Inculcating the spirit of technology led entrepreneurship among young researchers
- Honoring blue sky research–National awards like Shanti Swarup Bhatnagar Prize and CSIR Young Scientist Award
- Beneficiaries of HRD schemes include Who's Who of Indian Science

World Class Education & Training
 CSIR is the single largest global source of expert manpower for the leather, food processing, instrumentation and mechatronics with internationally recognized training courses.
 The graduates in leather technology occupy positions as policy makers and industrial leaders in over 65 countries, while those graduating in food processing technology are similarly placed in over 20 countries.



- HRD Schemes for Beneficiaries ranging from 16-65 Years of Age**
- Basic interest in science CSIR offers : CSIR Programme on Youth for Leadership in Science (CPYLS)
 - Want to do PhD ? CSIR offers : Junior Research Fellowship (JRF) - National Eligibility Test (NET), JRF (GATE), Senior Research Fellowship (SRF), Shyama Prasad Mukherjee Fellowship (SPMF)
 - Post-doctoral research CSIR offers : Research Associateship (RA), Senior Research Associateship (SRA)
 - Interaction amongst researchers CSIR offers : Foreign Travel Grant and Symposium Grant
 - State-of-the-art R&D CSIR offers : Research Schemes
 - Recognition of excellence CSIR offers : Shanti Swarup Bhatnagar (SSB) Prize & CSIR Young Scientist Award (YSA)
 - Support to superannuated scientists CSIR offers : Emeritus Scientist Scheme



Intellectual Property Management



- CSIR was the first in the country to announce Intellectual Property Management Policy in 1995. The result was an avalanche of inventions from all across the country.
- CSIR has been placed strategically on the world map by capturing about 50-60 per cent share of total US patents granted to Indians excluding foreign assignees during the last several years.
- CSIR currently holds a sizable portfolio of about 1800 foreign patents and about 1500 Indian patents.

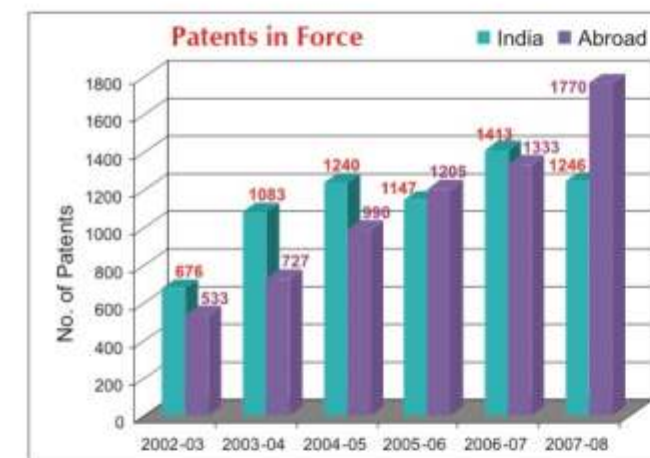
- CSIR has key portfolios in the areas of bio-informatics products, leather, optical fiber, drugs and pharmaceuticals, biotechnology, nanotechnology, polymers, food products and processes, herbals and plant varieties.
- CSIR, achieved for the country, first position in PCT filings from developing countries in 2002 and competed with multinationals like Samsung. CSIR continues to be one of the major PCT applicants from India—Highest PCT filer among the public-funded R&D organisations across the world (WIPO Report, 2007).
- CSIR, contributes to capacity building in the field of IP management covering techno-legal drafting, patent litigation, licensing, pricing and other aspects of IP management including information and documentation, patent search and analysis etc.

CSIR IP Policy Statement

To maximize the benefits to CSIR from its intellectual capital by stimulating higher levels of innovation through a judicious system of rewards, ensuring timely and effective legal protection for its IP and leveraging and forging strategic alliances for enhancing the value of its IP.

Haldi and Other Battles – Successfully Challenging US Patents

- In 1995, CSIR challenges US patent on turmeric powder as a wound healing agent.
- "Does not satisfy novelty criterion well-known in India for centuries"— On 23 August 1997, CSIR wins patent battle.
- In 1999, CSIR also wins Basmati patent battle.
- Sets international trend to challenge patents based on traditional knowledge.



| Rank | Assignee | No. of patent* applications |
|------|---------------------|-----------------------------|
| 1 | CSIR | 1523 |
| 2 | Qualcomm | 1431 |
| 3 | Bayte | 1311 |
| 4 | Philips Electronics | 1272 |
| 5 | Hindustan Unilever | 1088 |
| 6 | Honda | 960 |
| 7 | Microsoft | 908 |
| 8 | Samsung | 901 |
| 9 | Pfizer | 895 |
| 10 | BASF | 865 |

* Financial Express (6 July, 2008)



CSIR – Moving the Frontiers of Science

"Scientific discovery and scientific knowledge have been achieved only by those who have gone in pursuit of it without any practical purpose whatsoever in view."

Max Planck (1948)

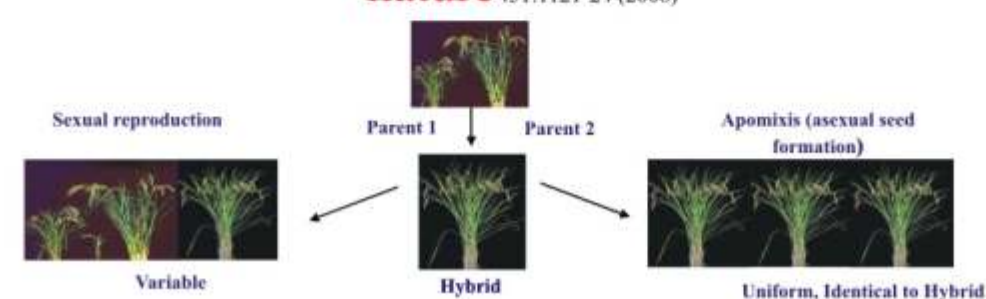


CSIR Science on the Cover Page of High Science Journals

Discovery of Today with Potential Applications Tomorrow

Apomixis: Low-Cost High Yielding Hybrid Seed

nature 451:1121-24 (2008)

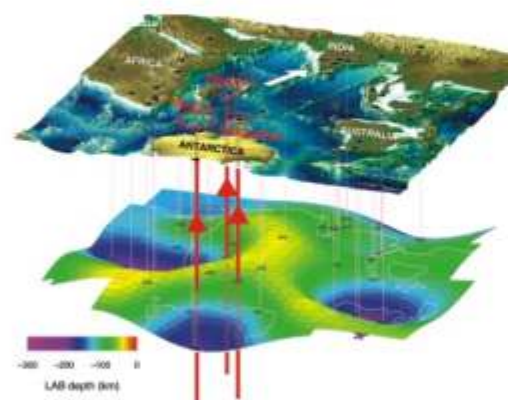


- Discovery of a gene named DYAD for engineering a major step in Apomixis
- Brings the world closer to engineering full Apomixis in crops
- Apomixis would allow farmers to multiply their own hybrid seeds

Empowering the Farmers in Future

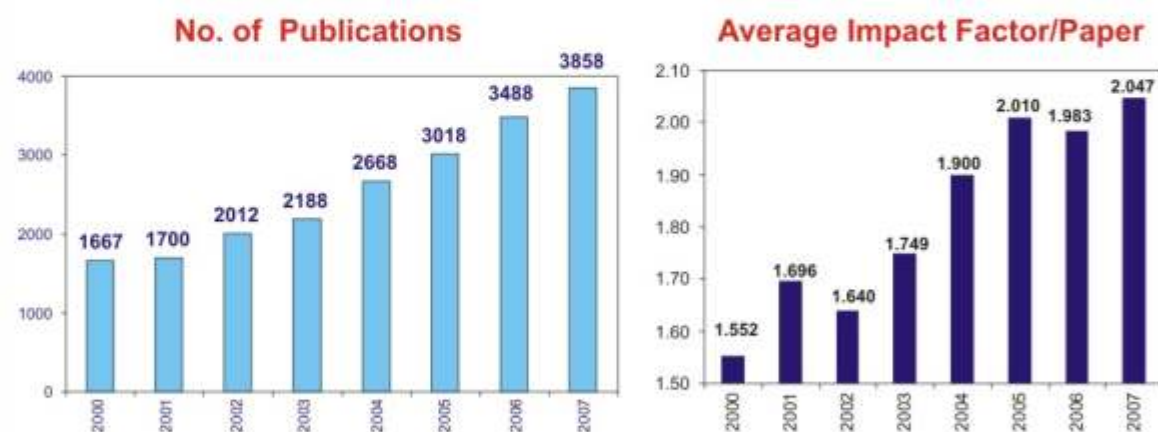
Study on the Rapid Drift of the Indian Tectonic Plate

nature 449:894-97 (2007)



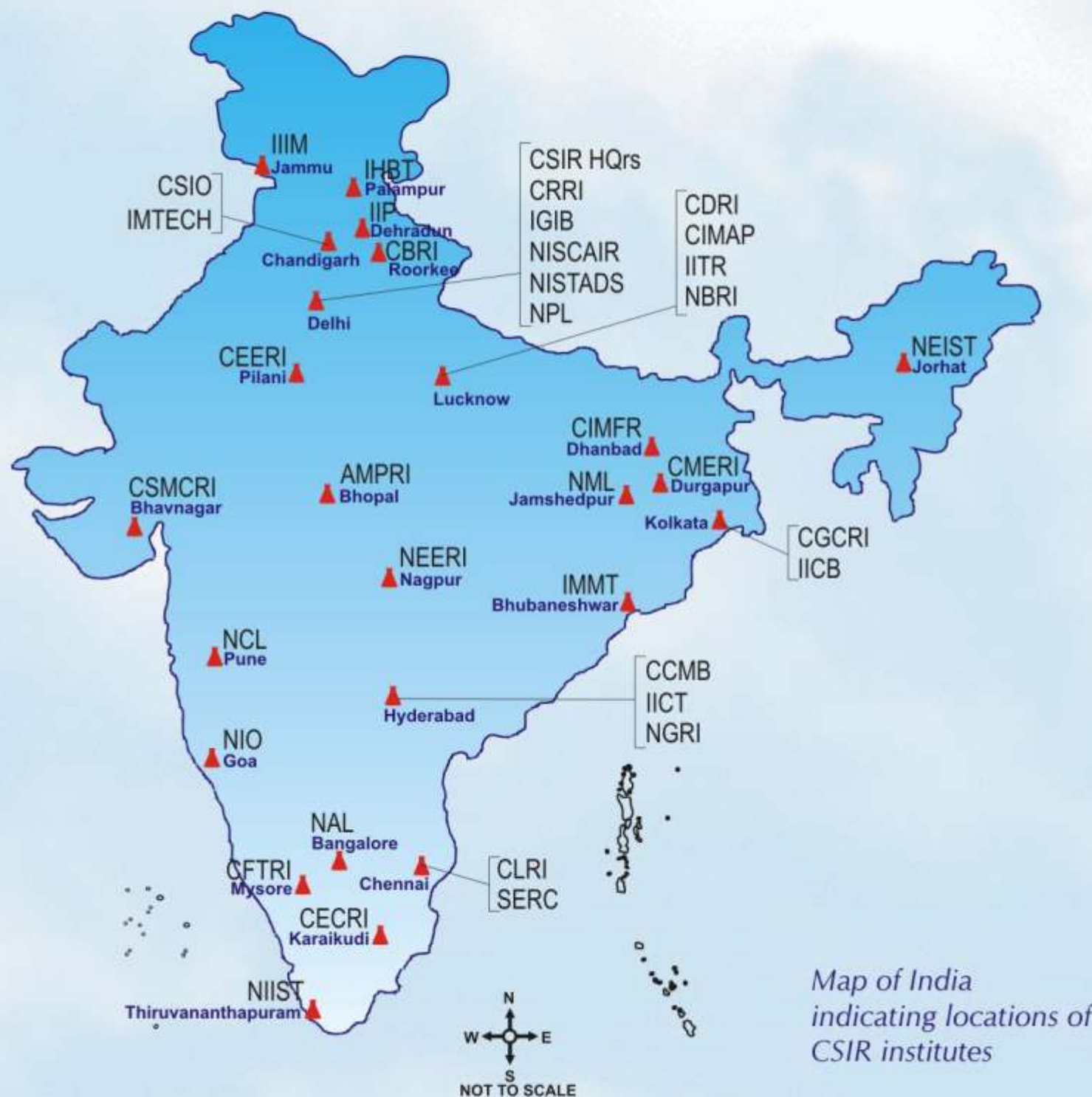
Topography of the surface and the LAB in the region of the Indian Ocean and the fragments of Gondwanaland surrounding it. The Indian lithosphere is exceptionally thin compared with the other fragments of Gondwanaland. Black triangles denote seismic stations. The station locations are shown in the facing picture with station codes, red circles mark the surface locations of the mantle plumes whose conduits are illustrated by the thick vertical lines.

CSIR's Global Science Presence





CSIR Institutes



| | | | |
|--------|--|---------|--|
| AMPRI | Advanced Materials and Processes Research Institute Bhopal-462 026, www.ampri.res.in | IIIM | Indian Institute of Integrative Medicine Jammu-180 001, www.iiim.org |
| CBRI | Central Building Research Institute, Roorkee-247 667 www.cbri.org | IIP | Indian Institute of Petroleum, Dehradun-248 005 www.iip.res.in |
| CCMB | Centre for Cellular and Molecular Biology Hyderabad-500 007, www.ccmb.res.in | IMMT | Institute of Minerals and Materials Technology Bhubaneswar-751 013, www.rribhu.res.in |
| CDRI | Central Drug Research Institute, Lucknow-226 001 cdriindia.org | IMTECH | Institute of Microbial Technology, Chandigarh -160 036 www.imtech.res.in |
| CECRI | Central Electrochemical Research Institute Karaikudi-623 006, www.cecni-india.com | IITR | Indian Institute of Toxicology Research Lucknow-226 015, www.itrcindia.org |
| CEERI | Central Electronics Engineering Research Institute Pilani-333 031, www.ceeri.res.in | NAL | National Aerospace Laboratories, Bangalore-560 017 www.nal.res.in |
| CFTRI | Central Food Technological Research Institute Mysore-570 020, www.cftri.com | NBRI | National Botanical Research Institute Lucknow-226 001, www.nbri-ko.org |
| CGCRI | Central Glass and Ceramic Research Institute Kolkata-700 032, www.cgcri.res.in | NCL | National Chemical Laboratory, Pune-411 008 www.ncl-india.org |
| CIMAP | Central Institute of Medicinal & Aromatic Plants Lucknow-226 015, www.cimap.res.in | NEERI | National Environmental Engineering Resarch Institute Nagpur-440 020, www.neeri.nic.in |
| CIMFR | Central Institute of Mining & Fuel Research Dhanbad-828 108, www.cmriindia.nic.in | NEIST | North-East Institute of Science and Technology Jorhat-785 006, www.neist.res.in |
| CLRI | Central Leather Research Institute, Chennai-600 020 www.clri.org | NGRI | National Geophysical Research Institute Hyderabad-500 007, www.ngri.org.in |
| CMERI | Central Mechanical Engineering Research Institute Durgapur-713 209, www.cmeri.org | NIO | National Institute of Oceanography, Goa-403 004 www.nio.org |
| CRRRI | Central Road Research Institute, New Delhi-110 020 www.cridom.org | NIIST | National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram-695 019 www.niist.csir.res.in |
| CSIO | Central Scientific Instruments Organisation Chandigarh-160 030, www.csio.nic.in | NISCAIR | National Institute of Science Communication And Information Resources, New Delhi-110012 www.niscair.res.in |
| CSMCRI | Central Salt & Marine Chemicals Research Institute Bhavnagar-364 002, www.csmcni.org | NISTADS | National Institute of Science Technology And Development Studies, New Delhi-110012 www.nistads.res.in |
| IGIB | Institute of Genomics & Integrative Biology Delhi-110 007, www.igib.res.in | NML | National Metallurgical Laboratory, Jamshedpur-831 007 www.nmlindia.org |
| IHBT | Institute of Himalayan Bioresource Technology Palampur-176 061 (HP), www.ihbt.org | NPL | National Physical Laboratory, New Delhi-110 012 www.nplindia.org |
| IICB | Indian Institute of Chemical Biology Kolkata-700 032, www.iicb.res.in | SERC | Structural Engineering Research Centre Chennai-600 113, www.sercm.org |
| IICT | Indian Institute of Chemical Technology Hyderabad-500 007, www.iictindia.org | | |