



**Science, Engineering,  
and Interdisciplinary Research @ IISc**

**Prof. Anurag Kumar  
Director, IISc Bangalore**



# IISc: A Bit of History



# Indian Institute of Science (IISc)



Established in 1909

Government  
of India



Jamsetji Tata



Jamsetji N. Tata, founder of Tata Sons



Maharaja of  
Mysore

Higher education and research  
**Earliest departments**  
First batch of

Conceived of IISc in 1892, shortly after  
the establishment of research  
universities in the US, such as Johns  
Hopkins and Caltech

ring  
gy

# The Institute's Mandate



**To provide for advanced instruction and to conduct original investigations in all branches of knowledge and, in particular, such branches of knowledge as are likely to promote the material and industrial welfare of India**



**From Clause 3.1 (Objects) of  
Scheme for the  
Administration and  
Management of  
the Properties and Funds of  
the Indian Institute of  
Science, Bangalore**

# Excellence in Science and Institution Building



**Sir CV Raman**

**Nobel Prize winner (1930)**

Bharat Ratna (India's highest civilian award)  
First Indian Director of IISc



**Sir JC Ghosh**

**Founding Director of the first IIT**

Established Aero, IC Engines, Metallurgy  
& High Voltage Engineering at IISc



**Prof. Homi Bhabha**

Former faculty member at IISc

**Established India's nuclear energy program**

Founder, Bhabha Atomic Research Centre &  
Tata Institute of Fundamental Research



**Prof. Satish Dhawan**

Director, IISc (1962-1981)

**Chairman, Indian Space  
Research Organization (1972-  
1984)**



**Dr. Vikram Sarabhai**

**Founded India's space program**

Trained under Sir CV Raman  
during WWII



**Prof. CNR Rao**

**Bharat Ratna; Director, IISc (1984-1994)**

Member, US National Academy of Sciences;  
Fellow of Royal Society; **Founding Director,  
Jawaharlal Nehru Centre, Bengaluru**

# Role in Nation Building



## Contributions to National Programs



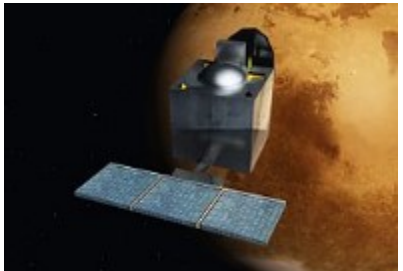
### Light Combat Aircraft

Aerodynamics modelling, fibre-optic-sensors systems for SHM & head-up display



### Missile Development Programme

Testing of hypersonic vehicle and missiles, and developing detector-cooler systems



### Mars Orbiter Mission

Indigenous calibration and testing of pressure and level sensors for cryogenic engines

## Incubating Major Institutions



The Tata Institute of  
Fundamental Research



Wipro Infotech



CPRI

Central Power Research  
Institute

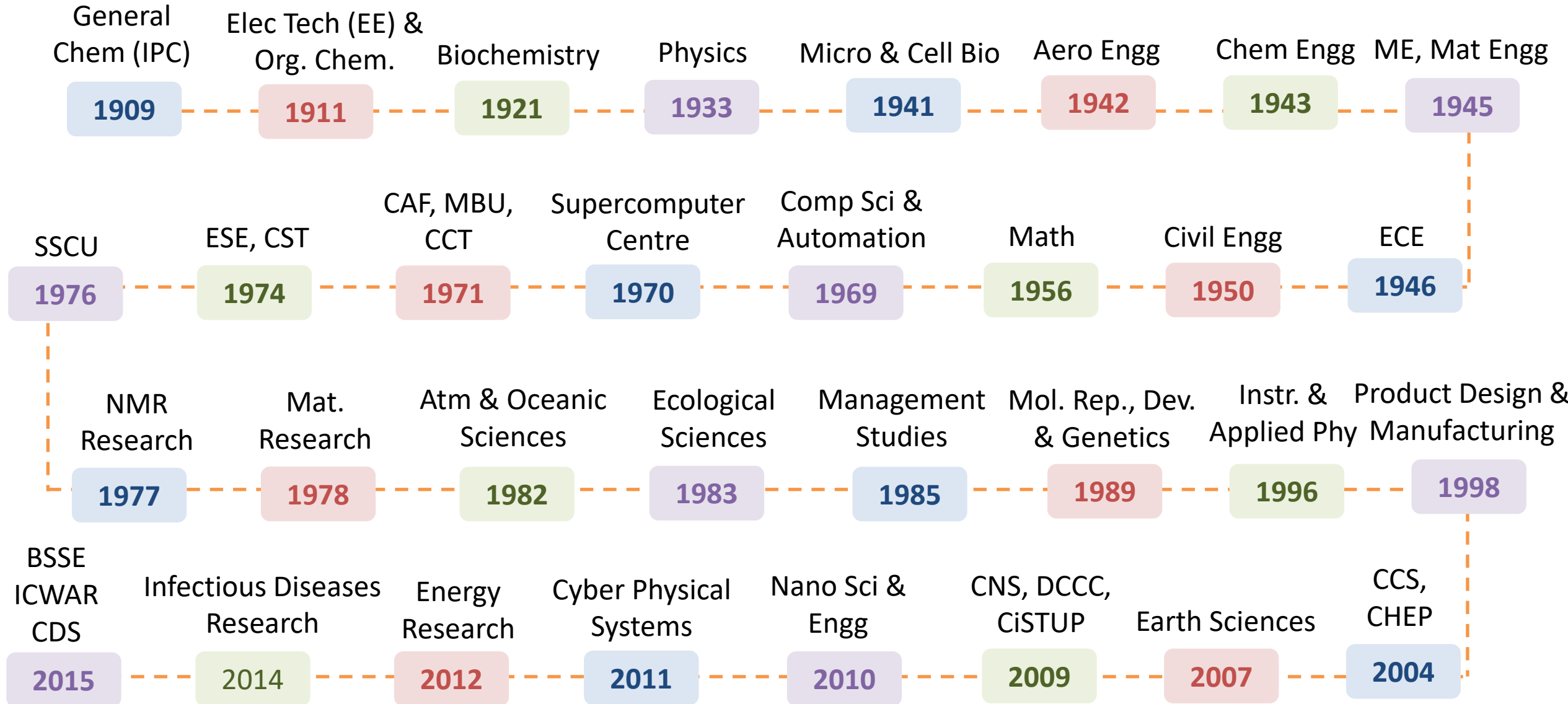


JNCASR

Jawaharlal Nehru Centre  
for Advanced Scientific  
Research



# Departments: 1909 - 2018



# IISc Today



# A Comprehensive University for Science and Engineering



42

DEPARTMENTS &  
CENTRES

518

ACADEMIC (450) +  
SCIENTIFIC STAFF  
(68)

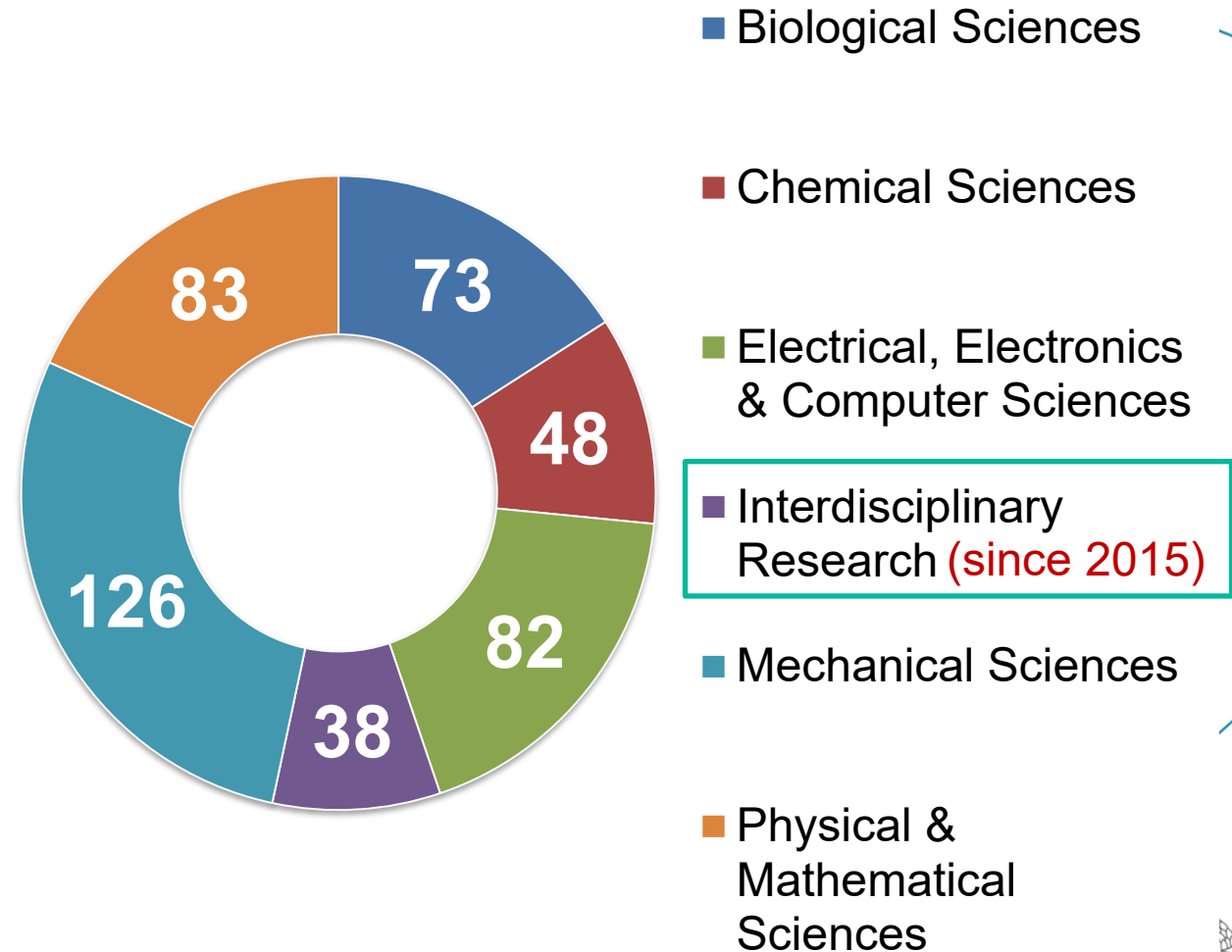
4186

STUDENTS  
2688 PhD/Int. PhD  
(1134 in Sci + 1554 in Engg)

~400

PhDs graduated in 2018-19  
0.9 PhD/faculty per year

## ACADEMIC FACULTY MEMBERS

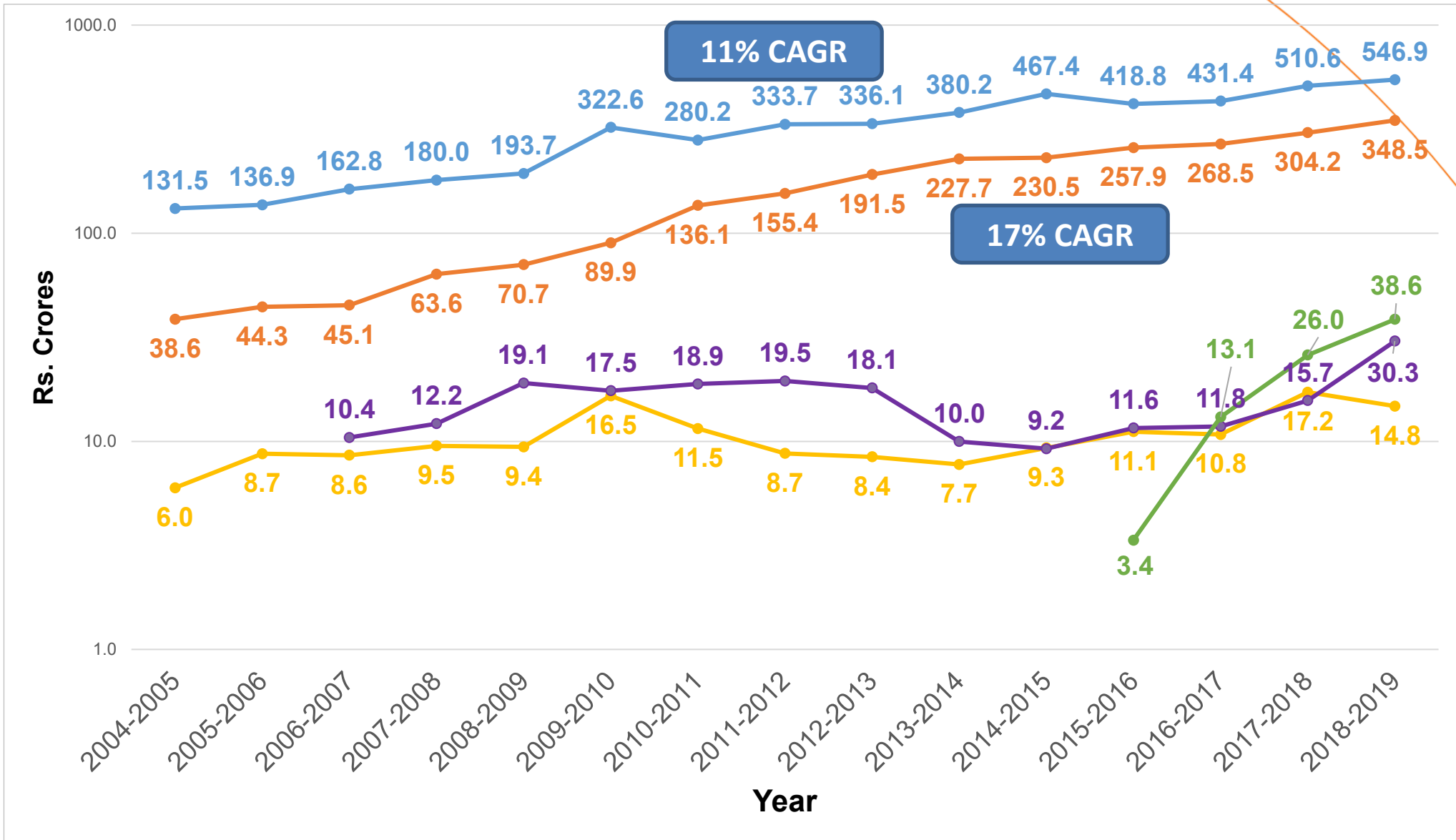


- Equal emphasis on the sciences and engineering since the very beginning
- Culture of fundamental investigations
  - IISc has nurtured curiosity driven research in all areas
  - Independence to pursue individual research goals
- Driving interdisciplinary research
  - A new division created with centers focused on solving pressing societal problems
  - Nano-science and engineering, water, energy, climate, transportation, smart socio-technical systems
- 65% of the students are enrolled in PhD programs
  - Research oriented masters' and UG programs



- Best practices in faculty recruitment
  - High expectations from the faculty
  - Promotions through rigorous international peer review
- Constantly introducing best practices and novel programs
  - Tenure system for faculty
  - High value start-up grants
  - Interdisciplinary PhD programs
  - Faculty entrepreneurship program initiated as early as 2003
  - Young Investigator (YI) positions
    - Additional salary and research grants for YIs

# Expenditure from Various Sources



- Direct Govt. Funding
- Sponsored Projects
- ODAA Projects
- SID Projects
- CSIC Projects



# Faculty Awards and Honours

## National Awards (cumulative, since founding)



**Bharat Ratna**  
(2)



**Padma Vibhushan**  
(3)



**Padma Bhushan**  
(14)



**Padma Shri**  
(18)



**SS Bhatnagar Prize**  
(96)

## National Fellowships (among serving faculty)

**Swarnajayanthi  
Fellowship  
Awards (34)**



**Indian Academy  
of Sciences**  
(113)



**Indian National  
Science Academy**  
(94)



**National Academy  
of Sciences, India**  
(75)



**Indian National  
Academy of  
Engineering** (65)

**J. C. Bose  
National Fellows**  
(69)

## International Honours

6

Infosys Prize Winners

9

IEEE Fellows

31

Fellows of The World  
Academy of Sciences

6

Editors-in-chief of  
international journals

217

Editors/Members of  
international journals  
3 ACM, 6 ACS, 4 ASME, 17  
IEEE, 9 IOP, 17 Nature, 4  
PLOS, 5 RSC

*Highest Number of National and International Awards and Recognitions,  
and Research Publications for any Academic Institution in India*





# Cross-Disciplinary Research Themes

**Brain, Computation  
& Data Science**



**Biomedical  
Systems & Devices**



**Quantum  
Technologies**



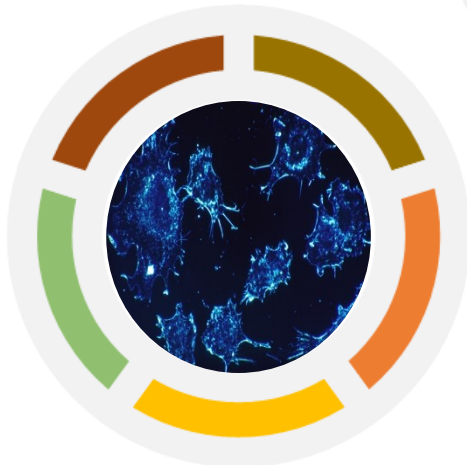
**Cyber-  
security**



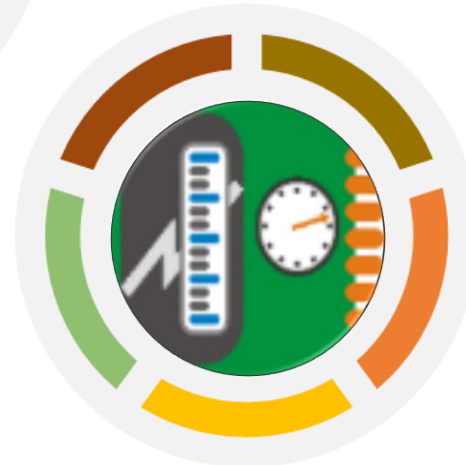
**Materials  
Informatics**



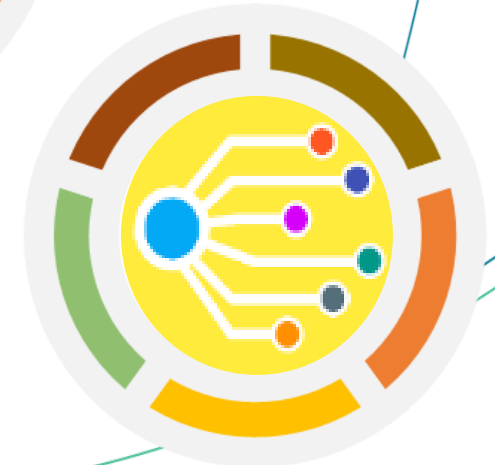
**Cancer  
Research**



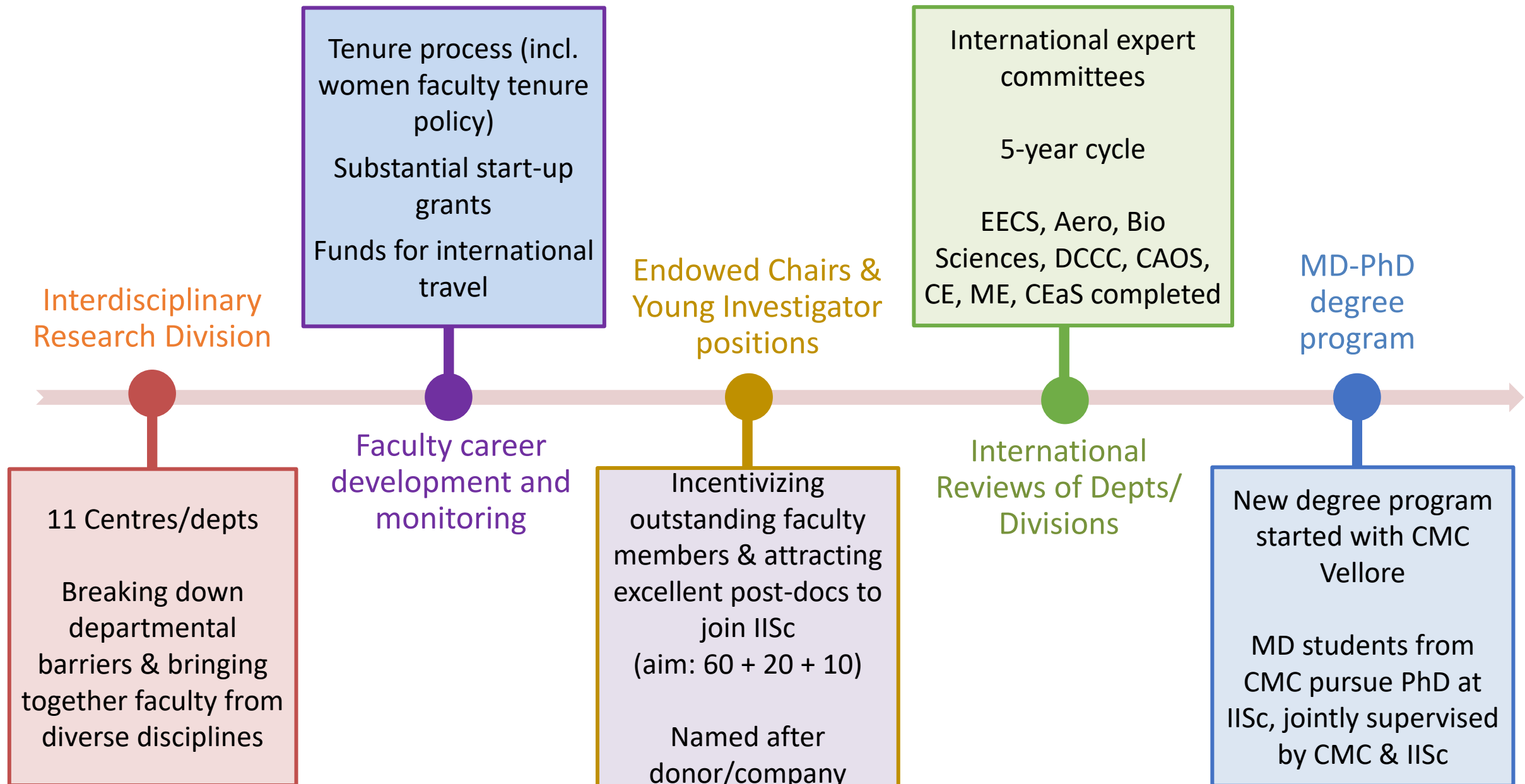
**Sensors**



**Visual  
Analytics**



# Some Recent Initiatives

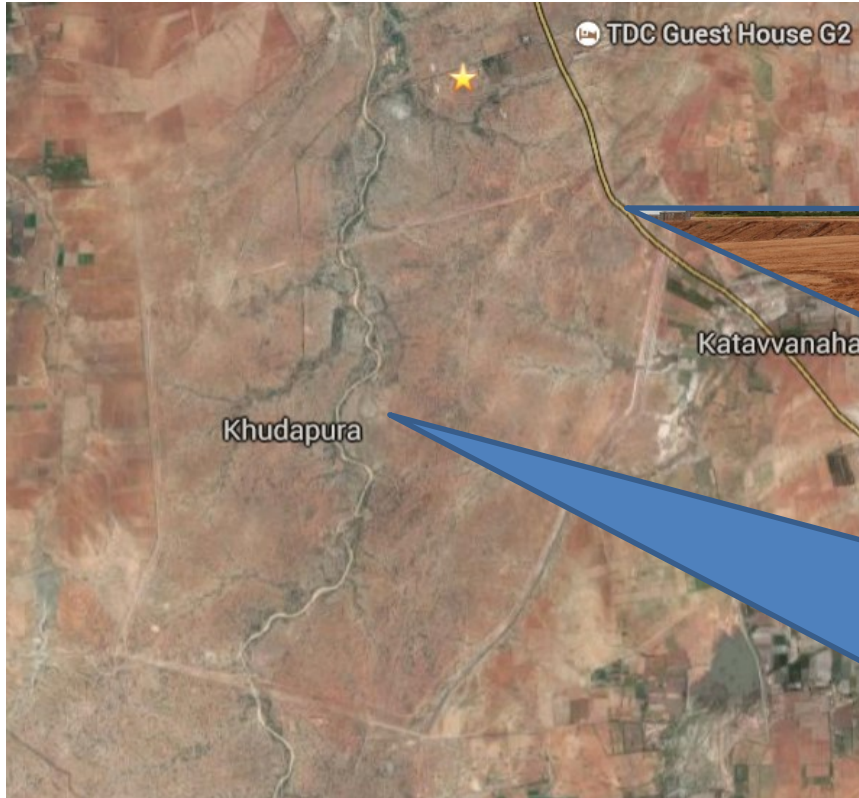


# The IISc Campuses





# The IISc Challakere Campus (1500 acres, 200 Km North of Bangalore)



Google Maps

## The Main Gate (modeled after Chitradurga Fort)



### Activities

- Climate change observatory
- Skill development centre
- Solar energy research facility
- Low carbon construction technology demonstrator

# A New Era of Buildings @ IISc

## TCS Smart-X Hub



Interdisciplinary research in smart systems: devices, bio-engineering, autonomous systems, infrastructure

Funding committed by TCS Foundation

## Centre for Brain Research



Research on aging brain, population surveys, Genome India, capacity building for neurosci. research

Funded by Pratiksha Trust (Mrs. & Mr. Kris Gopalakrishnan)

## Innovation Hub



Industry collaboration, translational research and incubation, support and training for MSME sectors

Funded by Ministry of Human Resource Development, GoI



# TCS Smart-X Hub



200,000 sft. state-of-the-art building

Rs. 110 crore CSR commitment from  
**TCS Foundation**

Interdisciplinary Activities:

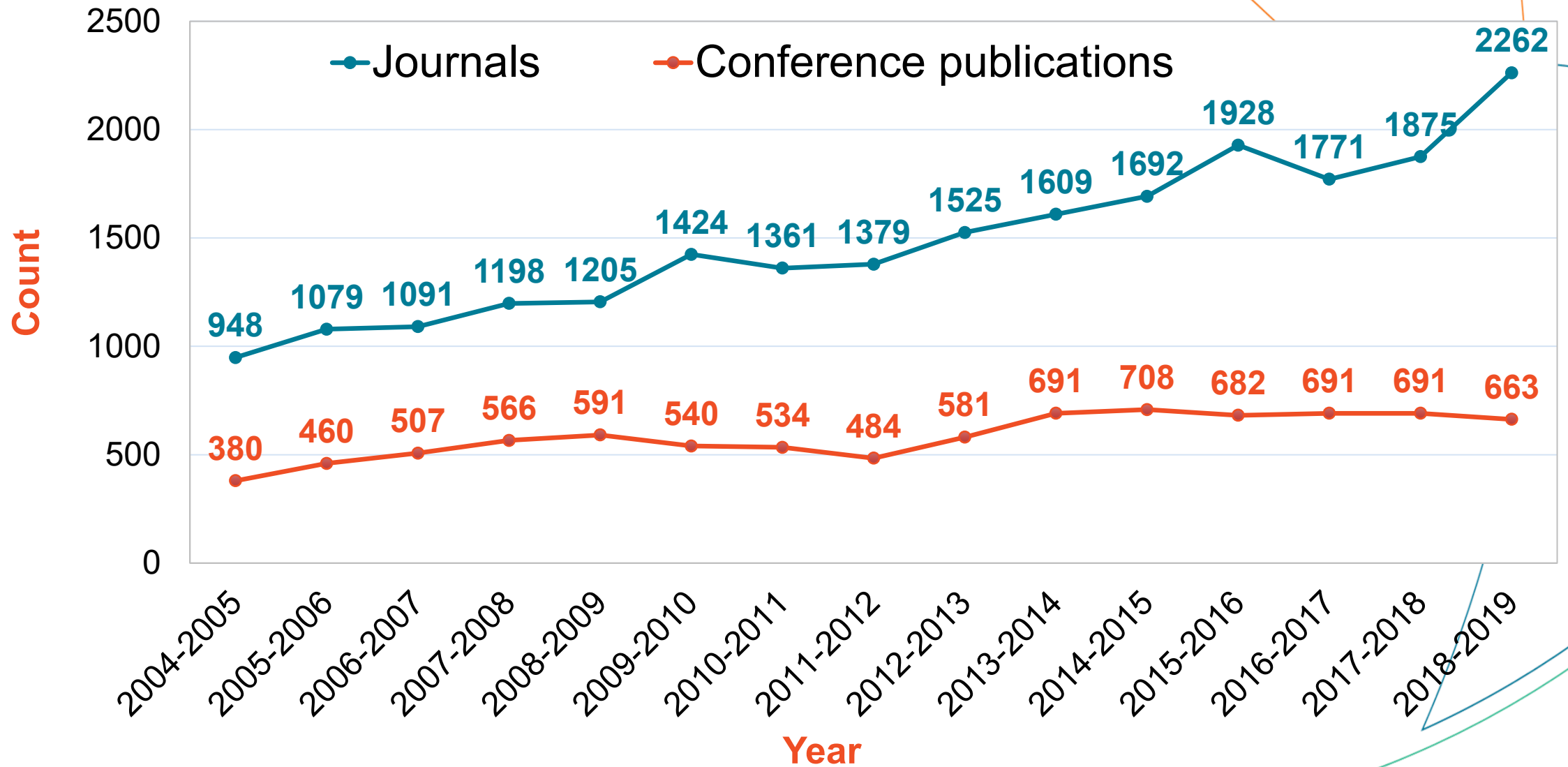
- BioSystems: Science and Engineering
- Nano Science and Engineering
- Transportation Engineering
- Cyber Physical Systems

Tendering under way, construction to  
commence soon

# Academic Performance



# Recent Publication Counts



# IISc: Cumulative Research Productivity

253

H-index

13,050

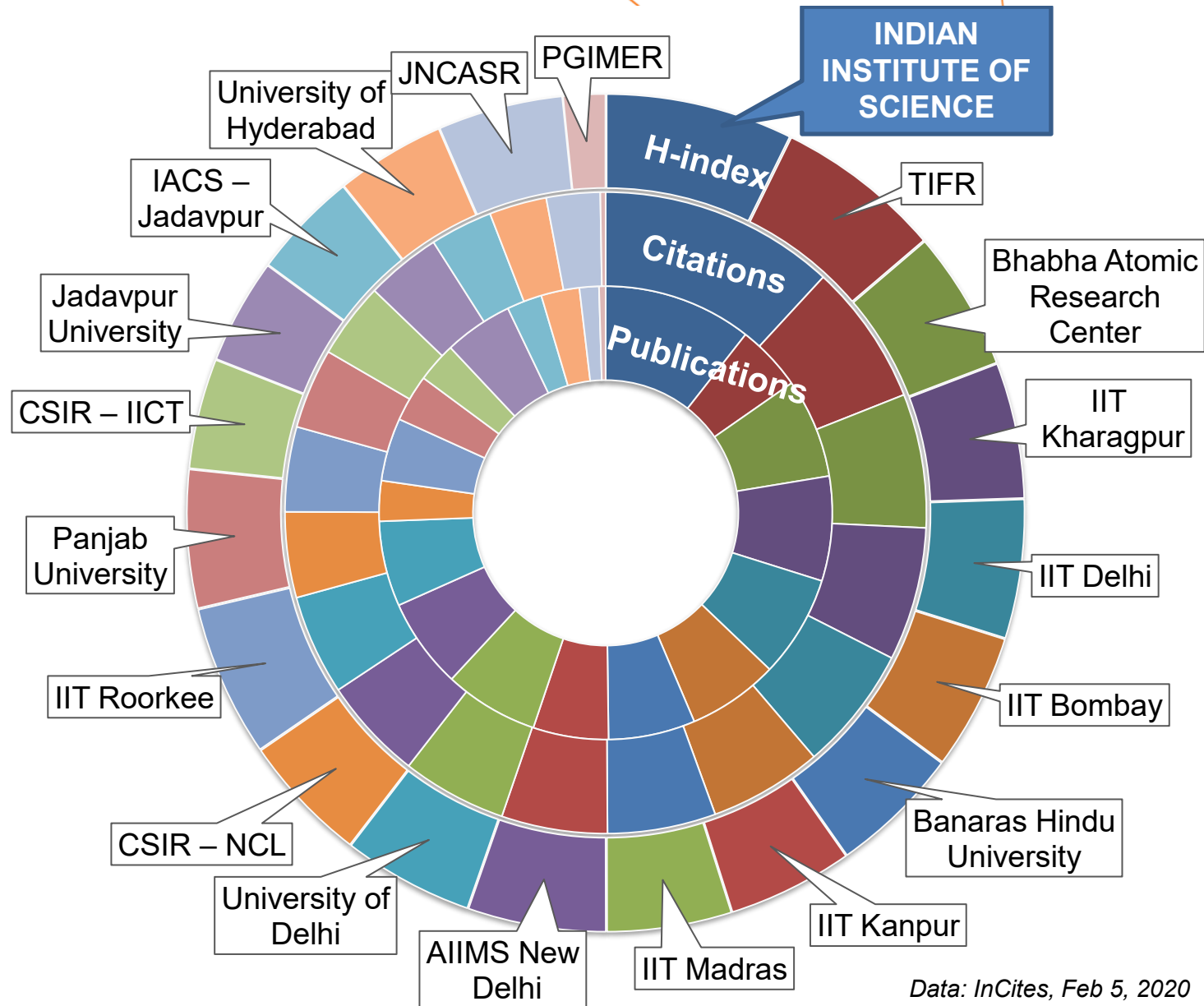
Publications in top  
journals &  
conferences  
in the last 5 years

56,925

Scopus  
Documents

9,42,158

Scopus  
Citations



# Rankings and Recognition



## Among universities

#1 (2016, 2017, 2018, 2019, 2020)

## Overall

#1 (2017, 2018), #2 (2019, 2020)



**#301-350** (2020)

**#91-100** in World Reputation Rankings (2018) - only Indian institute in top 100

**#16** in Emerging Economies (2020)



**#184** (2020)

**#2** in citations per faculty (2020)

## Subject Rankings

Aero Engg. **ARWU (2019) #49**

Materials Sci. **QS (2020) #51-100**

Chemical Engg. **QS (2020) #51-100**

Engg. & Tech. **THE (2020) #99**

## Institution of Eminence

Notified by Govt of India in **October 2018**

More autonomy in academic programs,

**Rs. 1000** crores funding over 5 years as matching grant



# Initiatives under the IoE Program

## Support for new and emerging research areas

Quantum Technologies, Autonomous Systems, Digital Healthcare and Systems Biology, Topological Matter, Novel Superconductors, Space Science, Chemical Biology & Disease Control, Antibiotic Resistance, Neuromorphic Computing, Industry 4.0

## Internationalisation

Satish Dhawan Distinguished International Visiting Professors  
CV Raman Post Docs  
Support for international PhD students & student visitors  
Substantial international travel support for IISc faculty & students

## Buildings for expansion and new research and innovation initiatives

Innovation Hub: Research Park and Incubator  
Interdisciplinary Research Building

## Infrastructure expansion and modernization

State-of-the-art IT platform (SAP S/4 HANA)  
Expanded campus optical fibre network  
Upgraded & smart electrical and water network  
Housing expansion  
High quality housekeeping and maintenance  
Improved healthcare & disabled-friendly access

## Effective operation of core research facilities

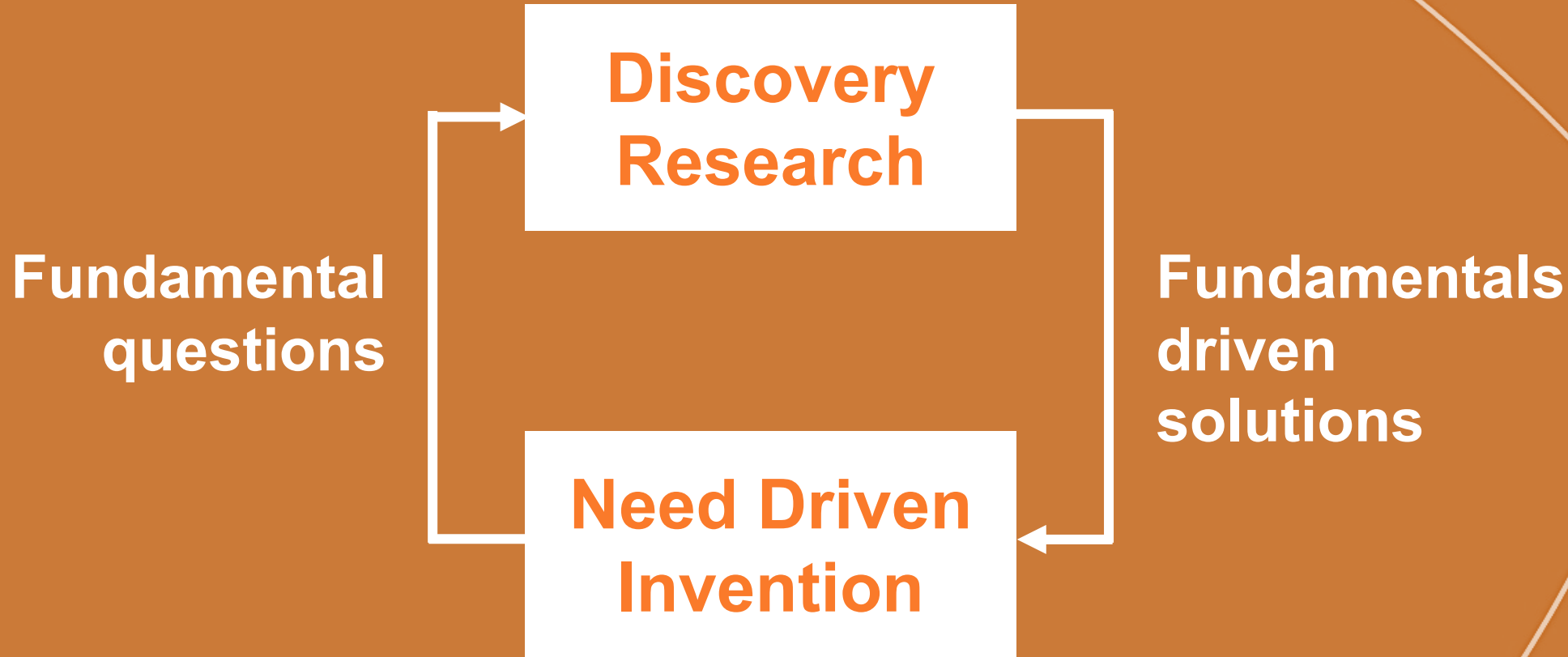
Funds for maintenance, spares, and consumables  
Professional facility managers

## Enhancing research impact

Publication charges  
Expenses for international patent filing  
Research workshops and conferences  
Measuring research impact: Scopus and Scival

**Additional grant from MHRD: Rs. 1000 crores over 5 years, to be matched by IISc**

# Discovery and Invention



*Narayanamurti and Odumosu, "Cycles of Invention and Discovery: Rethinking the Endless Frontier," Harvard, 2016*



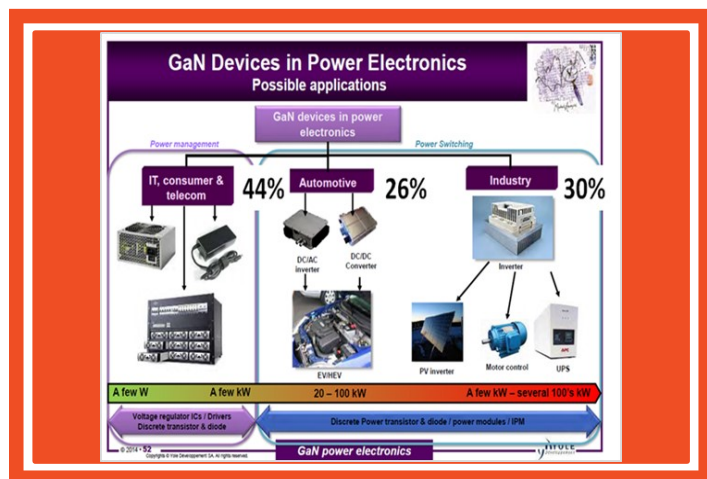
# National Capability Building



Indigenous  
Hepatitis-B  
vaccine from  
yeast strain  
developed at  
IISc



Supercritical  
carbon  
dioxide  
Brayton test  
loop

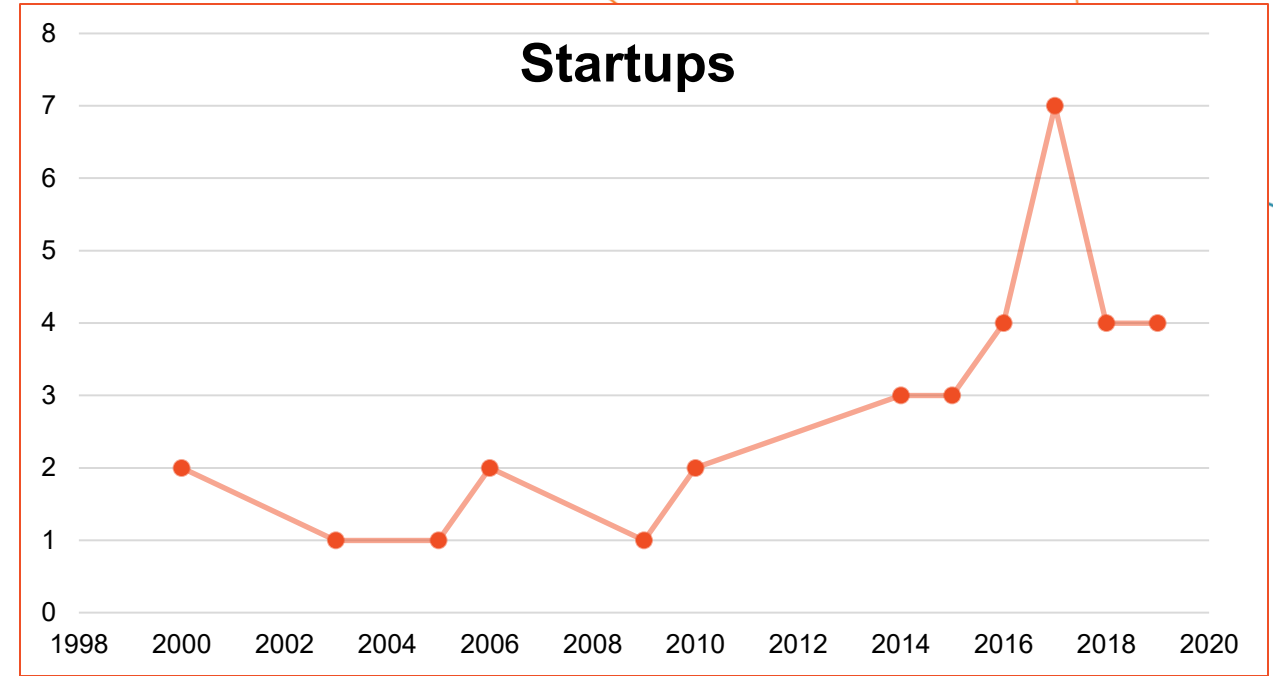
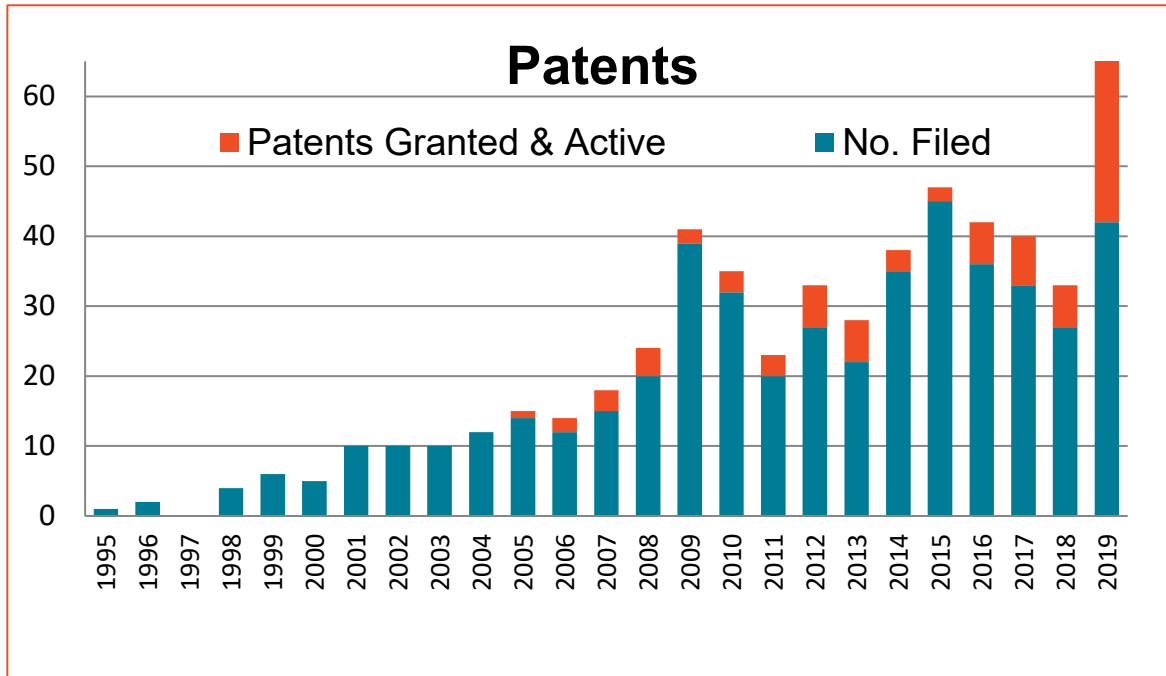


Gallium  
Nitride  
processes  
and devices



Metal 3D  
printing  
using  
Selective  
Electron  
Beam  
Melting

# Science → Patents → Startups



BioTech & Healthcare

Medical Devices

Aero-nautics

Materials

Mobility

Renewable Energy

Agri Tech

Space Tech

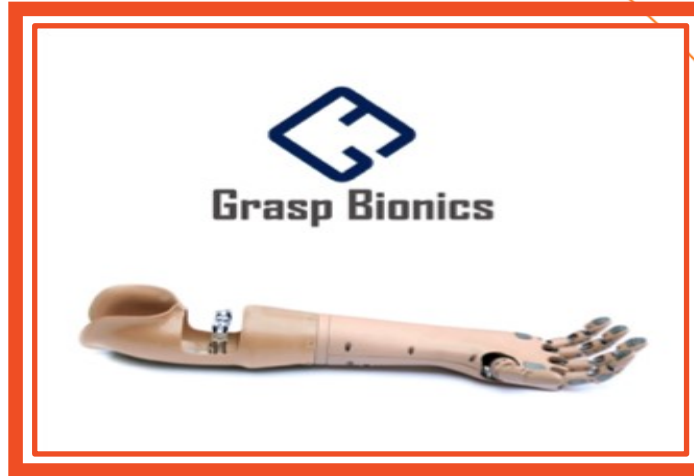
Electronics Computing

**25**  
companies  
incubated in  
2014-2019

# Recent Startups



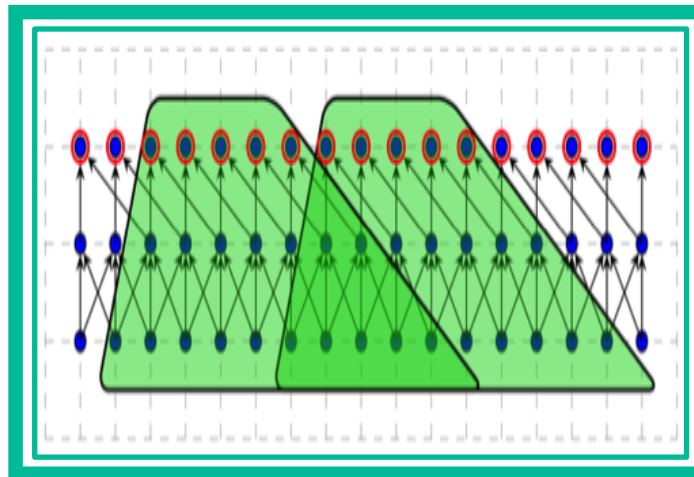
**Direct Electric**  
Innovative EV  
chargers for  
EV charging  
Stations



**Grasp Bionics**  
Easily  
operable and  
affordable arm  
prosthesis



**RaGaVeRa Indic Tech**  
Breaking  
language  
barriers using  
OCR, text to  
speech, etc.

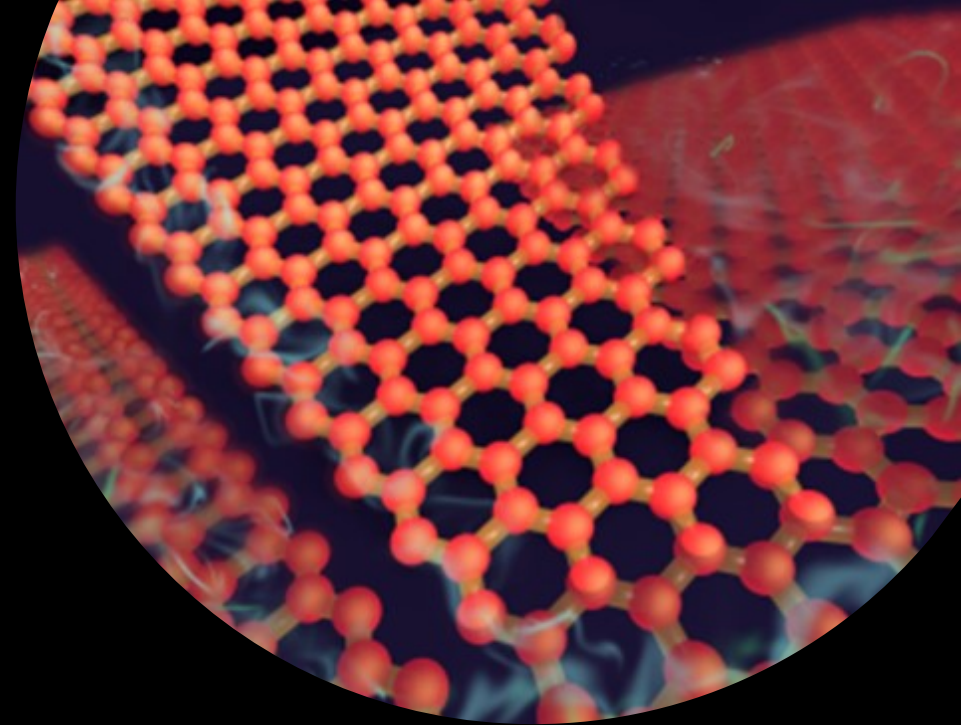


**Polymage Labs**  
Accelerating AI  
computations,  
high  
performance  
compilers for  
AI/ML





Discovery



Thank You

Invention  
and  
Innovation

