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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  - Learn how to write better abstracts, deliver more engaging presentations, and network to your next dream job. Brush up on your soft skills and set a new career path by mastering what cannot be taught in the lab.

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- **Drug Design and Delivery**
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  - The Drug Design Delivery Series has built a collection of the top minds in the field to explain the mechanics of drug discovery. Discover the latest research, receive an overview of different fields of study, and gain insights on how to possibly overcome your own medchem roadblocks.

- **Culinary Chemistry**
  - View the Collection
  - 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 radicures, how viruses have affected human history, or the molecular breakdown of a hangover.

- **Business & Entrepreneurship**
  - View the Collection
  - 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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From ACS Industry Member Programs

♦ Industry Matters Newsletter

ACS Member-only weekly newsletter with exclusive interviews with industry leaders and insights to advance your career.
Preview & Subscribe: acs.org/indnews

♦

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](http://www.ACS.org/COVID19-Network) to learn more!

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](http://www.acs.org/donate)
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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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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https://www.acs.org/content/acs/en/acs-webinars/india.html
New Education Policy 2020: Impact on India’s Higher Educational Institutions

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.
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!
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.

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)
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)

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!
NEP & Impact on India’s HEI Rankings

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%)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Academic Reputation</th>
<th>Faculty Ratio</th>
<th>Citation per Faculty</th>
<th>Employ Reputat</th>
<th>Proportion of Intl Students</th>
<th>Proportion of International Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>IITD (Rank: 185)</td>
<td>45.8</td>
<td>30.9</td>
<td>70</td>
<td>70.8</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>IISc (Rank: 186)</td>
<td>34.2</td>
<td>48.8</td>
<td>100</td>
<td>19.2</td>
<td>1.8</td>
<td>1.2</td>
</tr>
<tr>
<td>A 50th ranked Uni in Europe</td>
<td>84.5</td>
<td>94.5</td>
<td>27.2</td>
<td>97.6</td>
<td>91.2</td>
<td>56.9</td>
</tr>
</tbody>
</table>

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

HEIs...

1. Education

2. Knowledge Generation (R&D)
   - R&D: Relevance & Delivery

3. Innovation
CHOOSING RESEARCH PROBLEMS IN ACADEMIA IN INDIA

- R&D projects
- Industry Day
- Tech Parks
- CoEs
- PoPs
- Joint appointments
- Industry sabbaticals
- PMFS
- FIRE
- RHD Incubator

- Immersion programs
- Rural internships
- Societal problems
  - (Humanities & Social Sciences depts play a bigger role)

- DRDO, ISRO, DAE, ICAR, Security agencies, Ministries etc.
- Immersion programs
- Rural internships
- Societal problems
  - (Humanities & Social Sciences depts play a bigger role)

- NEP: National Research Foundation

- Strategic Agencies
- Library
- Industry
- Society

70-100% of problems originate in library and end up in library.

- 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

“More with Less for More”
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
- Information Technology
  - Saudi Arabia Crude oil exports in 2019: USD 133.6 Billion
  - Indian IT Exports in 2019: USD 137 Billion (NASSCOM)

BT
- Biotechnology
  - 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)

NT
- Nanotechnology
  - Ranked 3rd in the world for knowledge generation (Nature Nanotechnology)

CT
- Cognitive Technology
  - India ranked 5th in AI/ML citations (CSRankings.com)

QT
- Quantum Technologies
  - 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

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**QT**
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The 5 Ts

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Application Areas

**SHAPE**

- **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

Nanoelectronics Network For Research and Application (N-NetRA)

Cumulative investment of 700 Cr

Network of State-of-Art Nanofabrication facilities

A critical national resource

Supported by MeitY, DST and MHRD
Electronics

INDIA’S RISE IN NANOELECTRONICS RESEARCH

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

EDL - India Publications

TED - India Publications

Data Courtesy Of: Sandip Lashkare
INUP
Scalable & equitable access to facilities

Penetrated at district level

Workshops • 50
Training • 91
Projects • 991
Institutes • 607
Manpower • 8018
Publication • 818
Theses • 612
Patents • 45

N-NETRA Bridged the Gap
PoC, Prototype, ToT, Training

Academia

Industry

Picture Source: Web
Start-Ups from N-NETRA: PoC Diagnostics

BIRAC BIG Grant: ₹50 L
Vilgro startup grant: ₹25 L

Revenue: ₹90 L
Funding: ₹950 L

Start-Ups: Health

ShanMukha

Microfluidic Imaging Flow Cytometer for Malaria & Hemogram

1st & only ICMR approved mobile COVID PCR testing

Nanobots to fight e-faecalis in tubules
Start-Ups: Health

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

LAMP-PCR based viral detection Platform

Pain free drug delivery system

Start-Ups: Agriculture

ML IoT sensors for agriculture

10% higher yield, 20% less water

OFET biosensor for poultry, dairy, aqua

Revenue: 5 Cr
Start-Ups: Strategic

MEMS-based explosive detection

10 ng sensitivity, 97% accuracy

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

Start-Ups: Smart Systems

Anti-counterfeiting labels

3D markers that cannot be cloned

Smart Hand

Teleoperated Robotic Arm for Defence Forces
# Nanotechnology Patents

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>74387</td>
<td>1</td>
<td>825</td>
<td>7.98</td>
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<td>USA</td>
<td>23999</td>
<td>2</td>
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<td>India</td>
<td>15083</td>
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<td>54</td>
<td>0.52</td>
</tr>
<tr>
<td>South Korea</td>
<td>9431</td>
<td>5</td>
<td>1105</td>
<td>10.69</td>
</tr>
<tr>
<td>Japan</td>
<td>7429</td>
<td>7</td>
<td>918</td>
<td>8.88</td>
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<tr>
<td>Taiwan</td>
<td>2943</td>
<td>18</td>
<td>481</td>
<td>4.65</td>
</tr>
</tbody>
</table>

Source: NBIC

![Nanotechnology Sniff](image)
Mumbai: NanoSniffer can detect explosives within 10 secs

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

<table>
<thead>
<tr>
<th>8+5</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry+Govt sponsored Centers of Excellence launched</td>
<td>Faculty engaged on a funded research project</td>
</tr>
<tr>
<td>3x</td>
<td>4x</td>
</tr>
<tr>
<td>Increase in number of funded research projects</td>
<td>Increase in research funding &amp; Startups</td>
</tr>
<tr>
<td>10k+</td>
<td>500+</td>
</tr>
<tr>
<td>Publications in research journals</td>
<td>Patents filed</td>
</tr>
<tr>
<td>350+</td>
<td>9+</td>
</tr>
<tr>
<td>Industry Projects</td>
<td>New Academic entities</td>
</tr>
<tr>
<td>200+</td>
<td></td>
</tr>
<tr>
<td>New Faculty</td>
<td></td>
</tr>
</tbody>
</table>

Startups founded by IIT Delhi students and alumni

-科学院
-橙味
-Flipkart
-UBA
- virtually
-滴滴
-Quikr
-Reliance
-Minopt
-UpGrad
-Myntra
-Amazon
-Snapdeal
-Lenski
-Grab
-Cashify
-Vineet
-Transpose
-Sepstr
-Twilio
-Ispot
-Toople
-Infovista
-Pranav

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-Grab
-Cashify
-Vineet
-Transpose
-Sepstr
-Twilio
-Ispot
-Toople
-Infovista
-Pranav
IIT Delhi’s Self Discovery - COVID Times

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

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
New Education Policy 2020
Impact on India’s Higher Educational Institutions

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

ASK YOUR QUESTIONS AND MAKE YOUR COMMENTS IN THE QUESTIONS PANEL NOW!

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

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ACS Webinars

Skydiving into Retirement: How to Actively Manage the Transition

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

What You Will Learn:
- Ways your persona changes when you retire
- Why it's important to actively structure your retirement
- Some useful tools for retirement success

[Register for Free]

The Green Evolution: Sustainable Chemistry in Global Scholarly Education

Date: Thursday, September 9, 2021 @ 11am ET
Speakers: H. H. Chang, 2021 ACS President; Frank Rohranger, BASF; Thomas Hoffman and ACS Pharmaceutical Roundtable / Klaus Kummerer, Leibniz University
Moderator: Mary Kirsch, ACS Scientific Advisor

What You Will Learn:
- How the current economic, socio-political, and safety/environmental trends affect green chemistry innovations
- Why learning green chemistry at the university is an advantage to recent graduates to find gainful employment because it's a highly 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

[Register for Free]

Advancing Polymer Science with Organic Catalysts

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

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

[Register for Free]

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