AN OVERVIEW

1. INTRODUCTION

The Department of Scientific and Industrial Research (DSIR), one of the Departments of the Ministry of Science and Technology, was set up through a Presidential Notification, dated 4th January, 1985 (74/2/1/8 Cab.). The mandate of DSIR includes promotion of industrial research for indigenous technology promotion, development, utilization and transfer.

The Allocation of Business for the Department is as follows:

- All matters concerning the Council of Scientific and Industrial Research (CSIR).
- All matters relating to National Research Development Corporation (NRDC).
- All matters relating to Central Electronics Limited (CEL).
- Registration and Recognition of R&D Units.
- Technical matters relating to UNCTAD and WIPO.
- National register for foreign collaborations.
- Matters relating to creation of a pool for temporary placement of Indian Scientists and Technologists.

The primary endeavour of DSIR is to promote R&D by the industries; support industrial units to develop state-of-the-art globally competitive technologies of high commercial potential; catalyze faster commercialization of laboratory-scale R&D; augment technology transfer capabilities; enhance the share of technology intensive exports in overall exports; strengthen industrial consultancy and establish a user-friendly information network to facilitate scientific and industrial research in the country. The DSIR has two public sector enterprises viz. National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL) and two autonomous organizations viz. Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and assistance to a regional institution of the United Nations Economic and Social Commission for Asia and Pacific (UN-ESCAP) viz. Asian and Pacific Centre for Transfer of Technology (APCTT) as the focal point in the country.

2. DSIR Programmes

The Department of Scientific & Industrial Research (DSIR) operates a flagship program i.e. Industrial Research & Development Promotion Program (IRDPP) and two Umbrella Schemes on "Industrial Research & Development (IRD)" and "Assistance to PSEs".

Department through its flagship program i.e. "Industrial Research & Development Promotion Program (IRDPP)" has vision to promote Industrial research in the country through Industry and Institution centric motivational measures and incentives creating an enabling environment for development & utilization of novel technologies and innovations.

Department's umbrella scheme on "Industrial Research & Development (IRD) consists of following four sub-schemes :

(i) Promoting Innovations in

Individuals, Start-ups and MSMEs (PRISM) – This scheme primarily focuses on supporting individual innovators, start-up companies; incubate companies in public funded technology business incubators and MSMEs.

(ii) Patent Acquisition and Collaborative Research & Technology Development (PACE) – This is a scheme focusing on technology acquisition and its development and demonstration for commercialization.

(iii) Building Industrial Research & Development and Common Research Facility (BIRD-crf) – This is a scheme which focuses on creation of Common Research facilities for micro and small enterprises with an aim to enhance translational research and foster industry institution interaction targeted towards innovative product development.

(iv) Access to Knowledge for Technology Development and Dissemination (A2K+) – This sub-scheme includes components of Technology Development and Utilization Programme for Women (TDUPW); Support to Studies; Support to Events and Technology Development and Demonstration Programme (TDDP).

The umbrella scheme on "Assistance to PSEs" consist of two Public Sector Enterprises, the National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL).

Apart from Flagship program and Umbrella program, the other activity of the Department includes (i) Matters pertaining to Asian and Pacific Centre for Transfer of Technology (APCTT) and UNESCAP, and (ii) Information Technology and e-Governance (ITeG).

Department of Scientific and Industrial Research (DSIR), has been the national focal point of Asian and Pacific Centre for Transfer of Technology (APCTT) for India since its inception in 1977. DSIR also plays an active role in APCTT's functioning, particularly relating to its policies and programmes. India being the host country has been providing institutional support to APCTT since its inception. ITeG division implements e-Governance in the Department progressively that needs be in conformance to the National e-Governance.

2.1 Major Achievements

The major achievements of the various programmes of the Department during the period under report are as under:

2.1.1 *Industrial R&D Promotion Programme*

DSIR is the nodal Department for granting recognition to In-house Research and Development centres established by corporate industry. During this period, there were 2238 (December 2019) In-house R&D centres with DSIR recognition. Of the 696 company's granted renewal of recognition during the year, **22** companies incurred an annual R&D expenditure of over Rs.5000 lakhs each, 140 companies incurred an annual R&D expenditure in the range of Rs. 500 lakhs to Rs. 5000 lakhs and 104 companies incurred an annual R&D expenditure in the range of Rs. 200 lakhs to Rs. 500 lakhs. During the period under report, 186 In-house R&D centres were accorded fresh recognition and recognition of 696 R&D centres were renewed.

Scientific research foundations in the areas of medical; agriculture; natural and applied sciences; and social sciences seek DSIR recognition and registration as Scientific and

Industrial Research Organisations (SIROs) under the programme granting recognition to SIROs. The recognized and registered SIROs are eligible for availing Customs Duty exemption on imports required for R&D activities. During the period under report, 65 SIROs have been accorded fresh recognition.

Secretary, DSIR, Ministry of Science and Technology, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed for the plant and machinery installed for the manufacturing of products using indigenous know-how as per provisions of rule 5(2) of IT Rules. During the period under report, one certificate involving Rs. 88.30 crores during FY 2016-17 on cost of plant & machinery were issued by DSIR.

DSIR is the nodal Department for registration of public funded research institutions (PFRI), Universities, IITs, IISc and NITs, for availing concessional custom duty exemption, vide Notification No. 43/2017-Customs dt. 30.06.2017 and corrigendum dated 22.07.2017-Custom Notification no. 43/2017 dt 30.06.2017, amending the main notification No. 51/96-Customs dt. 23.07.1996 and amendments thereof. During the period under report, 14 such institutions were newly registered with DSIR; and 57 institutions were granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961. Fresh approvals were accorded to 93 companies by the prescribed authority. Agreements of co-operation for R&D were also signed with these companies. The detailed R&D expenditure of the approved companies have also been examined by DSIR and 263 reports valued at Rs. 8171.10 crores have been forwarded to Chief Commissioner of Income Tax (Exemption) CCIT (E) in Form 3CL, as required under the IT Act.

2.1.2 *Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)*

PRISM (Promoting Innovations in Individuals, Start-ups and MSMEs) scheme aims at to support individual innovators which will enable to achieve the agenda of inclusive development – one of the thrust area of 14th five year plan (2012-2017). It would also provide support to autonomous institutions or organizations or to society registered under the Societies Registration Act, 1860 or Indian Trusts Act, 1882 or other statues leading to development of state-of-art new technology solutions aimed at helping MSME cluster units. The Scheme tenure was till 31.03.2017. However, the scheme has now been extended till 31.03.2020 (31st March, 2020) i.e. co-terminus with the fourteenth finance commission period as a component scheme of Industrial Research and Development (IRD) Programme of DSIR.

The proposals shall preferably be considered in the following focus sectors: Green technology, Clean energy, Industrially utilizable smart materials, Waste to Wealth, Affordable Healthcare, Water & Sewage Management and any other technology or knowledge intensive area.

The financial assistance under the programme may vary from Rs. 2.00 lakh to Rs. 50.00 lakh. The department has also successfully completed 13 (thirteen) on-going PRISM projects supported during the period under report. Some of the successfully completed projects are Design and development of Compact, Low-cost Paper Carry Bag Making Machine, Artificial human-skin as an alternative to animal model for drug and cosmetic testing, Development of a Novel Animal Free reagent based prototype Blood Test Kit for Early Heart Attack Diagnosis, Solar Powered Farm Level Cold Storage with battery-less refrigeration and thermal storage [Phase-II], Effective & preventive

prosthesis for treatment of multiple neck ailments, Solar operated Micro Irrigation Applicator, A prototype of solar connected new hybrid MLI with minimum number of switches using EAC switching technique, Solar Compass – An Accurate Drawing Aid, Development of Bio-degradable and compostable sapling bags and trays using agricultural wastes, Development of Pedal Boat based Water Cleansing mechanisms, Smart Nest Management system for small scale business in rural areas, Low power portable Muga and Eri spinning machine, A mechanical powered transmission device and so on

The financial assistance were extended to 24 (twenty-four) new innovation-centric project proposals of individual innovators during the period ending 11th January, 2020.

2.1.3 *Patent Acquisition and Collaborative Research and Technology Development (PACE).*

The Department of Scientific and Industrial Research (DSIR) is continuing to operate the 12th Five Year Plan scheme on "Patent Acquisition and Collaborative Research and Technology Development (PACE)" during 2017-2020. The DSIR through the PACE scheme provides catalytic support to industries and institutions for development and demonstration of innovative product and process technologies, traversing the journey from proof of concept or laboratory stage to pilot stage, so that they can be launched for commercialization. The scheme supports ingenious work and assists in development of new technologies or creative/innovative application of the existing technologies to solve unmet needs of industry. The scheme also strengthens the interface between industry, R&D establishments and academic institutions by supporting collaborative proposals. The scheme also jointly supports initiatives of other Ministries / Departments aimed at technology development and demonstration, e.g. IMPRINT initiative of Ministry of Human Resource Development/ DST, wherein institutions of higher learning are being supported for development and demonstration of technologies. During the period under report three (03) PACE projects were monitored during the year. These projects involve a total project cost of Rs. 606.2 Lakhs for which Rs. 242.5 Lakh is in the form of loan to industry.

5 (Five) ongoing technology development projects from institutions (IITs and IISc) in the Manufacturing and Water Resources domains are supported under IMPacting Research INnovation and Technology (IMPRINT) initiative of Ministry of Human Resource Development (MHRD) and are under progress. These projects involve a total project cost of Rs.515.33 lakh for which DSIR is extending a support of Rs. 257.665 lakhs as grant to institutions and an equivalent grant is provided by MHRD.

2.1.4 *Common Research and Technology Development Hubs (CRTDHs).*

Department of Scientific and Industrial Research (DSIR) had launched a program to establish Common Research and Technology Development Hubs (CRTDHs) in Public-Funded Institutions having linkages with and proximity to MSME clusters under its 12th Five Year Plan scheme on 'Building Industrial Research & Development and Common Research Facilities' (BIRD-crf). 12 CRTDHs have now been established across the country.

The CRTDH programme is aimed at creation of common research facilities equipped with analytical equipment and pilot plant facilities to facilitate and encourage innovators, start-

ups and micro, small and medium enterprises for R&D and technology development. CRTDH programme facilitates start-ups and MSMEs to use the facilities available under the hubs, reside in the campus and work towards technology development, and grow to the next level (Lab to Market). The equipment and facilities under CRTDH are offered to the industries for usage under various models of engagement so as to adequately leverage not only the technologies developed at the host institute but also to develop new/improved technologies and processes based on needs of the enterprises. They are mentored and encouraged to file patents, trademarks, write publications, apply for grants under various other Government schemes thereby favourably impacting ease of doing business.

In the last 3 years, CRTDHs have engaged with more than 1800 MSMEs/Start-ups/ Innovators through sensitization workshops, trainings and by offering facilities created under CRTDH for usage. These CRTDHs have entered into more than 50 agreements for product/process development. 26 industries/individuals have been incubated under the hubs so far, and a large number of indirect employment has been generated by the scheme. Of the above CRTDH incubates, 03 have set up commercial units for marketing the products in the food processing sector.

2.1.5 Access to Knowledge for Technology Development and Dissemination (A2K+):

The continued twelveth five-year plan scheme of A2K+ has been evolved on the premises that access to knowledge is one of the most desirable inputs for any entrepreneur, innovator conceptualizing a business model to establish or run a company for wealth creation through innovative R&D interventions. The scheme includes the following programme components:

(i) National and International conferences, exhibitions (A2K+ Events)

(ii) Industrial Technology related studies (A2K+ Studies)

(iii) Technology Development and Utilization Programme for Women (TDUPW)

(iv) Technology Development and Demonstration Programme (TDDP)

The sub-scheme on A2K+ - Events provides a platform for exchange of views among industry, consultancy organizations, academic and research institutions that would lead to useful insights on issues relating to industrial research and technological innovation and help in evolving tools and techniques to remain competitive in today's business climate. During period under report, 17 proposals recommended by TAC were processed for financial concurrence &approval before sanctioning of the event.

The sub-scheme on A2K+ - Studies, support studies in emerging areas of technology aimed at providing useful information and knowledge base to industry, industry associations, academia, research institutions, consultants, entrepreneurs, research students and policy makers for doing any further work in these areas; to study and analyze the developments in the emerging technology areas and document the findings, learnings and outcomes for wider dissemination and preparation of status reports on technologies from public funded institutions that are ready for commercialization with a view to catalyze the translation of research output from institutions to market. During the period under report 14 studies are under progress.

The TDUPW program is aimed to meet the specific needs of women and to enhance their technological capabilities. Currently 11 projects were in progress under this program.

Another component of TDUPW programme is to set up Skill Satellite Centres to enhance the quality of life of women by imparting knowledge and skills. These Centres are expected to help the local women uplift their socio-economic status significantly. The programme has been launched and the Department is getting proposals for setting up Skill Satellite Centres for women.

The Technology Development and Demonstration Programme (TDDP) started in 1992. Department has supported 254 R&D projects of Industrial units with a total project cost of Rs. 750.60 crores in which DSIR support is Rs. 280.40 crores. The projects cover a number of industry sectors and the share of these industry sectors in the project supported are: 32% engineering; 27% electronics; 21% Chemical; 7% energy & waste utilization and 13% Health & Pharma. The projects supported have been spread over 22 states of the country and the share of top five states in the number of project supported is: Andhra Pradesh 18%, Karnataka 15%, Maharashtra 13%, Delhi 10% and Tamil Nadu 10%. The scheme was discontinued in XIth Five Year Plan and spill over projects are supported to complete the scheme. 101 technologies developed under the scheme have been commercialized and the department has received a cumulative royalty of Rs. 72.52 Crore during the period 1997-2019. In the current financial year, progress of last 3 on-going projects was monitored.

3. *Asian and Pacific Centre for Transfer of Technology (APCTT).*

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MOST), Government of India has been the national focal point of Asian and Pacific Centre for Transfer of Technology (APCTT) for India since its inception in 1977. Matters pertaining to APCTT and UNESCAP are dealt with in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. DSIR also plays an active role in APCTT's functioning, particularly relating to its policies and programmes. India being the host country has been providing institutional support to APCTT since its inception.

As of 31 December 2019, APCTT received institutional support fund of US$213,061 (United States Dollar) out of pledged US$400,000 from DSIR to meet the local costs in addition to funding for building repairs, renovation work, and municipal taxes. DSIR also extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region – Phase II" which concluded in 2016. The residual fund of this completed project was reprogrammed under a new project "Promotion of Regional Cooperation between India and ESCAP member States to Strengthen National Innovation Systems". Activities under this project were implemented during 2018-2019.

4. *Information Technology and e-Governance (ITeG).*

Information Technology and e-Governance (ITeG) group was formed during mid of the 10th Plan period in order to create an IT enabled work environment in the Department through accelerated usage of various Information Technology opportunities. Primarily aims to convert the existing procedures and processes into citizen centered, ITeG division implements e-Governance in the Department progressively that needs be in conformance to the National e-Governance Action Plan. ITeG Division operates on a separate IT Budget Head under Secretariat Economic Services during FY 2019-2020 for the implementation of IT Action Plan.

For IT and e-Governance activities a comprehensive IT-Action Plan in the department as formulated in line with the Government directions issued from time to time. Online integration of five schemes of DSIR including CSIR-HRDG, NRDC and CDC with DBT Mission portal. Enrich the contents of the DSIR website by including downloadable forms and guidelines relevant to various citizen services that Department provides.

5. RTI Act 2005

The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the Act Nodal Officer, Appellate Authority, Transparency Officer, Central Public Information Officer and Central Assistant Public Information Officer are designated. The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated.

DSIR has received 94 Applications during 01/01/2019 to 31/12/2019 and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System at *https://rtinonline.gov.in/RTIMIS*. During 01/01/2019 to 31/12/2019, **05** applications were registered as first appeal.

DSIR has been effectively using various IT applications like RTI Request & Appeal Management Information System at *http://rtionline.gov.in/RTIMIS,* RTI Annual Return Information System at *http://rtiar.nic.in* and *https://dsscic.nic.in/users/pn-login* wherein quarterly returns were uploaded regularly.

The Division provided technical support by way of lectures on 'RTI Act 2005 and its Implementation' covering RTI Act 2005, Proactive Disclosures under Section 4 (1) (b) of the RTI Act 2005, RTI Online Portal, RTI Annual Return Information System and Transparency Audit during (i) Training Programme on Effective Implementation of RTI Act and Record Management organized by Council of Scientific and Industrial Research-Human Resource Development Centre (CSIR-HRDC), Ghaziabad during 29-30 April 2019 at Ghaziabad, (ii) Awareness Programme on Implementation of RTI Act 2005 organized by Council of Scientific and Industrial Research-Central Drug Research Institute (CSIR-CDRI), Lucknow on 14 November 2019 at Lucknow.

6. AUTONOMOUS INSTITUTIONS

6.1 Council of Scientific & Industrial research (CSIR)

The Council of Scientific & Industrial research (CSIR) establishment in the year 1942, is a premier research organization in the country. The organization has emerged as a multidisciplinary, multi-locational network of 38 national laboratories which undertake well focused basic and applied research in diverse fields of science and technology. CSIR has also established 39 outreach centres, one Innovation Complex and three units. CSIR's R&D expertise and experience is embodied in about 3502 active scientists supported by about 4648 scientific and technical personnel.

CSIR's focus is on pursuing science which strives for global impact, technology that enables innovation driven industry and nurture trans-disciplinary leadership thereby catalysing inclusive economic development for the people of India. It thus provides: Science & Technology interventions to benefit society; cutting edge technologies to industry so as to enhance national competitiveness; and technological support to the strategic sector to strengthen and deepen the capability and capacity base.

It catalyses S&T based entrepreneurship as well and has been building a sustainable ecosystem for S&T based Human Resource development including Skill Development.

CSIR has been providing significant technological interventions in many areas which include environment, health, drinking water, food, housing, energy, specialty chemicals & petrochemicals, glass & ceramics, medicinal plants & plants of economic value, leather, mining, metals & minerals, machinery & instrumentation, strategic sectors including aerospace etc. In doing so, CSIR partners with Industry in a significant manner.

CSIR is the Nation's custodian for Measurement Standards of Mass, Distance, Time, Temperature, Current etc. CSIR has created and is the custodian of Traditional Knowledge Digital Library (TKDL) which is a powerful weapon against unethical commercial exploitation of Indian traditional knowledge. CSIR maintains Microbial Type Culture Collection (MTCC), and Gene Bank.

Pioneer of India's intellectual property movement, CSIR today is strengthening its patent portfolio to carve out global niches for the country in select technology domains. CSIR has pursued cutting edge science and advanced knowledge frontiers. It has published around 5205 papers in SCI Journals during 2018 with average impact factor of 3.456.

CSIR has a strong connect with different stakeholders like industries, line ministries etc. and strong relation with international S&T institutions. Focus is also upon creating incubation facilities for spin off and startups through its various constituent laboratories and CSIR would hand hold these companies so as to create a new segment of knowledge enterprises.

CSIR has been focusing in a significant manner on the development of S&T Human Resource and provided the yeoman service through various fellowships. It has been imparting skills in diverse S&T areas so as to empower youth for better career and employment opportunities. CSIR has forged linkage with Ministry of Skill Development and Entrepreneurship to enhance and widen its contributions for Skill Development in the country.

6.1.1 Significant Events

CSIR Facilitates India's First Ever Biofuel-Powered Flight- ***Paves the way for sustainable and alternative fuels***

India's first historic biofuel-powered flight was flagged off on its maiden voyage on 27 August 2018 from Dehradun airport by Uttarakhand Chief Minister Shri Trivendra Singh Rawat. The bio-aviation fuel was produced indigenously by CSIR-IIP from jatropha oil and was based on the patented technology of the institute.

With this development, India has turned out to be one of the few nations in the world to utilise biofuel for planes. SpiceJet's latest generation Q400 aircraft featured in India's first biofuel-fueled flight from Dehradun to Delhi airport, which lasted for almost 45 minutes.

On the occasion, Dr. Harsh Vardhan, Hon'ble Minister, S&T, Earth Sciences and Environment, Forest & Climate Change and Vice President, CSIR, said that it is a historic day and that the biofuel technology is going to be a game changer as the Biojet fuel is greenhouse gas neutral, carbon neutral, reduces air pollution and would also bring down the import bill on crude oil. "Commercialisation of biofuel promises large-scale employment avenues both in the formal and informal sector," added Dr. Vardhan.

Besides reducing the greenhouse gas emission by nearly 15% and sulphur oxide emissions by over 99%, the use of Bio-aviation fuel is expected to provide indigenous jet fuel supply security, conceivable cost savings as availability at the farm level scales up, superior engine performance and lesser maintenance cost for the airline operators.

Union Ministers Shri Jayant Sinha, Shri Suresh Prabhu, Dr. Harsh Vardhan, Shri Nitin Gadkari, Shri Dharmendra Pradhan, and Director CSIR-IIP Dr. Anjan Ray

International Science Literature and Film Festival- As a part of India International Science Festival 2018

Dr. Harsh Vardhan, Hon'ble Minister of Science & Technology, Earth Sciences and Environment, Forest & Climate Change expressed that science films and science literature play a very important role in science communication. He also added that he dreamt of the day when science films would be the first choice of entertainment of the people.

The International Science Literature and Film Festival was coordinated (CSIR-NISCAIR) and Vigyan Prasar as a part of the 4th India International Science Festival.

The three-day event had an interesting mix of sessions that included panel discussions on science literature and science films; workshops on filmmaking, communicating science to the public, and visualising and designing science cartoons; interactions with authors and filmmakers; screening of science films, and an International Science Book Fair.

Elaborating the vision and mission of CSIR, Dr. Shekhar C. Mande, DG, CSIR explained that the organisation works on everything in terms of science and technology. Every CSIR lab has a niche and a strong base of excellent scientists who are contributing their excellence for the society, in the domain of their knowledge base.

Dr. Harsh Vardhan, Hon'ble Minister of Science & Technology, Earth Sciences and Environment, Forest & Climate Change addressing the gathering at the concluding function of the ISLFF at Lucknow

National Science Day Celebration and Shanti Swarup Bhatnagar Prize distribution

National Science Day celebration was held on 28th February 2019, at Vigyan Bhawan, New Delhi.The occasion was graced by the Hon'ble Prime Minister of India, Shri Narendra Modi as the Chief Guest.

Hon'ble Prime Minister and President, CSIR Shri Narendra Modi conferred Shanti Swarup Bhatnagar Prizes for the years 2016, 2017 and 2018 for Science and Technology. While congratulating the awardees, he said that science, technology and innovation

should be connected with the aspirations and requirements of the society.

In order to make India a global hub for manufacturing, knowledge and technology-based industries, Shri Narendra Modi asked the scientific community to take advantage of the Fourth Industrial Revolution and develop technologies.

Hon'ble Minister Science & Technology Minister, Dr Harsh Vardhan said that the efforts of the scientific community have taken CSIR to the ninth position in international ranking out of 1207 institutions of the world. Further, he mentioned about the various Government initiatives to foster innovation and strengthen the Science and Technology space in India.

Hon'ble PM Shri Narendra Modi called on scientists and researchers to adopt an interdisciplinary approach

The Shanti Swarup Bhatnagar prize winners with the Hon'ble PM, Minister and DG

International Conference and Exhibition on Energy and Environment: Challenges and Opportunities (ENCO-2019)

CSIR-CIMFR organised an International Conference and Exhibition on Energy and Environment: Challenges and Opportunities (ENCO-2019), during 20-22 February 2019 at Vigyan Bhawan, New Delhi. The conference was inaugurated by the Honorable President of India, Shri Ram Nath Kovind.

The three-day conference was aimed at identifying research and development requirements to develop new methods, technologies and applications for clean, safe, cooperative sustenance of society, environment, energy and industries in the post-2020 era.

Speaking on the occasion, the Hon'ble President appreciated CSIR for its globally acclaimed work in the field of science & technology and specifically CSIR-CIMFR for its contributions in coal-based, energy-oriented research and for developing safe, productive and sustainable mining methods.

The president further drew the attention of the audience towards current concerns about energy and environment not only for developing countries but also for developed ones. "Global trends show that coal will remain the predominant energy source for most countries, including India, while renewable sources will also grow," said Hon'ble President and urged the gathering to come up with actionable ideas on environmental issues related to using of fossil fuels and viable alternatives.

He also recalled India's commitments in the Paris Agreement and said that India had many commitments at the Paris Climate Conference expressing the strong desire to control carbon emission by Nationally Determined Contribution targets. Further, he advised the audience to deliberate on the

development of eco-friendly technologies for green mining to ensure environment-friendly use of natural resources.

During the Conference, Dr Harsh Vardhan, Union Science & Technology Minister, inaugurated an industrial exhibition in the Vigyan Bhawan Lawn. During his address, he mentioned that the world today recognises India's achievements, initiatives and visionary approach in the field of clean energy. He talked about the world's largest and innovative energy-efficient lighting programme of India with 330 million LED lights which reduced the emission of carbon dioxide by 32 million tonnes per year.

Dr Harsh Vardhan said that energy use needs to be optimal to make its supply sustainable. Though, worldwide coal is the predominant source of energy, hydroelectric, nuclear, solar and other renewable sources of energy are being considered as low carbon alternatives.

Addressing the gathering, DG-CSIR and Secretary-DSIR, Dr Shekhar C. Mande, said, "In the Paris Agreement, a target has been set for achieving less than two degrees of temperature change. India is one of the very few countries which is on target to meet the targets defined in the Paris Climate Change Agreement." Further, he also briefed about the achievements of CSIR labs.

Member, NITI Aayog, Dr V.K. Saraswat, in his keynote address said, "The theme of the conference Energy & Environment is most timely because all of us know that energy is the lifeline and this lifeline is coming under stress due to increasing demand." Energy use is an indication of the growth of the nation. Per capita energy consumption directly indicates the GDP of the nation, he added.

During the event, a Souvenir on the occasion was also released and Dr Vardhan presented the first copy of the Souvenir to the Hon'ble President. Earlier, he was also presented with a "Coal-ball".

Around a thousand delegates from India and abroad participated in the conference, including policymakers, regulators, thought leaders, managers, entrepreneurs, administrators, practising engineers, environmentalists, geo-environmentalists, researchers, academicians and technocrats. The conference was marked by keynote papers, oral presentations and poster presentations.

Hon'ble President delivering his address

Release of Souvenir

Inauguration the Next Generation Sequencing Facility

Hon'ble Minister of Science and Technology, Health and Family Welfare and Earth Sciences, Dr Harsh Vardhan, inaugurated the Next Generation Sequencing (NGS) facility at CSIR-Centre for CSIR-CCMB, on 20 July 2019. The Minister also laid the foundation stone for a new Skilling, Training and Lecture Hall Complex at CSIR-CCMB.

The NGS facility includes cutting edge

technology for high throughput genome sequencing, which also enables diagnostic related sequencing of transcriptome and exome (parts of the genome that are expressed in cells) of clinical samples. These services will be open for clinicians/hospitals and industry as well as academicians and universities.

Dr Vardhan during his address said that it will be of great help to patients with rare genetic disorder and will meet the pressing need for prevention of diseases and counselling. He also recalled the inauguration of the National Wildlife Gene Bank and reintroduction of Mouse Deer into the central zoo.

The Minister also said that he is privileged to lay the foundation for the CSIR-CCMB Skilling, Training and Lecture Hall Complex and said that these activities align with the Skill India Movement initiated by the Government of India.

Further, he informed the audience that the Government aims to deliver a new India to all Indians by 2022 which includes Wellness Centres across the country for positive and preventive healthcare system under the Aayushman Bharat scheme.

Later while addressing the staff and students of all three laboratories CSIR-IICT, CSIR-CCMB and CSIR-NGRI, at CSIR-IICT, Dr. Vardhan mentioned that CSIR laboratories are the most happening in terms of excellence in scientific publications as well as in technology transfers. He reminded all the scientific staff that the public money spent on the national laboratories should go back to them in the form of technologies improving their lives.

CSIR Foundation Day Celebration

The Council of Scientific and Industrial Research (CSIR) celebrated its 78th Foundation Day on 26 September 2019, in Vigyan Bhavan, New Delhi with great enthusiasm. The event was attended by a large number of young innovators, school children, scientists, awardees with their family members, and the CSIR fraternity. The occasion was graced by the Hon'ble President of India, Shri Ram Nath Kovind as the Chief Guest.

Highlighting the importance of scientific research and technology, Hon'ble President of India Shri Ram Nath Kovind said that the real implication of scientific research lies in its capability to help people accelerate socio-economic development in various areas like health and hygiene, sanitation, education and agriculture which in turn depend upon the extent of permeation of scientific research and innovation to society, institutions and enterprises.

He applauded the role of CSIR and said that CSIR is known for its cutting-edge R&D in diverse areas. Its work covers a wide spectrum of science and technology. More importantly, CSIR has helped improve the quality of life of our fellow citizens and helped business and industry with specific science and technology applications. Across different areas such as food and agriculture, generic drugs, leather, chemicals, several technologies developed by CSIR have been embraced by the market. CSIR occupies a key place in India's scientific space, emphasised the Hon'ble President.

"Science and technology are one of the key levers to achieve our national goals and to address the larger concerns confronting humanity today," said Shri Ram Nath Kovind. "We have set ourselves a goal of becoming a five-trillion dollar economy by 2025. We are committed to achieving Sustainable Development Goals. We also wish to play our role in addressing global concerns such as climate change. To a great extent, our success in meeting these challenges would depend on our ability to find creative solutions based

on scientific research. In this regard, your work has benefited society in ways that are not always known to many. For instance, I am told that through its interventions, CSIR contributed its bit in saving precious lives during cyclone Fani that hit Odisha earlier this year" he added.

The President concluded his talk by saying that we look to CSIR to help us navigate and adapt to this new technological-world as well as to strengthen basic scientific research. He further added that he is confident that CSIR will continue to work on new technologies as well as basic research relevant to different developmental goals.

Welcoming the gathering, Hon'ble Minister Dr Harsh Vardhan showed his immense pride in CSIR contributions and stated that the nation has very high expectations from CSIR in order to develop solutions and technologies to ensure sustainable development in the nation. During the programme, the Minister presented a prototype of high-temperature fuel cell, an indigenous technology developed by CSIR labs in collaboration with industries, to the President of India.

The CSIR Foundation Day lecture was delivered by Principal Scientific Advisor to the Government of India, Dr K. Vijay Raghavan. "In today's world we are in a new kind of crisis; humanity has always dealt with many crises in our civilizational existence but we have always managed to come out through our innovations, ideas, science and technology and so on," said Prof. Vijay Raghavan.

Dr Shekhar C. Mande, Director-General of CSIR, highlighted the importance of connecting Science and Technology to society and called upon the students and scientists to seek excellence in the field of Science.

A book titled "*Bhatnagar Laureates 1958-2018*" comprising the profiles and research work of the winners of CSIR's Shanti Swarup Bhatnagar Awards from 1958 to 2018, was also released during the programme.

The event concluded with the announcement of prestigious Shanti Swarup Bhatnagar Awards 2019, the highest multidisciplinary science awards in India along with other prizes for excellence in science and technology, instituted by CSIR.

From L to R: Dr Shekhar C. Mande, DG, CSIR; Dr Harsh Vardhan, Minister of Science & Technology, Health and Family Welfare and Earth Sciences; Shri Ram Nath Kovind, Hon'ble President of India; Shri A. Chakraborty, Head CSIR-HRDG

CSIR MoU with the Indian Navy

CSIR signed Memorandum of Understanding (MoU) with Indian Navy on 5 April 2019 to undertake joint research and development of advanced technologies for the Indian Navy.

Both CSIR and Indian Navy collaborated on 5 April 2019 to undertake joint research and development of advanced technologies for the Indian Navy. The MoU was signed by Vice Admiral G.S. Pabby PVSM, AVSM, VSM Chief of Materiel of Indian Navy and Dr Shekhar C. Mande, Secretary, DSIR and Director General, CSIR. The event was attended by Directors of seven CSIR Labs, Flag Officers and Heads of Directorates of Indian Navy and eminent scientists from CSIR Labs.

The MoU provides a formal framework for interaction between the Indian Navy and CSIR. It would facilitate joint R&D activities in diverse fields of Mechanical, Electronics, Communication, Computer Science, Propulsion systems, Metallurgy and Nanotechnology.

Indian Navy signs MoU with CSIR

CSIR-NPL Collaborates with Government Mint to Develop India's Own Gold Standard

India, despite being one of the largest markets for gold, most of the gold reference material is imported to check the purity of gold. Currently, goldsmiths use certified reference material from the National Institute of Standards and Technology (NIST) of the US.

The new standard bar of gold – BND 4201 is the reference material for gold of 9999 fineness and can be used to verify the purity of gold sold in shops. Bharatiya Nirdeshak Dravya (BND 4201) is India's first home grown high purity gold reference standard developed through a collaboration among the India Government Mint (IGM), Bhabha Atomic Research Centre (BARC), CSIR-National Physical Laboratory (CSIR-NPL) and National Centre for Compositional Characterisation of Materials.

The measurement of the high purity BND-4201 is traceable to SI units; therefore the possibilities of exporting to other economies are very high.

Development of this reference material indigenously would help jewellers to move towards more conductive methods rather than conventional fire assay methods for testing purity of gold, which is time consuming and environment destructive as poisonous gases are released.

Licensing of CSIR-NAL's Lead Zirconate Titanate (PZT) Powder Technology to M/s IPA Pvt. Ltd., Bengaluru

CSIR-NAL signed License Agreement with M/s IPA Pvt. Ltd., Bengaluru for "Production of PZT powders and the products manufactured thereof". PZT powders of high piezo properties (with piezoelectric charge constant (d_{33}) > 500 pC/N and maximum d_{33} of 700 pC/N) using the wet chemical route.

The agreement was signed for the production and commercialisation of Lead Zirconate Titanate (PZT) powder for sensor and actuation applications. PZT powder is used for fabrication of various types of components used for many engineering applications such as aerospace vibration control, precision fluid flow control, underwater sonar transducers, accelerometers, force transducers, vibration sensors, vibration energy harvesting, etc.

CSIR-IGIB Licenses out Diagnostic Tests for Rare Genetic Diseases

CSIR-IGIB has entered into an agreement with Dr Lal Path Labs to commercialise a set of 27 genetics tests it has developed over the years. Dr Lal Path Labs has a large network of diagnostic centres across the country. To be launched in phases over the year, these tests could make diagnosis of genetic diseases much easier.

CSIR-IGIB has a rich expertise in the area of genomics and the institute has carried out over 14,000 genetic tests, benefiting about 4,000 patients. These tests cover a variety of diseases/disorders including movement disorders, motor neuron disease, mitochondrial disorders, developmental and inborn errors of metabolism, and leukodystrophies.

CSIR-NPL and M/s Global PT Provider (P) Ltd Sign Agreement of Production of Bharatiya Nirdeshak Dravya

CSIR-NPL and M/s Global PT Provider (P) Ltd signed an agreement for the production of Bharatiya Nirdeshak Dravya (BND). CSIR-NPL contributes metrological traceability to the reference material producers, which can be further exported in different countries under the brand name of Bharatiya Nirdeshak Dravya (BND). Global PT is the NABL authorised PT provider and also producer of reference materials which includes hardness blocks.

Tirupur Corporation Signs MoU with CSIR-CLRI regarding production of *Biogas from Degradable Waste*

The Tirupur Corporation has signed a Memorandum of Understanding with CSIR-CLRI to prepare a Detailed Project Report (DPR) and develop sustainable technology for a Bio-Compressed Natural Gas (Bio-CNG) bottling plant. The plant will help the environment by converting the degradable waste generated in the city into CNG which can then be used by automobiles with good mileage. Currently, nearly 100 tonnes of organic waste is generated every day in the city from approximately 520 tonnes of mixed municipal solid waste. The two plants will have a cumulative capacity to produce 300 Bio-CNG cylinders per day.

Indigenous Lithium Ion Battery Production to Drastically Cut Foreign Imports

CSIR-CECRI and RAASI Solar Power Pvt Ltd have signed a Memorandum of Agreement for transfer of technology for India's first Lithium Ion (Li-ion) Battery project. The Agreement was signed in Bengaluru on 9 June 2018 Director, CSIR-CECRI and Chairman-cum-Managing Director of RAASI Group in the presence of Union Minister for Science & Technology Dr. Harsh Vardhan.

Currently, Indian manufacturers source Lithium Ion Battery from China, Japan and South Korea among some other countries. But now, CSIR-CECRI has developed an indigenous technology of Lithium-ion cells and set up a demo facility in Chennai to manufacture prototype Lithium-Ion cells. It has secured global IPRs with potential to enable cost reduction, coupled with appropriate supply chain and manufacturing technology for mass production.

"Today's development is a validation of the capabilities of CSIR and its laboratories to meet technology in critical areas to support our industry, besides other sectors," said Dr. Harsh Vardhan after the signing ceremony. "It will give tremendous boost to two flagship programmes of Prime Minister Shri Narendra Modi – increasing the share of Clean Energy in the energy basket by generating 175 Giga Watts by 2022, of which 100 Giga Watts will be Solar and the second, National Electric Mobility Mission, to switch completely to electric vehicles by 2030."

Dr Harsh Vardhan further said, the project is in tune with Prime Minister's vision of "Make in India", to turn India into a manufacturing hub and to cut down outflow of foreign exchange.

The Memorandum of Agreement signed between CSIR-CECRI and RAASI Group

Establishment of a National Calibration Facility for PM_1, $PM_{2.5}$ and PM_{10} Sampling Inlets

A particulate matter (PM) wind-tunnel has been established at CSIR-NPL. This is a first and unique facility in the country to test and calibrate PM_1, $PM_{2.5}$ and PM_{10} samplers. With this facility, now all the PM samplers manufactured in the country can be calibrated and certified. Also, all the imported PM samplers can be tested for their suitability under Indian conditions. Parameters such as cutoff size, Sharpness of cutoff etc. can be tested and calibrated by using this facility.

A high-volume PM2.5 sampler has been developed and patented by CSIR-NPL. The technology has been transferred to M/s Environmental Solutions.

Honourable Minister of S&T and ES Dr. Harsh Vardhan has inaugurated the indigenously developed and commercialized high-volume sampler by the M/s Environmental Solutions under the licensed technology (know-how) of CSIR-NPL patented technology.

Indigenous developed wind-tunnel facility to test and calibrate PM1, PM2.5 and PM10 samplers

Development of Hansa –NG Air Craft

Significant efforts were made towards the development of Hansa- New Generation (NG) aircraft with the improvements such as, glass cockpit, advanced fuel efficient ROTAX engine with better performance (increased range & endurance), optimized airframe, Glass Cockpit, steerable nose wheel, electrically operated flaps, IFR compliance, improved ingress-egress, better interiors/ergonomics and external finish. The technology for light weight composite material has been developed for producing the Hansa parts. For the first time in history of Hansa aircraft programme, DG, CSIR had on-board flying experience in the Hansa. Hansa has been upgraded to Glass cockpit and certified by DGCA. The aircraft took part in Aero India 2019

.Hansa-NG with DG CSIR on-board the aircraft at Aero India

Dr Shekhar C. Mande, DG-CSIR, Felicitated with Bharat Asmita Tantra-Vidnyan Shrestha Award

Dr Shekhar C. Mande, Director General, Council of Scientific and Industrial Research (CSIR) has been awarded the 'Bharat Asmita Tantra-Vidnyan Shrestha Award'. The Award Ceremony was held on 3 February 2019 jointly organised by MIT World Peace University, MIT School of Government and Bharat Asmita Foundation.

CSIR bags Exhibitor of the Year Award

CSIR was adjudged as "Exhibitor of the Year" at the 106th Indian Science Congress – Pride of India (PoI) Mega Science Expo on the focal theme "Future India: Science & Technology" organised during 3-7 January 2019 at the Lovely Professional University (LPU), Phagwara, Punjab.

The five-day Mega Science Exhibition showcased cutting-edge technologies, leading scientific products and services, path-breaking R&D initiatives, schemes and achievements of India's foremost and leading public and private sectors, central and state government departments, research labs, educational institutions, corporate, defence, etc.

Latest technological advancements made in various sectors by CSIR, DRDO, ICMR, DST, MoES, GSI, DAE, ISRO, DBT, ICAR, etc. and other institutions, academic bodies, universities and other stakeholders associated with the education sector were exhibited at the PoI Expo.

'Exhibition of the Year' Award to CSIR at 106th Indian Science Congress

6.1.2. Significant S&T achievements

Anacardic Acid: A potential molecule to increase cotton fibre yield and quality

India tops the world in having the largest area under cotton cultivation. However, the yield of cotton in India is declining at 500 kg/ha compared to the other cotton producing countries like Brazil. Innovative technologies are therefore needed to improve cotton yield in India which will be a direct benefit to the farmer. CSIR-NBRI developed a formulation based on a green molecule-Anacardic acid which improves cotton yield. Multi-location trials in different cotton growing states showed 10-15% increase in yield of popular cotton hybrids. The technology promises at least 10% increase in cotton yield that will contribute to Rs. 2000-5000/hectare increase in the income of a farmer. Besides, it leads to earliness in cotton production that will help farmers prepare land for next crop.

Red mud based lead free material for X-ray and CT scanner rooms

CSIR-AMPRI has designed Joint free red mud based radiation shielding tiles. The

material is tested by as per AERB norms and semi pilot plant level studies were carried out to further improve density and reduce the thickness of tiles . Results revealed that 0.6 mm thickness of the tiles possess attenuation characteristics (100 kVp) equivalent to 0.9 mm lead. Shielding thickness at 100 KVp in terms of half value thickness (HVT) is 1.6 mm which is equivalent to 15 mm of concrete.

Upscaling and installation of developed tiles in X-Ray, CT scanner rooms and Cath-Lab has been done at M/S Saideep Healthcare Pvt Ltd Ahmednagar, Maharashtra by M/s Assurays, Noida. Radiation levels are below permissible limit and radiation shielding provided is as per AERB norms of permissible radiation levels.

Shiitake mushroom: vitamin D2 Enriched

Shiitake *(Lentinula edodes)* is an edible mushroom which has high medicinal value. Vitamin D is essential for bone health and to boost immune system. A technology for enhanced production of ergocalciferols (Vitamin D2) in Shiitake mushroom has been developed by CSIR-IHBT for captive cultivation for Vitamin D2 enriched mushroom in 2 months with yield of 0.5-0.6 kg fresh fruiting body per kg of dried substrate. Encapsulated 500 mg shiitake powder meets 50% recommended dietary allowances (RDA) of Vitamin D2. Technology has been transferred to M/s Innotech AgroPostikum Pvt. Ltd., Guwahati Biotech Park, IIT Guwahati, Assam and M/s Pravin Masalewale, 44, Hadapsar Industrial Estate, Hadapsar, Pune.

Image-guided vascular vein visualizer (VeinViz)

In case of critical ill patients, intravenous (IV) therapy is considered as the fastest mean of providing fluids and medications through peripheral venous catheter. It is often a problem for clinicians to find and locate vein and in the process they pricks several time before placing the needle successfully, which causes pain and distress to the patient, and frustration to the clinicians. CSIR-CSIO has been working to develop a non- invasive, real-time portable device for detection and visualization of peripheral subcutaneous veins of neonatal, obese and dark skin patients. A prototype of the device has been developed.

Prototype of developed Vein-VizDevice

Green Technologies for Quality Drinking Water

CSIR-CMERI has developed three technologies for supply of quality drinking water from groundwater sources. The newly developed technologies are based on the principles of oxidation, precipitation and filtration and do not require electric power and so are completely green.

In India, groundwater is the major source for drinking and domestic purposes. However, the presence of contaminants like iron, arsenic and fluoride in groundwater is also a matter of concern. The new technologies will ensure quality drinking water from groundwater sources free from iron, arsenic and fluoride contaminations. The technologies are ready for commercialisation and would be

transferred to the private companies Sarvo Technologies Ltd. of Haryana and ISW Industries in Howrah in West Bengal for implementation across the nation.

Fire Retardant Water Based Clear/ Transparent Coating for Wood & Wood Based Interiors

CSIR-CBRI developed fire retardant water based clear/transparent coating that could be used on all types of wood and wood based interiors (i.e. the materials / products used inside the building, either existing or new). The application of coating may be done by brush, roller or spray gun. The raw materials include amides, phosphoric acid (specified % available commercially), and water, Boron compounds, catalyst and preservative in specified quantities and the reaction was carried out in stages using specified quantities of ingredients at specified temperatures for specified time. The resultant product is "Fire Retardant Water Based Clear/Transparent Coating". The technology has been transferred to M/s Paramount Intercontinental Pvt. Ltd, Sonepat.

Stone dust-precipitator systems for stone carving artisans

It has been observed that a large workmanship in Sirohi and surrounding areas is Artisan are working on stone carving, which is the key source of income for them. Most of these are illiterate and tribal. Some of them work from home and also those who are working in factories do not use protective means. Due to the working without protection, silica dust enters into the lungs by inhalation of breath. It is marked by inflammation and scaring of the lungs resulting in nodular lesions in the upper lobes of the lungs and after few years of working a large number of them dies due to silicosis.

CSIR-CEERI has developed stone dust-precipitator system for stone carving artisans, provides dust free environment to the workers and is ready for deployment in smaller factories. This system collects the tiny dust particles with its high suction power, which is near about 10 times more than that of the inhaling power of human beings. System is based on vacuum technology and in this system there is a main chamber, which works as a junction of dust collecting branches.

To create a vacuum in this chamber, a high speed exhaust kit is placed at the top, which sucks air from the chamber continuously and throws it outwards. There are four filters fitted around the chamber, which separates the stone dust from air. These filters consists of continuous water spray, so that the stone dust gets removed from filters and collected in the dust collector in the form of sludge along with water. A standalone system for single artisan has also been developed.

Indigenous Anti-Counterfeit Ink

CSIR-NPL has developed technology for production of a high security ink that makes counterfeiting difficult. The ink developed by the institute is printable on all papers and surfaces and can be tested both under UV and Infrared lights. This dual-mode glowing by the ink adds to its secure nature making it doubly counterfeit proof. The ink is formulated from a cost-effective dual-mode luminescent composite pigment. It is prepared by a combination of rare earth elements like Gadolinium, Ytterbium and Erbium oxides with phosphors such as Zinc and manganese sulphide.

The composite pigments in the ink, are tunable and thus more secure. Meaning that the pigments responding to specific excitation wavelengths and that emit specific wavelengths of light are possible. This makes

it extremely difficult to counterfeit. In other words, patterns that appear identical on paper or on different currencies may glow differently when exposed to a selected and specific frequency of light. Besides making currency secure, these novel inks can also be used in printing labels of pharmaceuticals or in printing important documents.

With the patent pending, the ink's availability in the market may not be too distant. It would then be another unique gift from the CSIR-NPL which gave us the indelible ink to ensure a free franchise.

Prints using the new security ink appear differently under normal light (a) and under UV light (b)

Natural Composite for Stronger Bone Grafts

CSIR-NML has developed a novel nanocomposite that has shown potential to be used as a regenerative bone graft especially in regions that need high strength.

The nanocomposite was synthesised through a simple and cost-effective route. The composite contains carboxymethyl cellulose, gelatin and hydroxyapatite, with the hydroxyapatite in nanoscale (25-10 nm size).

Since bone grafts to be used in load-bearing applications must match the strength of the natural bone, the researchers evaluated the strength and elasticity of the nanocomposite and found it to be in the same range as human cancellous and cortical bone. So there is no risk of damage to adjacent bones after implantation. The nanocomposite gets absorbed inside the body and new bone is formed in that place. And unlike metallic implants, there is no need to take out the new implants.

Converting Paddy Biomass into Green 'Biocoal'

CSIR-NPL has devised a solution to deal with the problem of stubble burning. The scientists have called for conversion of paddy biomass into green 'biocoal' to be used in thermal power plants.

According to a study published in *Current Science*, this conversion of paddy stubble into green product biocoal through torrefaction process would also help farmers to earn money using the agriculture residue. Besides, by optimizing the processing parameters of torrefaction process, desired calorific value of torrefied product has been archived, as per the study conducted in Haryana. It also pointed out that 10 per cent use of torrefied product with coal can consume 140 million tonnes of rice straw, thus considerably reducing the consumption of fossil fuels and also cutting down environmental pollution and greenhouse gas (GHG) emission.

Similarly, residue of other crops like wheat, sugarcane, oilseed, maize and cotton which is estimated to be around 500 million tonnes in the country, can be used as biocoal in thermal plants after torrefaction.

CSIR Launches Aroma Mission in Leh

The CSIR-IIIM launched the CSIR-Aroma Mission at Leh, Ladakh. The CSIR Aroma Mission seeks to bring about transformative change in the aroma sector through interventions in agriculture, processing and

product development for fuelling the growth of the aroma industry and boosting rural employment.

With its widely varying agro-climatic conditions, Jammu and Kashmir is suitable for production of a variety of aromatic crops like Rose, Lavender, Rosemary, Wild Marigold, Monarda, Scented Geranium, Mints and different aromatic grasses. The CSIR Aroma Mission launched at the High Mountain Arid Agriculture Research Institute in Leh seeks to provide all support and guidance in promoting cultivation of these crops in Ladakh leading to not only augmenting the aroma industry but also considerably enhancing farmers' incomes.

An awareness programme "Catalyzing Rural Employment through Cultivation, Processing, Value Addition & Marketing of Aromatic Plants" was conducted at the Shenam Hall, Leh, Ladakh where a team of scientists from CSIR-IIIM interacted with more than 100 farmers, students, women self help groups and other participants from different parts of Ladakh.

The prime objective of the Aroma Mission is promoting the cultivation of aromatic crops for essential oils that are in great demand in the aroma industry. It is expected to enable Indian farmers and aroma industry to become global leaders in the production and export of essential oils on the pattern of menthol mint. This is expected to provide substantial benefits to the farmers in achieving higher profits, utilization of waste lands and protection of their crops from wild and grazing animals.

It is expected that an additional 700 tonnes of essential oil could be produced annually for perfumery, cosmetics and pharmaceutical industries, and use of these oils in value addition and herbal products would generate a business of at least 200 crores.

The income of the farmers is expected to increase by Rs. 30,000 to 60,000/ha/year. About 45,000 skilled human resource capable of multiplying quality planting material, distillation, fractionation and value addition will be developed. More than 25,000 farming families would be directly benefitted and an employment of more than 10-15 lakhs mandays will be generated in rural areas.

First of its Kind "Waste Management Park" Built

CSIR-NEERI has established first of its kind Waste Management Park to Nagpur. The main focus of the park is to make people aware of effective waste management by reducing, reusing, recycling and segregating the waste; the park is itself a desirable model for depicting how well waste can be converted into useful products.

The Waste Management Park exhibits how waste can be managed, reduced and beautified. The park has two huts that serve as a learning centre about how different kinds of wastes like hazardous waste, Construction and Demolition (C&D) waste, biomedical/ reject waste, etc. can be treated and recycled and simultaneously highlight what a citizen can do to minimise waste generation.

HERBAS Pro:

A Computer-aided Machine Vision System for Authentication of Herbal Plants used in Ayurvedic Medicine. A Computer-aided Machine Vision System for authentication of herbal plants used in Ayurvedic Medicines named HERBAS Pro has been developed byCSIR-CEERI, Chennai Centre. The project was sponsored by M/s Arya Vaidya Sala, Kottakkal, Kerala, costing Rs.10.01 lakhs for the duration of 8 months.

The system captures the images of the herbs from the affixed microscope, collects

data, creates a reference for new herbs and authenticates the herbal test specimen. The software for the system has a dimension measurement feature during image streaming mode that allows the user to measure the distance between feature points based on the microscope objectives. The system also enables the user to generate Quality Check Reports (QCR) for the analysis performed over the herb specimen.

HERBAS Pro system is designed to facilitate botanists in the authentication and grading process of the herbs used in Ayurvedic medicines at the microscopic level and to generate a herb reference collection of the herbs that are being provided by various suppliers. The system would enormously help in improving the marketability of the company's product.

Technology that Converts Distillery Waste to Fertiliser developed

Distilleries generate 10-15 litres of wastewater effluent or "spent-wash" while producing one litre of alcohol from fermentation of sugarcane molasses. There are almost 300-odd molasses-based distilleries in India churning out 2.5-2.6 billion litres of alcohol annually, and in doing so also discharging 30-35 billion litres of spent wash that can contaminate surface and ground water.

CSIR-CSMCRI has developed a process to separate the main source of pollution — potash and biodegradable organic matter — from distillery spent-wash. While helping distilleries comply with the Central Pollution Control Board's mandated zero liquid discharge (ZLD) action plans, this technology will also meet up to a tenth of India's potassium-based fertiliser requirements, now entirely met through imports. It will encourage more distilleries to come up and produce ethanol for blending with petrol, cutting the country's oil import bill and bringing sugarcane growers better returns.

The technology employs a coagulation process to separate complex organic compounds from spent-wash. According to CSIR-CSMCRI, the process yields 10 tonnes of complex organics, 2.5 tonnes of potassium nitrate and 75,000-80,000 litres of recycled water from every one lakh litres of spent-wash.

CSIR-CSMCRI has already filed a patent and has converted the process into a commercial-scale technology in collaboration with Chem Process Systems Private Ltd, an Ahmedabad-based firm. The first full-fledged commercial plant using the technology is expected to be commissioned by Aurangabad Distillery Ltd (ADL) at Walchandnagar, Maharashtra soon.

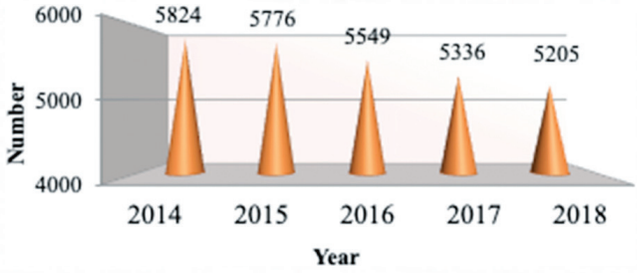
Novel Way to Inhibit Bacterial Growth

CSIR-CCMB have discovered a new mechanism to inhibit bacterial growth, paving the way for novel antibiotics to fight against infections resistant to drugs.

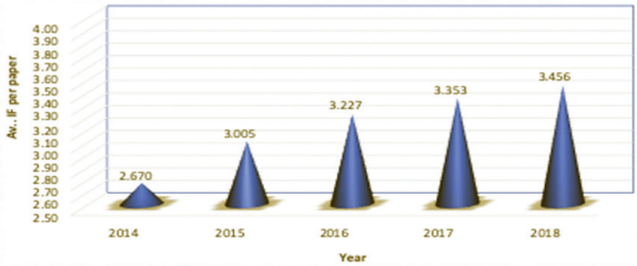
The scientists isolated an Antimicrobial Protein (AMP) from the milk of a unique egg-laying mammal, namely, Echidna, also known as spiny anteaters found in Australia and New Guinea. The extracted protein may serve as an alternative to antibiotics used on livestock. The Antimicrobial Protein (AMP) in the milk of the mammal can puncture the cell membranes of multiple bacterial species thereby destroying the infection. The study has been published in the journal Biochimica et Biophysica Acta–Biomembranes.

6.1.3 Scientific Excellence

CSIR has published 5205 research papers during 2018 in SCI journals of repute.

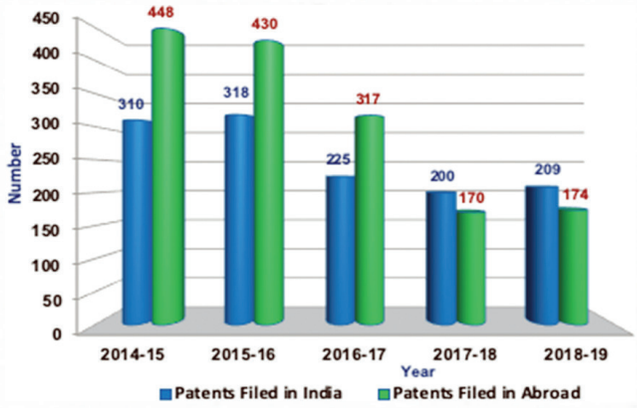


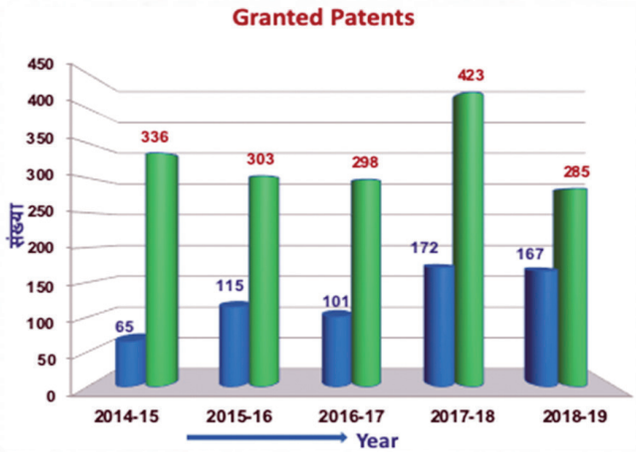
The new knowledge generated from CSIR laboratories is reflected in terms of high average Impact Factor (3.456). Following graphs shows the trend of research over the last five years.



6.1.4 Excellence in Intellectual Property

CSIR has filed 174 patents abroad and 209 patents in India during 2018-19, and it has been granted 285 patents in abroad and 167 patents in India. Following graphs provide data on patents filed and patents granted over the last five years:





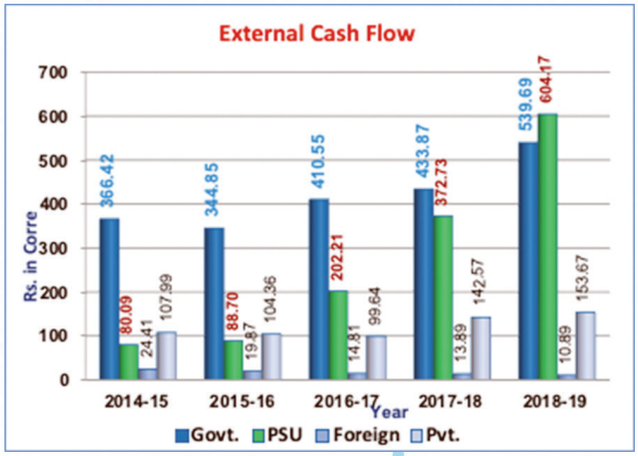
CSIR's Copyright Filing:

CSIR has also explored the possibility of obtaining rights over other forms of IP generated by various laboratories. CSIR has filed **35 Copyright applications** during 2018-19.

The Copyright applications filed by CSIR subsist in different categories such as literary work, software and artistic work.

Value Generation through External Cash Flow:

CSIR has generated External Cash Flow of Rs. 1308.44 crore during 2018-19, through working with various Govt./ non-Govt. Indian and foreign organizations. Following graphs provide data on ECF generated over the last five years:



6.2 Consultancy Development Centre (CDC):

The Consultancy Development Centre (CDC) was set up in January 1986 in the form of a registered society supported by the Department of Scientific and Industrial Research (DSIR) as its Administrative Ministry, to promote, develop and strengthen consultancy capabilities in the country. CDC was approved as an Autonomous Institution of DSIR by the Government of India in 2004. The Centre is managed by a Governing Council consisting of members drawn *inter alia* from Government Departments, Research organizations, Academic institutions and Consultancy companies. CDC has been getting an annual plan support from DSIR for carrying out schemes, projects and activities aimed largely at competency enhancement and capacity building of consultants in the country.

During the year, CDC undertook various activities keeping in view its mandate of promotion and development of consultancy covering capacity building, creation of trained human resources in the consulting domain and facilitation of client organizations in the selection of right consultants for their projects.

CDC is proposed to be merged with CSIR, as an outcome of the Autonomous Bodies Review exercise carried out by NITI Aayog / Ministry of Finance.

7. PUBLIC SECTOR ENTERPRISES

7.1 National Research Development Corporation (NRDC):

National **R**esearch **D**evelopment **C**orporation (NRDC) is a Government of India enterprise, under the Administrative control of Department of Scientific & Industrial Research (DSIR), established in 1953 under section 25 now section 8, of the companies act. The main objective is to promote, develop and commercialize technologies/ know how/ inventions/ patents/ processes emanating from various national R&D institutions. The Corporation offers its services through-out the country in improving the Nation's manufacturing base with innovative technologies specially suitable for our entrepreneurs and conditions. It acts as an effective Interface for translating R&D results into marketable products. Over the last more than six decades of its existence, the Corporation has forged strong links with various R&D organizations both within the country and abroad and pursued bringing inventions and innovations to commercial fruition. The Corporation is recognized as a repository of a wide range of technologies and has licensed technologies to over 5000 entrepreneurs spread over almost all areas of industry and has provided assistance for filing of 1800 patents. During the period under report, NRDC has signed 52 MOUs/ MOAs/Agreements with Institutions/ Organizations for intellectual property

protection, technology commercialization, technology consultation and other value-added services. During the financial year 109 new processes/technologies were assigned to the Corporation for licensing and NRDC managed to sign 22 license agreements. The consolidated Lump sum Premia & Royalty income is 910.69 Lakhs for NRDC.

7.2 Central Electronics Limited (CEL):

Central Electronics Limited (CEL) is a Public Sector Enterprise under the Department of Scientific and Industrial Research (DSIR), Ministry of Science & Technology, Government of India. It was established in 1974 with an objective to commercially exploit indigenous technologies developed by National Laboratories and R & D Institutions in the country. CEL is one of the companies that utilized home grown technologies during all these years of its existence. The Company is primarily engaged in production of strategic components for defence applications of national importance, equipment for railway safety and solar photovoltaic modules and systems.

The Company has developed a number of products for the first time in the country through its own R & D efforts and in close association with the premier National & International Laboratories including Defense Laboratories. In recognition of all these efforts, CEL not only have the distinction of being a DSIR recognized R & D Company, but also has been honored a number of times with prestigious awards including "National Award for R & D by DSIR".

CEL has already established partnerships and linkages with various stake-holders and business associates in the areas of railways, telecom, police, power generation and distribution companies, service providers in the energy sector, public funded institutions and even rural communities through the state governments. The existing marketing channels are being consolidated and expanded harnessing the unique advantage CEL has experienced manpower in terms of its product base and PSU status.

The renewed mandate of CEL includes development and harnessing technology for (i) Solar Energy Systems and Solutions (ii) Strategic Electronic Components and systems required for Defense, Space, Atomic Energy. (iii) Signaling and Safety in Public Transport Systems (iv) Infrastructure, Eco-systems management and energy conservation and (v)Security and Surveillance in strategic establishments. CEL has been the pioneer in the country in the different areas of manufacturing &proprietary manufacturer of the many strategic electronic components for use by defense organizations in the country. The Company has achieved production of Rs.229.73 Crore and turnover Rs.232.55 Crores. Microwave Electronics Division (MED) - achieved sales of Rs.32.09 Crore and production of Rs.37.31 Crore in 2018-19. The Company has achieved the Gross Margin of Rs. 11.69 Crore. The Net profit after tax was Rs.1.69 Crores against Rs. 21.70 Crores in the previous year.