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Type them into questions box!

"Why am I muted?"
Don't worry. Everyone is muted except the presenter and host. Thank you and enjoy the show.

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From renewable fuels to creating the materials for the technology of tomorrow, chemistry plays a pivotal role in advancing our world. Meet the chemists that are building a better world and see how their science is making it happen.

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Why does food taste better when it is grilled or what molecular compounds make a great wine? Discover the delectable science of your favorite food and drink and don't forget to come back for a second helping.

Popular Chemistry

▶ View the Collection

Feeling burdened by all that molecular weight? Listen to experts expound on the amazing side of current hot science topics. Discover the chemistry of rockets, how viruses have affected human history, or the molecular breakdown of a hangover.

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How do ideas make it from the lab to the real world? Discover the ins and outs of the chemical industry whether you are looking to start a business or desire a priceless industry-wide perspective.

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Learn from the best and brightest minds in chemistry! Hundreds of webinars on diverse topics presented by experts in the chemical sciences and enterprise.

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www.acs.org/acswebinars

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YOUR CAREER

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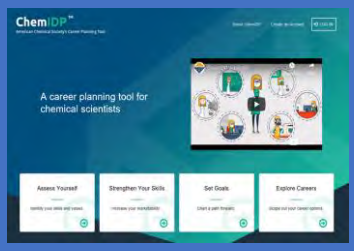

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- in ACS Innovation Hub

  Connect, collaborate, and stay informed about the trends leading chemical innovation

  Join: bit.ly/ACSinnovationhub

ACS Career Navigator: Your Home for Career Services

Whether you are just starting your journey, transitioning jobs, or looking to brush up or learn new skills, the **ACS Career Navigator** has the resources to point you in the right direction.

We have a collection of career resources to support you during this global pandemic:


Professional Education


Virtual Career Consultants

ACS Leadership Development System


Career Navigator LIVE!


ChemIDP


College to Career

ACS Webinars

Virtual Classrooms

Visit www.ACS.org/COVID19-Network to learn more!

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Join us in our efforts to increase the diversity of chemistry.

Valued donors like you have sustained ACS educational programs that are welcoming students from diverse backgrounds into our profession.

www.acs.org/donate

ACS Office of Philanthropy
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A Career Planning Tool For Chemical Scientists

ChemIDP is an Individual Development Plan designed specifically for graduate students and postdoctoral scholars in the chemical sciences. Through immersive, self-paced activities, users explore potential careers, determine specific skills needed for success, and develop plans to achieve professional goals. **ChemIDP** tracks user progress and input, providing tips and strategies to complete goals and guide career exploration.

https://chemidp.acs.org

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ACS Department of Diversity Programs

Advancing ACS's Core Value of Diversity, Inclusion & Respect

We believe in the strength of diversity in all its forms, because inclusion of and respect for diverse people, experiences, and ideas lead to superior solutions to world challenges and advances chemistry as a global, multidisciplinary science.

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ACS Chemistry for Life®

Date: Wednesday, September 8, 2021 @ 2-3pm ET
Speaker: Bill Carroll, Carroll Applied Science
Moderator: Tom Halleran, American Chemical Society

Register for Free!

What You Will Learn:

- How your persona changes when you retire
- Why it's important to actively structure your retirement
- Some useful tools for retirement success

Co-produced with: ACS Careers

Date: Thursday, September 9, 2021 @ 11am-12pm ET
Speakers: H.N. Cheng, 2021 ACS President / Frank Roschangar, Boehringer-Ingelheim and ACS Pharmaceutical Roundtable / Klaus Kümmerer, Leuphana University
Moderator: Mary Kirchhoff, ACS Scientific Advancement

Register for Free!

What You Will Learn:

- How the current economic, socio-political, and safety/environmental trends all favor green chemistry innovations
- Why learning green chemistry at the university is an advantage to recent graduates to find great employment because it's a promising and emerging area, involving multidisciplinary teams, and encompassing new applications of chemical skills
- How green chemistry education plays a role in reshaping chemistry's image, contributing to a better world tomorrow

Co-produced with: ACS on Campus, ACS Green Chemistry Institute, CAS, and German Chemical Society

Date: Wednesday, September 15, 2021 @ 2-3:30pm ET
Speakers: Andrew Dove, University of Birmingham, UK and Robert Waymouth, Stanford University
Moderator: Rachel Letteri, University of Virginia

Register for Free!

What You Will Learn:

- Application of organic catalysts for stereocontrolled step growth polymerization
- Development of high temperature organic catalysts for polymerization and depolymerization
- Using organic catalysts to selectively depolymerize plastic mixtures
- New designs for ultrafast organocatalytic polymerization reactions
- Synergies between continuous flow chemistry and rapid organocatalytic polymerization reactions
- New catalysts enabling the design of emerging functional materials for gene delivery

Co-produced with: ACS Division of Polymer Chemistry

www.acs.org/acswebinars

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More from India Webinar Series!

ACS Chemistry for Life®

Featuring:


Anubhav Saxena
Pidilite Industries Limited


Ashutosh Sharma
Department of Science and Technology
ACS Applied Material and Interfaces


Dipankar Das Sarma
Indian Institute of Science
ACS Energy Letters


Sandeep Verma
Science and Engineering Research Board


Amitabha Bandyopadhyay
Indian Institute of Technology Kanpur


Sarbajit Banerjee
Texas A&M University
ACS Omega


Deeksha Gupta
American Chemical Society

https://www.acs.org/content/acs/en/acs-webinars/india.html

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ACS Chemistry for Life®

Co-produced with: **ACS International**

New Education Policy 2020

Impact on India's Higher Educational Institutions

Professor V. Ramgopal Rao
Director, Indian Institute of Technology Delhi, India

FREE Webinar TODAY at 6pm Indian Standard Time ACS Webinars CLICK • WATCH • LEARN • DISCUSS

THIS ACS WEBINAR WILL BEGIN SHORTLY . . .

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ACS Webinars CLICK • WATCH • LEARN • DISCUSS

ACS Chemistry for Life®

New Education Policy 2020: Impact on India's Higher Educational Institutions

V. RAMGOPAL RAO
Director, Indian Institute of Technology Delhi, India

DEEKSHA GUPTA
Associate Director-India, American Chemical Society

Presentation slides are available now! The edited recording will be made available as soon as possible.

www.acs.org/acswebinars

This ACS Webinar is co-produced with the ACS International, C&EN Jobs, and ACS Publications.

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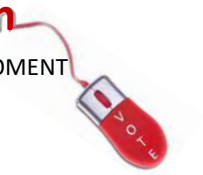
Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Are you aware of New Education Policy 2020?

- Yes
- No
- Partly
- I want to know more

** If your answer differs greatly from the choices above tell us in the chat!*

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IIT Delhi

NEW EDUCATION POLICY 2020: IMPACT ON INDIA'S HIGHER EDUCATIONAL INSTITUTIONS

V. Ramgopal Rao

IIT Delhi

http://www.ee.iitb.ac.in/~rrao
Email: rrao@ee.iitb.ac.in
rrao@iitd.ac.in

ACS Webinars India
September 1, 2021

Current Status of Indian R&D

- India ranks 3rd in the world in terms of research output
- India's share of scientific publications is 5.31%. China's share is 20.67% and for US, it is 16.54%.
- India saw a growth rate of 11% in scientific publications as compared to the world average of 4%
- Ranked #1 in terms of "papers written"/$ spent….
- In certain areas such as Nanotechnology, India is ranked 3rd in the world.

➢ Need to focus on impact and translation of this knowledge into wealth.

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NEP is Indian Academia's "Morill" Moment…

- **Last 10 years, Indian HEIs have become more research oriented**
- **However, the R&D in Indian academic institutions is still primarily driven by North American and European models**
- **In mid 1800's, good "colleges" in US followed England and Germany – oriented towards classics, theology and natural sciences.**
- **Land-grant universities in US under the Morill Act of 1862, to focus on "such branches of learning as are related to agriculture and the mechanic arts"– created centres of research that mattered to the country.**
- **We seem to have found our Morill moment. Some of our research is becoming top-down – "*solution to a problem*" rather "*solution looking for a problem*". NEP is a step in the right direction.**

(ISRO/DAE, DRDO model, NEC, IMPRINT, JATC, UBA, Grand Challenges initiatives, Immersion programmes)

18

What will NEP achieve if implemented in the right spirit?

- Fragmented higher education system **to** Multi-disciplinary universities
- Sub-critical Research Funding **to** NRF with resources allocated as % GDP and 'problem first' approach
- Research & Development **to** Relevance & Delivery
- From tight government control of our HEIs **to** Autonomous HEIs managed by a Board with more alumni on the Boards
- Gross Enrollment Ratio from the current 26.3% **to** 50% by 2035
- Multiple bodies controlling the Universities **to** consolidation of Regulatory bodies
- From Studying **to** Learning (flexible Curriculum)

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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

Are you aware of how Institutional ranking is determined?

- Yes
- No
- Partly
- I want to know more

** If your answer differs greatly from the choices above tell us in the chat!*

20

NEP & Impact on India's HEI Rankings

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NEP & Rankings

QS World (Methodology)

- Academic Reputation from Global Survey (40%)
- Employer Reputation from Global Survey (10%)
- Faculty -Student Ratio (20%)
- Citation per Faculty Scopus (20%)
- Proportion of Intl Students (5%)
- Proportion of International Faculty (5%)

	Academic Reputation from Global Survey	Faculty - Student Ratio	Citation per Faculty Scopus	Employer Reputation from Global Survey	Proportion of Intl Students	Proportion of International Faculty
IITD (Rank: 185)	45.8	30.9	70	70.8	1.2	1.7
IISC (Rank: 186)	34.2	48.8	100	19.2	1.8	1.2
A 50 th ranked University in Europe	84.5	94.5	27.2	97.6	91.2	56.9

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Note how academic reputation, lack of multi-disciplinarity and absence of International footprint set us back

Where others get ahead….

- Academic faculty Staff-3360
- International-1829
- No. of students-46678
- No. of Intl Students-17030

A western University at #50

- Academic faculty Staff-504
- No. of students-3512
- No. of Intl Students-34

IISc #186

IIT Delhi #185

- Academic faculty Staff-650 (Intl.11)
- No. of Students-11000
- No. of Intl Students-100

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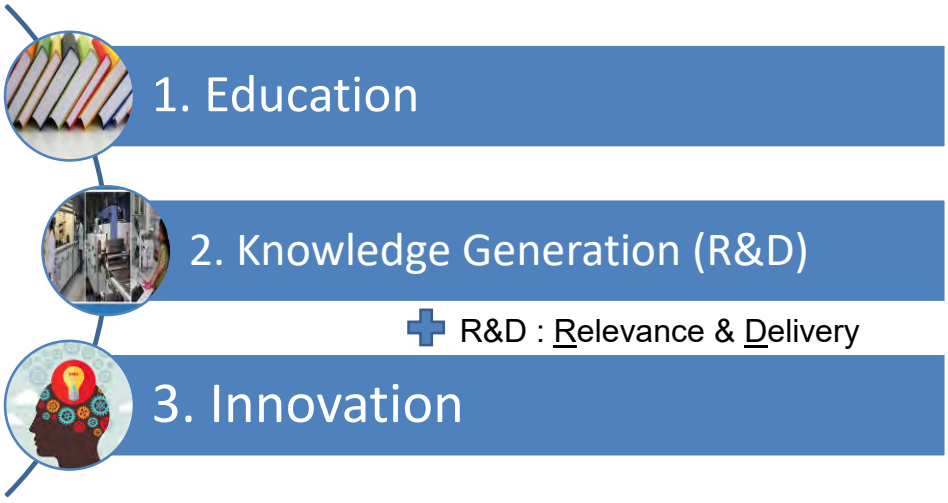
HEIs…



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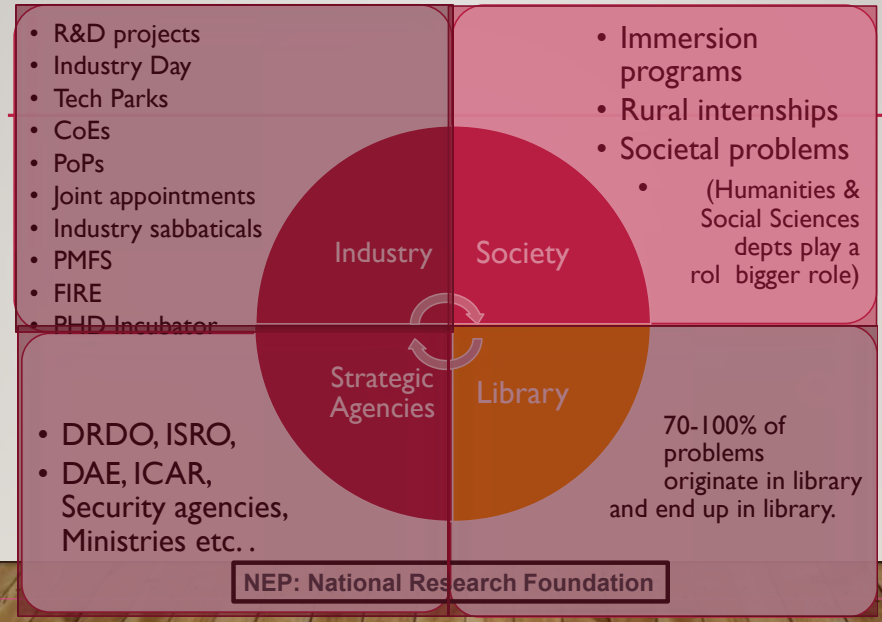
CHOOSING RESEARCH PROBLEMS IN ACADEMIA IN INDIA



25

IIT Delhi

- more than half of India's population is under the age of 25, and one million people a month are expected to join the labour force over the next decade.
  - Technologies that help youth excel & acquire skills (ex: Akash tablet)
- India's massive agricultural sector employs over 50% of the population, yet accounts for only about 17% of total GDP
  - Use innovation/technology as a vehicle to improve productivity
- healthcare a major concern, rural health infrastructure hardly existent
  - 22 Million population pushed below poverty line annually due to healthcare expenditure. 750 million people live in areas where there is almost no healthcare.
- Security- a major concern area for India
- Energy – Renewables is a big issue. Not much land availability in India
- Huge Water crisis: 4% of world's water resources and 18% of world's population

>> Available, Accessible and Affordable technologies

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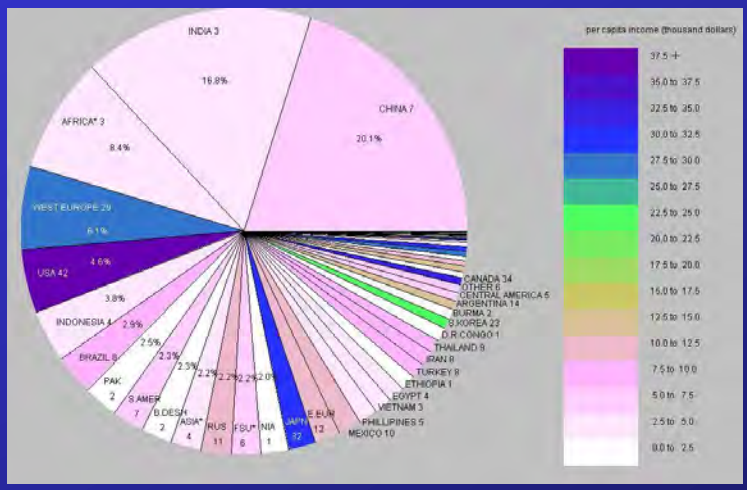
"More with Less for More"

Developing world

The World Bank Atlas method - detailed methodology



Almost half the world — over three billion people — live on less than $2.50 a day. At least 80% of humanity lives on less than $10 a day.

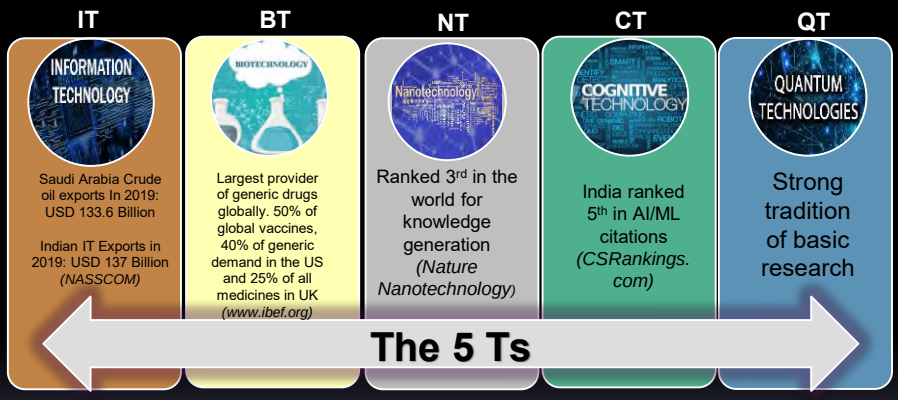
The Five Key Technology Platforms

IT	BT	NT	CT	QT
				
Saudi Arabia Crude oil exports In 2019: USD 133.6 Billion Indian IT Exports in 2019: USD 137 Billion *(NASSCOM)*	Largest provider of generic drugs globally. 50% of global vaccines, 40% of generic demand in the US and 25% of all medicines in UK *(www.ibef.org)*	Ranked 3rd in the world for knowledge generation *(Nature Nanotechnology)*	India ranked 5th in AI/ML citations *(CSRankings.com)*	Strong tradition of basic research

The 5 Ts

India has done well where clear goals are set.
Examples are ISRO, DAE etc. A top down approach is key for translation of knowledge to wealth.

The Five Key Technology Platforms



India has done well where clear goals are set. Examples are ISRO, DAE etc. A top down approach is key for translation of knowledge to wealth.

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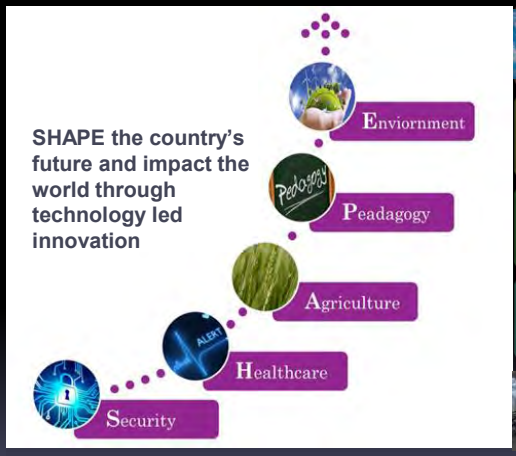
Application Areas

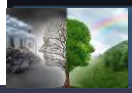


Security : from homeland security to cyber security applications

Healthcare: Web enabled healthcare initiatives, diagnostics, rural healthcare etc. Sanitation requirements

Agriculture: Precision agriculture areas, sensors etc. Reducing water wastage

Pedagogy: Million young people joining the work force every month. Technologies to help their training needs, improve teaching-learning methodologies etc.



Environment: Use of renewable sources for energy, sensor networks for monitoring and transmitting information related to the pollution, ground water quality etc.

Indian academia has the potential

What's needed?

Research Investments + a Mission-mode approach

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Nanoelectronics Network For Research and Application (N-NetRA)

Cumulative investment of 700 Cr

Network of State-of-Art Nanofabrication facilities

Centre for Nano Science & Engineering

Centre for Nanotechnology

Centre for NEMS & Nanophotonics

Nanofabrication Center

Nano Science and Technology

National Centre for Flexible Electronics

Nano-Research Facility

A critical national resource

Supported by MeitY, DST and MHRD

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Electronics

YOUNG PROFESSIONALS

INDIA'S RISE IN NANOELECTRONICS RESEARCH

UDAYAN GANGULY, SANDIP LASHKARE, AND SWAROOP GANGULY, IIT BOMBAY

Witnessing a Quiet Evolution

As semiconductor innovations power the digital age, India has aspired to

At the time of graduation, some students would embark on a pilgrimage to Indian research-centric insti-

pelling indicators. Both EDL and TED are considered the most exclusive venues to publish electron device-related research.

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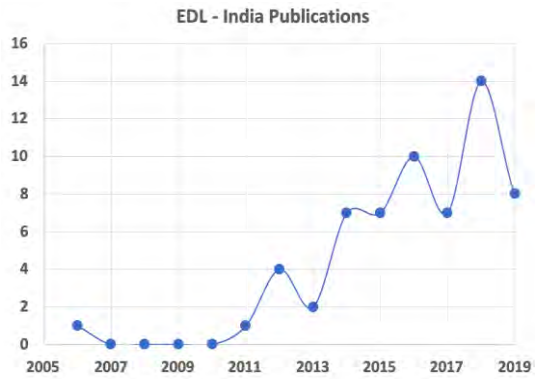
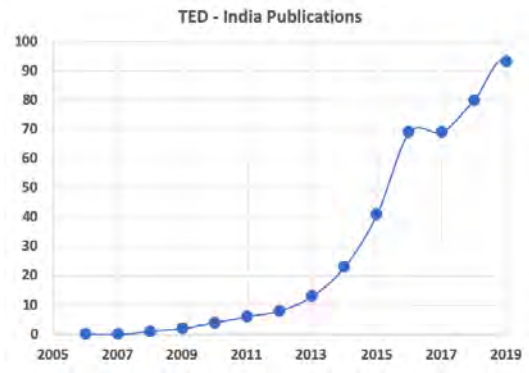
Electronics

INDIA'S RISE IN NANOELECTRONICS RESEARCH

UDAYAN GANGULY, SANDIP LASHKARE, AND SWAROOP GANGULY, IIT BOMBAY





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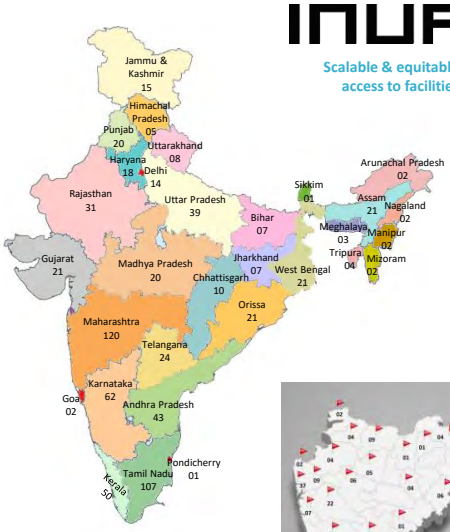
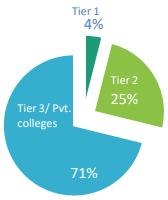
Data Courtesy Of: Sandip Lashkare

INUP

Scalable & equitable access to facilities



Penetrated at district level



Servicing the underserved

Workshops
• 50

Training
• 91

Projects
• 991

Institutes
• 607

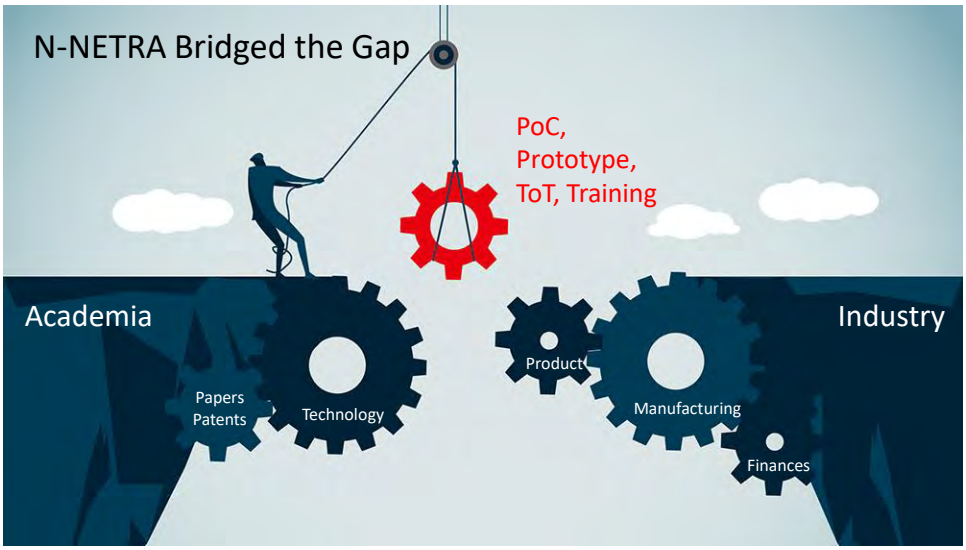
Manpower
• 8018

Publication
• 818

Theses
• 612

Patents
• 45

35



Picture Source: Web

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Start-Ups from N-NETRA: PoC Diagnostics

PRIMARY HEALTHTECH

BIRAC BIG Grant: ₹50 L

Villgro startup grant: ₹25 L

Path Shodh HEALTHCARE

Revenue : ₹90 L

Funding: ₹950 L

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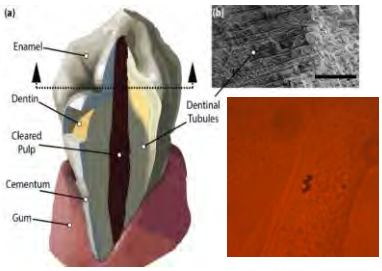
Start-Ups: Health

ShanMukha

Microfluidic Imaging Flow Cytometer for Malaria & Hemogram

1st & only ICMR approved mobile COVID PCR testing

TheraNautilus



Nanobots to fight e-faecalis in tubules

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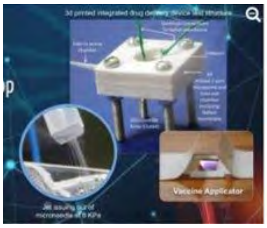
Start-Ups: Health

APTAGEN



DNA Aptasensor kit for early detection of UTI and Vitamin D deficiency

LAMP-PCR based viral detection Platform



Innovodigm

Pain free drug delivery system

39

Start-Ups: Agriculture

SOILSENS

ML IoT sensors for agriculture

10% higher yield, 20% less water

RR ANIMAL HEALTH CARE LTD.

OFET biosensor for poultry, dairy, aqua

Revenue: 5 Cr

40

Start-Ups: Strategic

nanosniff

MEMS-based explosive detection

10 ng sensitivity, 97% accuracy

AGNIT

Funded by GoI
Gallium Nitride Ecosystem Enabling Centre and Incubator (GEECI)

III-N HEMT for RF & Power

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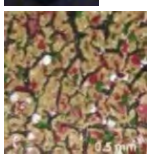
Start-Ups: Smart Systems

checko
TRANSPACKS TECHNOLOGIES PVT. LTD.



Anti-counterfeiting labels

3D markers that cannot be cloned

SYMBICA

Smart Hand

Teleoperated Robotic Arm for Defence Forces

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NANOTECHNOLOGY PATENTS

Country	Number of Publications in Nanotechnology (2019)	Global Rank in Publications	Number of Patents in Nanotechnology (2019)	% Share of Patents
China	74387	1	825	7.98
USA	23999	2	4666	45.16
India	15083	3	54	0.52
South Korea	9431	5	1105	10.69
Japan	7429	7	918	8.88
Taiwan	2943	18	481	4.65

Source: NBIC
https://statnano.com/news/67470/2019%E2%80%99s-20-Leading-Countries-in-Nanotechnology-Publications
https://statnano.com/news/67294/2019's-Most-innovative-Countries-in-Nanotechnology

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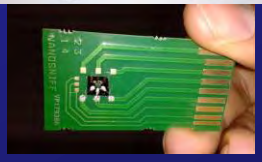
nanosniff



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IIT Bombay

Mumbai: NanoSniffer can detect explosives within 10 secs

TNN | Apr 10, 2021, 04:28 IST

A- A+

NEWS BRIEF

NanoSniffer: IIT Bombay Incubated Startup Develops World's First Microsensor-Based Explosive Trace Detector

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SOILSENS

HOME ABOUT SOLUTIONS CONTACT LOGIN

PROXIMAL SOILSENS TECHNOLOGIES

SoilSenS gives the solutions for optimized irrigation for agriculture.
Our aim is to make the agriculture sector, profitable and sustainable by improving the crop yield through efficient usage of water

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Proximal SoilSens Technologies Pvt. Ltd. (Soilsens.com)

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INDIA = OPPORTUNITIES

- Address the bottom of the pyramid – most of MNC products get diverted to the market that reaches only about 100 million of India's 1.3 billion population (M4L4M)
- R&D in academic institutions is primarily driven by North American and European models. There is a need to innovate in areas where there is domestic demand.
- Local R&D for product development is absolutely essential for reducing the costs and for taking care of the needs of the people in India – be it for agriculture or security or healthcare applications.
- It is possible to do high quality research in academic insitutions in India now, and yet make it relevant to India's needs.
- Multiple Govt. of India initiatives for startups – IMPRINT, UAY, GITA, BIRAC, TDB, TSDP etc.

➢ ***Creativity in our Higher Education sector is as important as literacy at the grassroots level!!!***

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NEED FOR OUR HE INSTITUTIONS TO EVOLVE…….

- "**Idea Factory**" approach: bring unlike minds together, create the right atmosphere but structure interactions

  Bring "**unlike**" Minds together through

  - different Cultural backgrounds (Eg. Joint degree programmes, IPFP, International students and faculty, Int. Campus)
  - different Disciplinary Training (*SIRe, SoPP, ScAI, DMSE, DoD, DESE, CART, SeNSE, OPC, FIRP, M-FIRP, IITD-AIIMS, IITD-AIIA, IITD-ICAR, IITD-NII, IITD-ILBS, IITD-RCB, CoEs etc.*)
  - different Attitudes (Research Parks, Industry Day, PoP, Joint Appointments, JATC, UBA)

- Create an eco-system for high tech startups (Central facilities, space, faculty appraisals, FIRE, PHD Incubator, Student Startup action plan, 1-2-3-4 D&L, Investments in Startups, Endowment fund etc.)

WHAT CAN NEP DO, IF IMPLEMENTED RIGHT?

In the last 5 years, IIT Delhi has turbocharged its research activities

- **8+5** Industry+Govt sponsored Centers of Excellence launched
- **75%** Faculty engaged on a funded research project
- **3x** Increase in number of funded research projects
- **4x** Increase in research funding & Startups
- **10k+** Publications in research journals
- **500+** Patents filed
- **350+** Industry Projects
- **9+** New Academic entities
- **200+** New Faculty

Startups founded by IIT Delhi students and alumni

zomato, meesho, snapdeal, YEPME, doubtnut, UpGrad, MobiKwik, IvyCap, GeoIQ, udaan, Lexity, NUTANIX, Chaayos, Clovia, SHOPCLUES, harness, Flipkart, CARDEKHO, TRIMIAN, rocketfuel, Qubole, BharatPe, CASHIFY, bidgely, LevelUp, HEALTHKART, perkbox, inshorts, eightfold.ai, RIVIGO, Lucidata, JUGNOO, tripoto, Productiv, img, LIMEROAD, KritiKart, bloomreach, shadowfax, CUROFY, FITSO, indifi, KVANTUM, Groww, Quikr, nagarro, seekout, Delhivery, Shuttl, policybazaar, vyn

IIT Delhi's Self Discovery - COVID Times

- Relevance
- Focus
- Team Spirit
- Urgency
- Nationalism
- Delivery
- Industry Connect
- Institutional Support

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Highest number of patents (153) filed in 2020 in the history of the institute

NEP Impact on India's HEIs

- **multi-disciplinary** in their educational offerings
- **Locally** Engaged & **globally** networked.
- having **innovation** and entrepreneurship as major drivers
- a demonstrator for conversion of knowledge to wealth & a **diversified financial structure**
- student-centric and a flexible curriculum tightly integrated with **out-of-class learning**
- having a major chunk of curriculum dedicated to social sciences, **ethics, leadership skills**, creativity etc.
- having a **diverse set of faculty** with large chunk of faculty as Joint & Professors-of-Practice drawing their remuneration from more than one source
- hubs for **industrial R&D** with corporates engaging academia on a collaborative relationship model rather than on a transactional model

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New Education Policy 2020

Impact on India's Higher Educational Institutions

Professor V. Ramgopal Rao
Director, Indian Institute of Technology Delhi, India

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V. RAMGOPAL RAO
Director, Indian Institute of Technology Delhi, India

DEEKSHA GUPTA
Associate Director-India, American Chemical Society

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- How your persona changes when you retire
- Why it's important to actively structure your retirement
- Some useful tools for retirement success

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- How green chemistry education plays a role in reshaping chemistry's image, contributing to a better world tomorrow

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Moderator: Rachel Letteri, University of Virginia

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- Application of organic catalysts for stereocontrolled step growth polymerization
- Development of high temperature organic catalysts for polymerization and depolymerization
- Using organic catalysts to selectively depolymerize plastic mixtures
- New designs for ultrafast organocatalytic polymerization reactions
- Synergies between continuous flow chemistry and rapid organocatalytic polymerization reactions
- New catalysts enabling the design of emerging functional materials for gene delivery

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