

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

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





# 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 students

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 the 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**



**CPRI  
Central Power Research  
Institute**



**Wipro Infotech**



**JNCASR  
Jawaharlal Nehru for  
Advanced Scientific Research**



# **IISc: Current Status, Academic Performance, Finances, and the Campus**



**42** DEPARTMENTS &  
CENTRES

**520** ACADEMIC (448) +  
SCIENTIFIC STAFF (72)

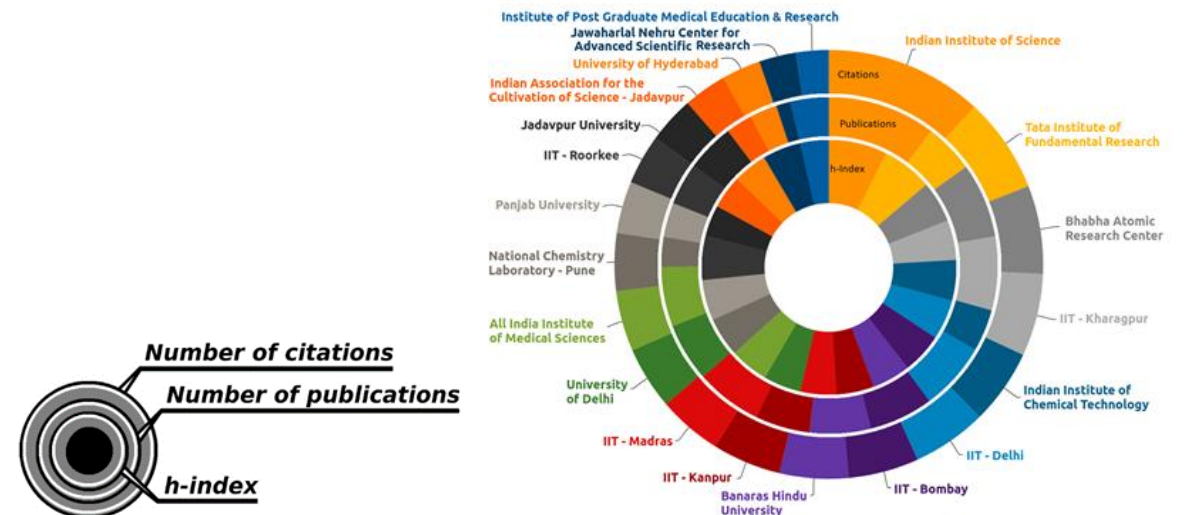
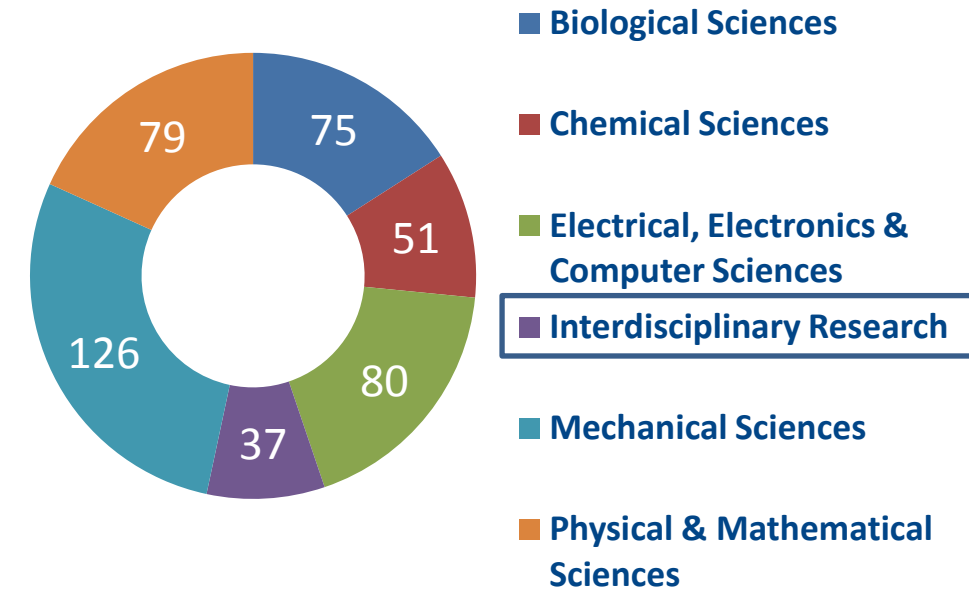
**4118** STUDENTS  
2728 PhD/Int. PhD  
1190 in Sci + 1538 in Engg

**No.1**

In the Ministry of Human Resource  
Development National Rankings  
University Category

Data: As on June 10, 2019

## ACADEMIC FACULTY MEMBERS





# IISc: Research Productivity



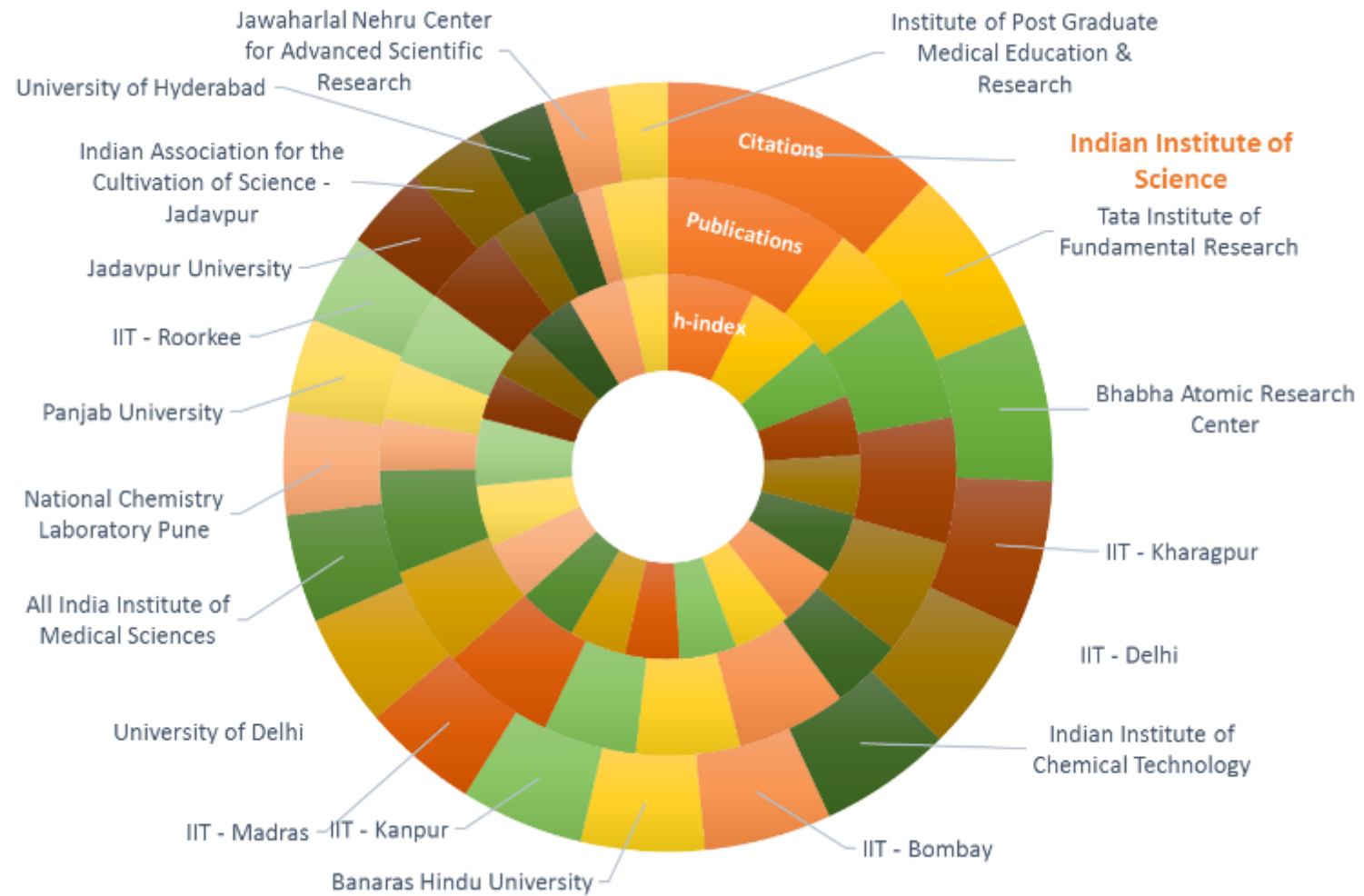
48,042 Web of Science Documents

7,07,451 Citations

226 H-index

~12000 Publications in top journals & conferences in the last 5 years

~400 PhDs graduated in academic year 2017-18  
Getting close to 1 PhD/Faculty member per year





# Rankings and Recognition



**#1 university** (2016, 2017, 2018, 2019)

**#1 institute overall** (2017, 2018), **#2** (2019)



**#251-300** (2019)

**#91-100** in World Reputation Rankings (2018)

*- only Indian inst. in top 100*

**#14** in Emerging Economies (2019)



**#184** (2020)

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

Subject	Ranking
Aerospace Engg.	ARWU #39
Materials Sci.	QS #51-100
Chemical Engg.	QS #51-100
Engg. & Tech.	THE #95

Selected by the Government of India as an **Institution of Eminence** in July 2018

Will provide more autonomy in academic programs, and  
US\$ 145 million additional funding over 5 years, as a matching grant



# Proposed 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**



# Faculty Awards & Honours

## National Awards (cumulative, since founding)



Bharat Ratna  
(2)



Padma Vibhushan  
(3)



Padma Bhushan  
(14)



Padma Shri  
(18)



SS Bhatnagar Prize  
(95)

## National Fellowships (among serving faculty)

Swarnajayanthi  
Fellowship  
Awards (31)



Indian Academy  
of Sciences  
(107)



Indian National  
Science Academy  
(91)



National Academy  
of Sciences, India  
(74)



Indian National  
Academy of  
Engineering (59)

J. C. Bose  
National Fellows  
(68)

## International Honours

*(among serving faculty)*

5

Infosys Prize Winners

9

IEEE Fellows

30

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*



# Major Awards (2014-18)

## Shanti Swarup Bhatnagar Prize



**Kaushal Kumar Verma**  
Prof, Math (2014)



**PS Mukherjee**  
Prof, IPC (2016)



**KR Prasad**  
Prof, Org Chem (2014)



**Neelesh Mehta**  
Prof, ECE (2017)



**B Gopal**  
Prof, MBU (2015)



**Alope Paul**  
Prof, Mat Engg (2017)



**Rishikesh Narayanan**  
AcP, MBU (2016)



**Ganesh Nagaraju**  
AcP, BC (2018)



**Sudhir Kumar Vempati**  
AcP, CHEP (2016)



**Ambarish Ghosh**  
AcP, CeNSE (2018)

## Infosys Prize



**Jayant Haritsa**  
Prof, CSA/CDS (2014)



**V Kumaran**  
Prof, Chem Engg (2016)



**Navakanta Bhat**  
Prof, CeNSE (2018)



**SK Satheesh**  
Prof, CAOS (2018)



# Awards & Recognitions: Padma Shri (2019)



**Rohini Godbole**

Professor, CHEP

1995-Present

**Padma Shri (Science & Engineering)**

## Research contributions & impact

- Methods to search for new particles & interactions in high energy particle colliders
- Innovative ideas & strategies to understand hadronic interactions of high energy photons, search for the top quark, Higgs boson, supersymmetric partners of Standard Model (SM) particles, and to probe many ideas of physics beyond SM
- Many ideas put to use in current high energy collider experiments (at the Large Hadron Collider, CERN) and are sure to be used in future colliders (International Linear Collider, Compact Linear Collider, Future Circular Collider & the possible electron proton collider)

## Other contributions

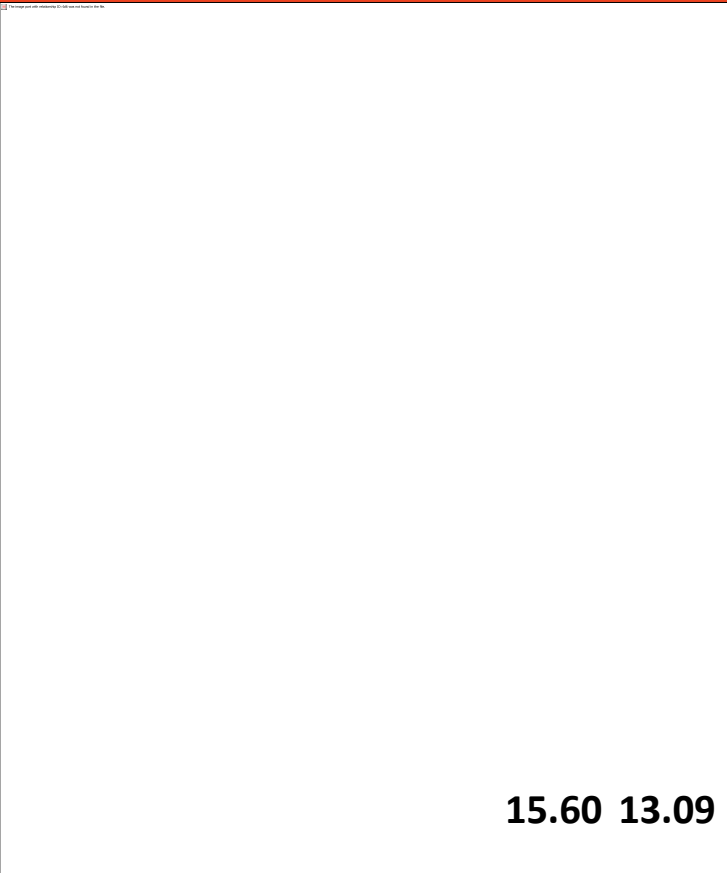
- Major roles in multi-institutional, multi-national collaborative projects & ensuring participation of young researchers
- Efforts to encourage industry participation in design & construction of complex instrumentation at international facilities
- Member of
  - International Detector Advisory Group for the International Linear Collider
  - Linear Collider Board (which is leading the international effort to design and realize the electron positron Linear Collider, the follower of LHC)
  - High Energy Physics Advisory Panel (USA)
  - Scientific Advisory Committee of the Dutch Research School of Theoretical Physics
- Efforts to increase participation & role of women in science



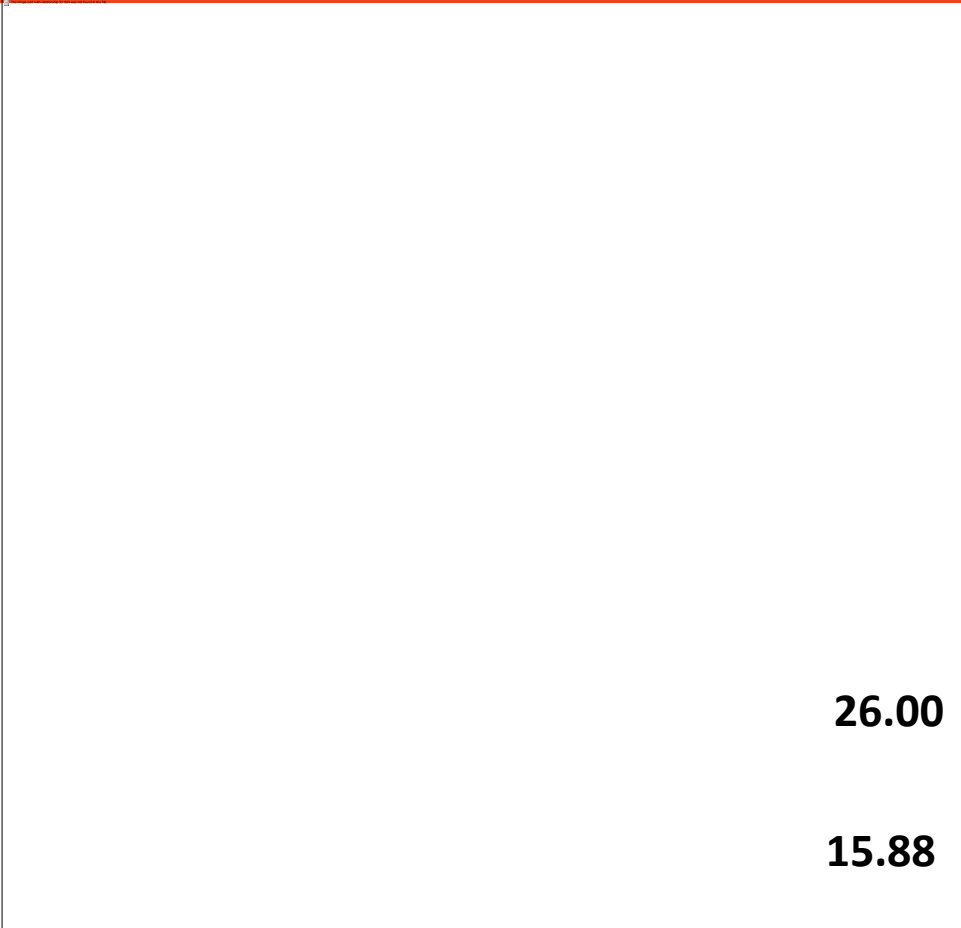
# Expenditure and Sources



**2016-17:**  
**Rs. 826.12 cr**



**2017-18:**  
**Rs. 959.05 cr**



- Direct Govt. Funding
- Govt. Research Grants
- Non-govt. Research Grants and Scholarships, Chairs, Consultancy, etc.
- Internal Resources
- Support from alumni, other donors, CSR

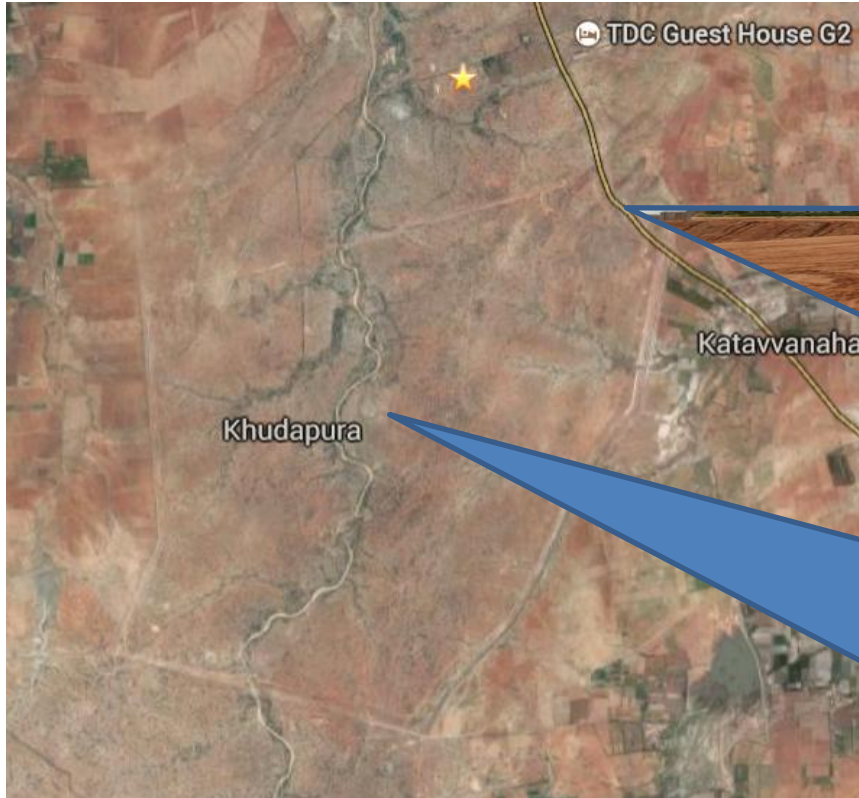
Amounts in Rs. Crores







# 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



# Strengths & Uniqueness



- 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



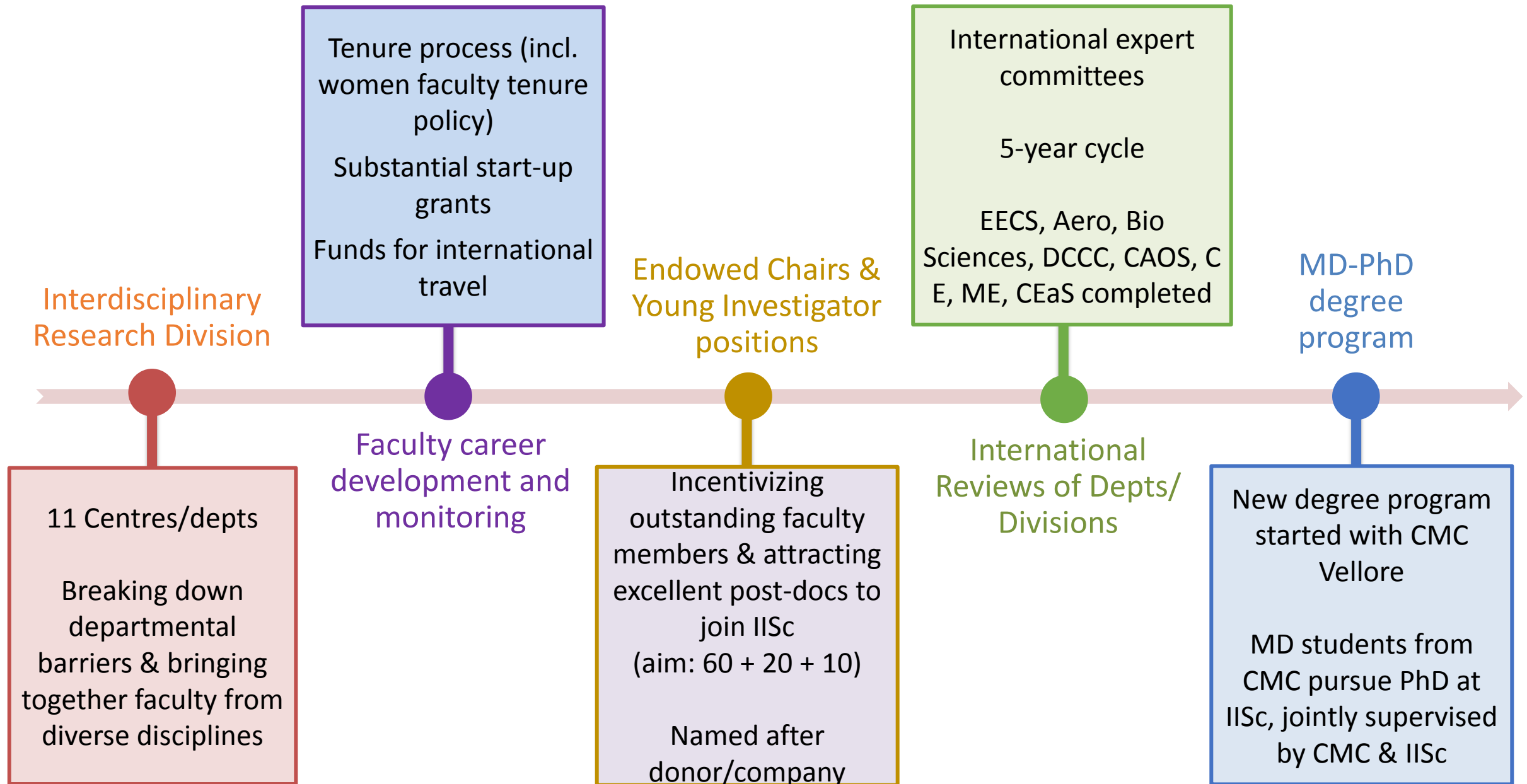
# Strengths & Uniqueness



- 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



# Some Recent Initiatives





# Some Research Themes – Cutting Across Departments



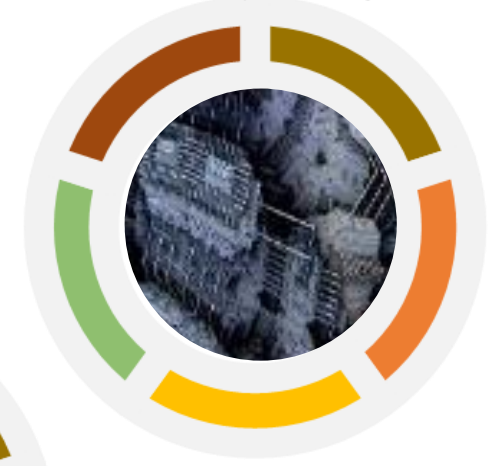
**Brain, Computation &  
Data Science**



**Biomedical Systems  
& Devices**



**Quantum  
Computing**



**Cyber-  
security**



**Materials  
Informatics**



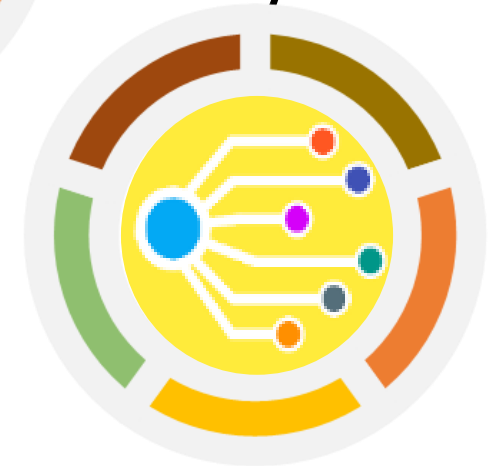
**Cancer Research**



**Sensors**

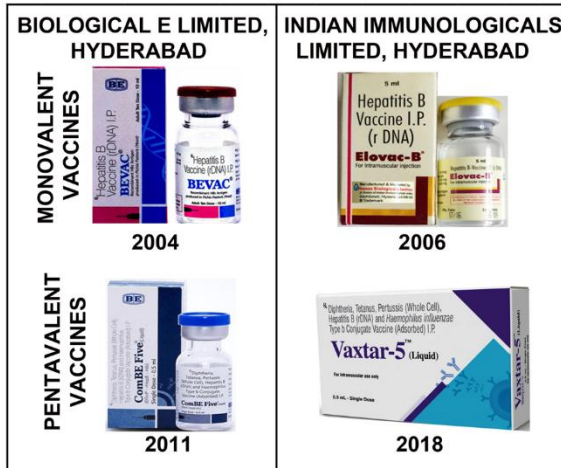


**Visual  
Analytics**



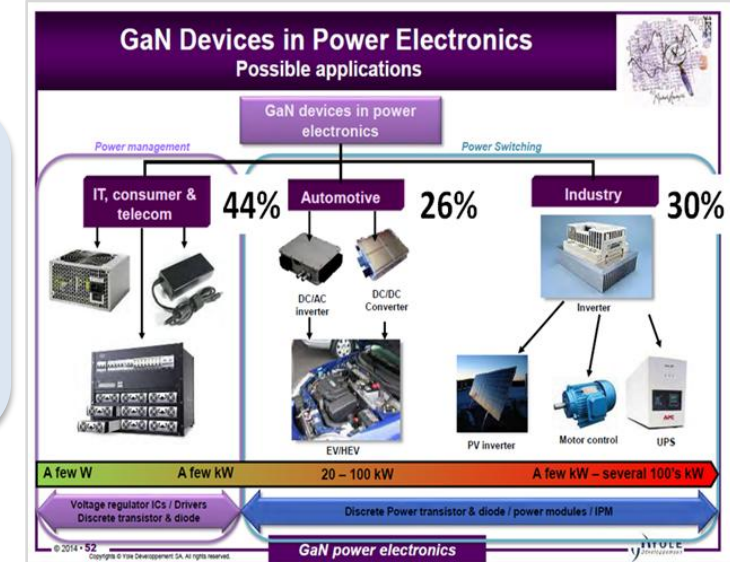


# National Capability Building



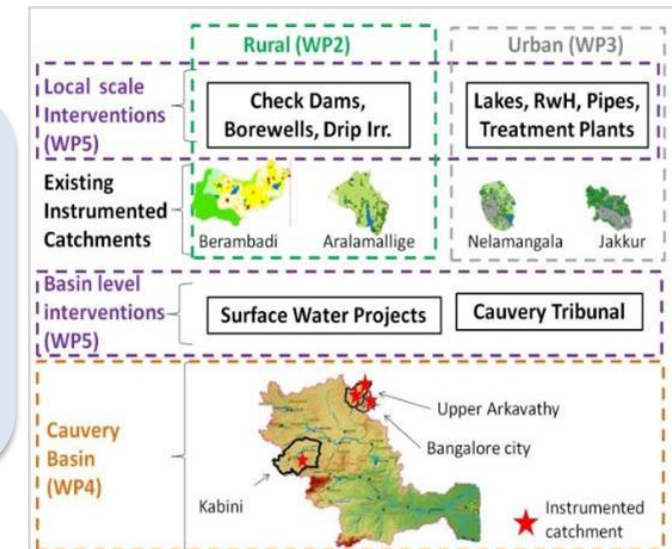
**Indigenous recombinant Hepatitis B vaccine, from the yeast strain developed at IISc**

**Gallium Nitride process and devices**



**Supercritical CO<sub>2</sub> Brayton test loop**

**Basin-scale water management**





## **Some Large Collaborative Research Initiatives**



# Centre for Brain Research

Supported by the **Pratiksha Trust** established by Infosys Co-Founder **Kris & Sudha Gopalakrishnan**

**Rs. 225 crores**

Research on aging brain & dementia

## **SANSCOG study:**

Longitudinal study of 10,000 people to identify risk & protective factors for dementia. Expertise required in cognition, basic neurobiology, genetics, imaging, data analytics & management.

## **Genome India Initiative**

Whole genome sequencing for Indian population

**Rs. 50 crores**

New building



**Rs. 30 crores**

Focus on Neuromorphic Computing

Support for exchange visitors, post-docs, interns, seed grants, travel fellowships, workshops, compact courses

## Visiting Chairs



**Shihab Shamma**  
Univ. Maryland



**Vasant Honavar**  
Penn State



**Christos Papadimitriou**  
Columbia

## Young Investigators



**Chetan Singh Thakur**  
Electronic Systems Engg



**Sriram Ganapathy**  
Elec. Engg.



**Prasanta Ghosh**  
Elec. Engg.

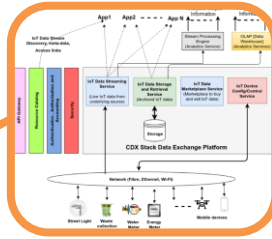


**Sridharan Devarajan**  
Neuroscience



# Robert Bosch Centre for Cyber Physical Systems

*Interdisciplinary Research and Academic Centre focusing on large scale socio-technical systems, collaborative robotics and autonomous mobility*



India Urban Data Exchange (IUDX) for **Smart Cities**. Empowering the Smart City Mission of Govt. of India.



Custom-built **walking robot**: Using deep-reinforcement learning algorithms to achieve wide variety of walking behaviours



**Autonomous drones and vehicles** navigating using ML/AI Algorithms with the aid of **5G Infrastructure**. Applications include law & order, infra assessment.

Partnering with TCS to compete in prestigious MBZ International Robotics Challenge (2020).  
Crossed first round & received \$100,000 milestone award.



# Divecha Centre for Climate Change

*Supported by Arjun Divecha & the Grantham Foundation*

## Initiatives



International policy-cum-research initiative to support national & international climate change policies.  
**Divecha Centre hosts South Asian regional hub.**



**Water Solutions Lab** established recently to understand water-related science, policy & societal questions, address water risks in near-real time, and support planning.

## Activities

### Policy Briefs:

- For various ministries/policy makers and the public on topical issues.
- **Most recent:** De-carbonization of Indian power sector could significantly reduce emissions and associated health risks.

### Meeting with Hon. Members of Parliament:

- Creating awareness on impact of climate change on the Himalayan glaciers and water security of the Indo-Gangetic plains.

### “Future Earth” Global Meet 2019:

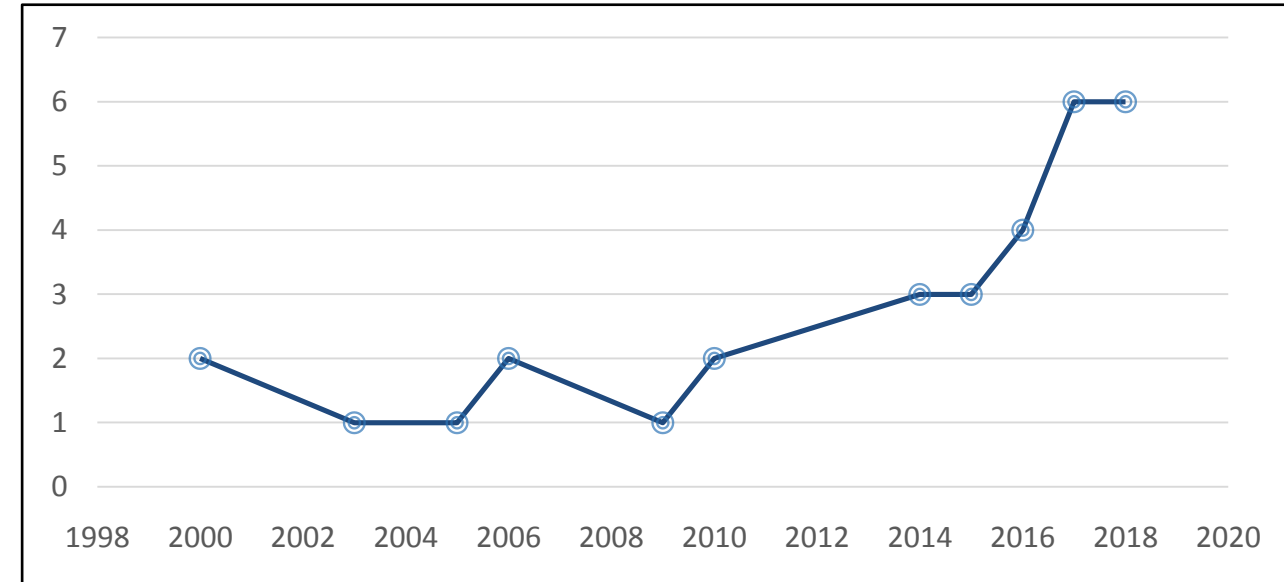
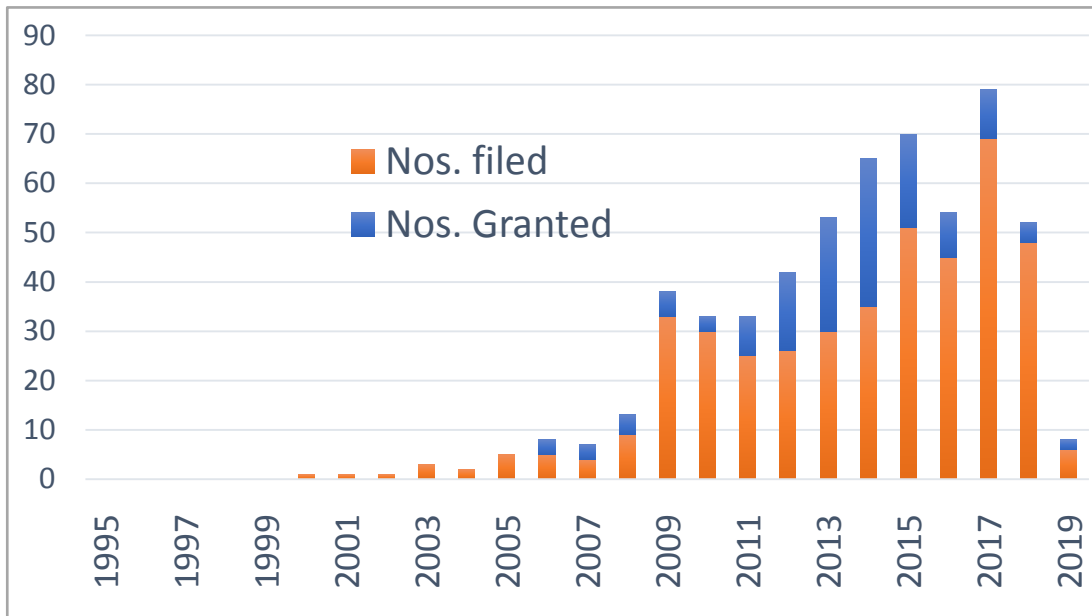
- International event in September 2019 on the theme: “Towards a Sustainable Water Future”
- 1000+ participants from across the globe: scientists, policy makers/ministers, industries, general public



# **Industry Interface, Innovation, and Entrepreneurship @ IISc**



# Science → Patents → Start-Ups



**BioTech & Healthcare**

**Medical Devices**

**Aeronautics**

**Materials**

**Mobility**

**Renewable Energy**

**Agri Tech**

**Space Tech**

**Electronics Computing**

**22 companies  
incubated  
during  
2014-2018**



# Research Driven Start-Ups



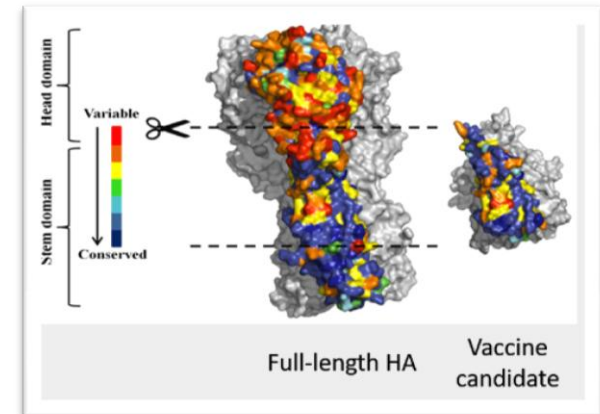
**PathShodh**  
HEALTHCARE  
*Inventina lifelines..*



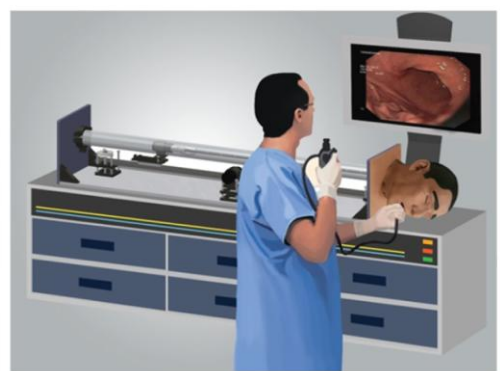
**PathShodh:** Point-of-care diabetes monitoring for 8 different biomarkers



**OpenWater:** Zero waste water purification; removes fluoride, arsenic & bacteria

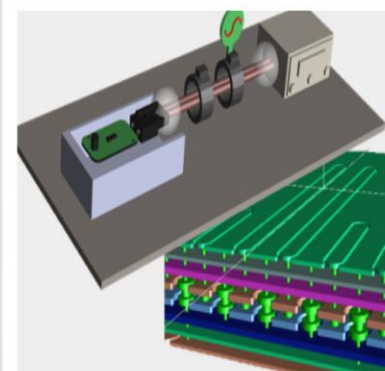


**Mynvax:** Towards a “universal” influenza vaccine: A recombinant vaccine that acts against the conserved stem of the virus, rather than the variable head



**Mimyik:** Endoscopy training device, combining haptics and visualisation

**SimYog:** Electromagnetic simulation/testing platform for electronic systems







*Safe nucleic acid stain & specialty fluorescent dyes*



*Broadband internet beamed from space*



*Farming solutions based on design interventions*



*Laproscope simulator using haptic response*

## Startups by current faculty members

Protein design of universal flu vaccines

● **Mynvax (2018)**  
*Raghavan Varadarajan, MBU*

Simulation/testing platform for automobile systems

● **Simyog (2017)**  
*Dipanjan Gope, ECE*

Electro-physical water purifier

● **Open Water (2017)**  
*Sanjiv Sambandan, IAP*

Process-specific enzymes

● **Bio-Synth (2016)**  
*B. Gopal, MBU*

Point-of-care in vitro diagnostics

● **Shanmukha (2016)**  
*Sai Siva Gorthi, IAP*

Point-of-care diabetes detection device

● **PathShodh (2015)**  
*Navakanta Bhat, CeNSE*

Animal diagnostics kits and services

● **Equine Biotech (2015)**  
*Utpal Tatu, Biochemistry*

Optics, instrumentation & sensing solutions

● **InScientific (2010)**  
*S. Asokan, IAP*



# Industrial Research Partners



Over **550** projects with **200** companies across the globe



**Pratt & Whitney**  
A United Technologies Company

**SIEMENS**

*Ingenuity for life*



**YASKAWA**





# Recent Industry R&D Initiatives



Biochemical fingerprinting  
of metabolic pathways in  
the development of health  
& energy drink



Deep learning based  
ecosystem for aircraft  
health management using  
visual and sensor data

**faurecia**

Intelligent Dashboard  
Control System (IDCS) &  
Distraction and Cognitive  
Load Detection



Intelligent image  
analysis methods  
in digital rock

**VOLVO**

Improved direct  
visibility & driver  
safety

**YASKAWA**

Study of Imitation  
Learning Approaches  
to train Robot Arm

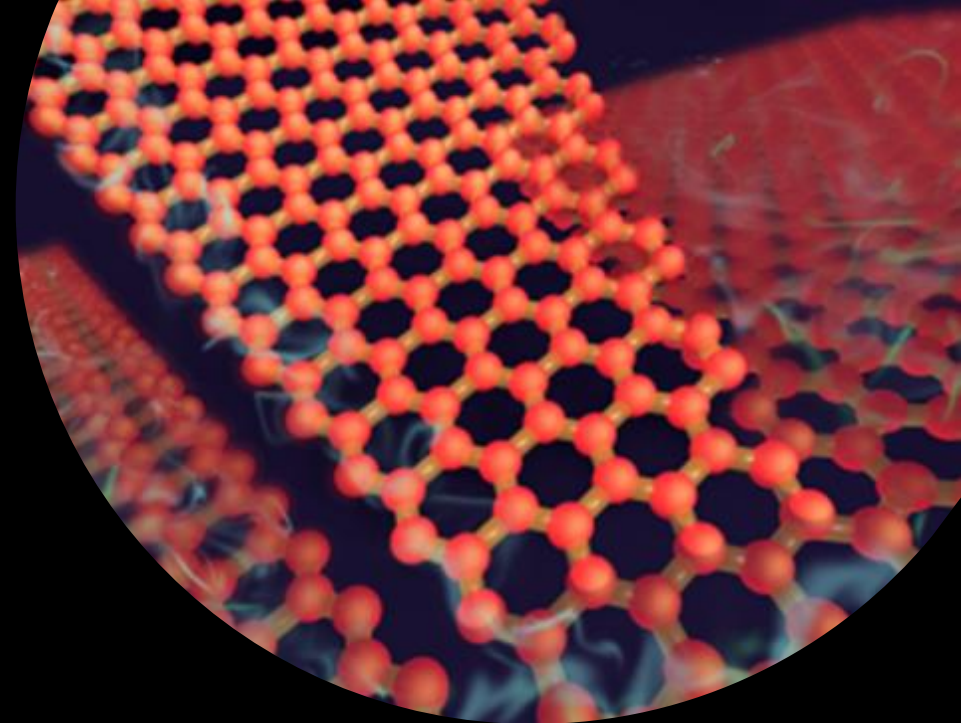


Sensor for  
malodorous  
gases





Discovery



Thank You

Invention





# Backup Slides





# Cancer Research

Identifying biomarkers (microRNAs) and drug targets for aggressive brain tumours

**Kumar Somasundaram (MCB)**

*Modern Pathology (2010), Clinical Cancer Research (2018). US Patent filed.*

Cancer initiation: Differential synthesis of protein variants as key determinant of various cancers

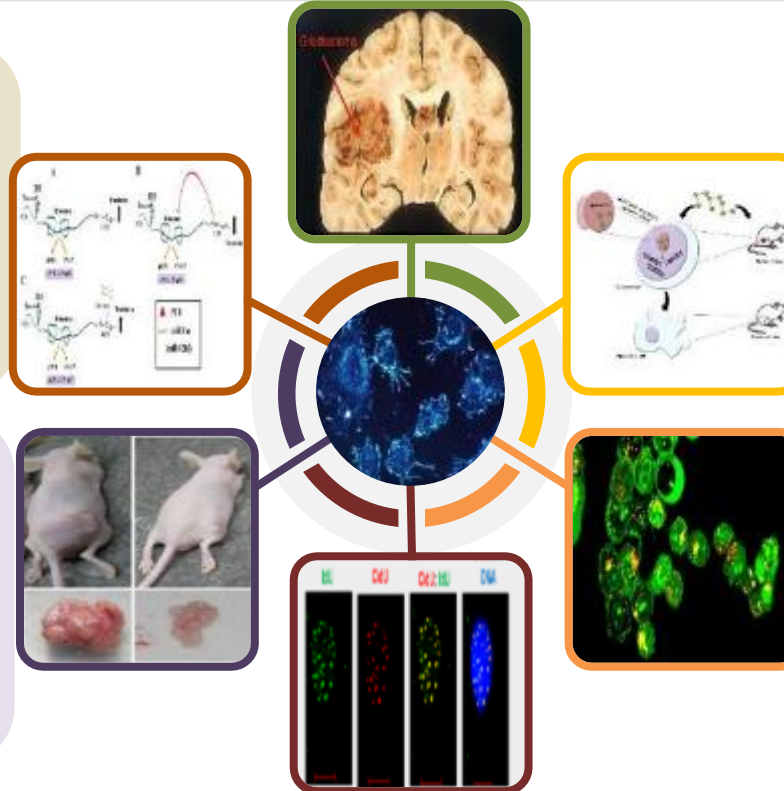
**Saumitra Das (BC)**

*Nucleic Acids Research (2017)*

Identifying the role of microRNA-155 as potential therapeutic target in oral cancer

**Arun Kumar (MRDG)**

*Journal of Biological Chemistry (2013)*



Novel molecule (SCR7) stops DNA repair in cancer cells, slows spread & brings down radiation dose

**Sathees Raghavan (BC)**, *Cell (2012)*, US & Indian Patents. Sold by many companies.

Understanding cancer spread: double -ve feedback between 2 proteins enables cancer cell survival

**Annapoorni Rangarajan (MRDG)**

*Cancer Research (2018)*

Mechanisms of DNA repair: Mutation identified that leads to pathological DNA replication

**Ganesh Nagaraju (BC)**

*Nucleic Acids Research (2015, 2017), Cell Reports (in press)*



# Brain, Computation & Data Science

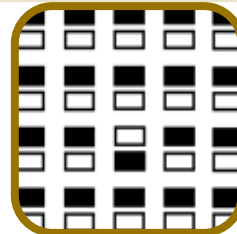
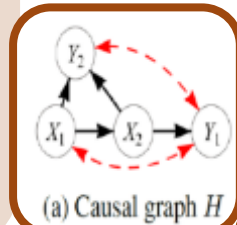
**Searching for oddball target:** Optimal strategy to employ scarce attention resources using Markov decision process

**Rajesh Sundaresan (ECE) + SP Arun (CNS)**

*IEEE Transactions on Information Theory (2017)*

Algorithm with polynomial time-complexity for computing minimal set of interventions for some families of causal graphs

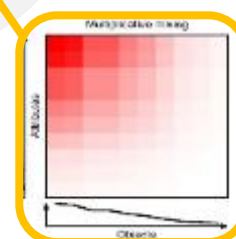
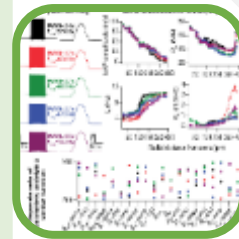
**Arnab Bhattacharya (CSA)**  
*AAAI (2019)*



**ReAI-LiFE:** Rapid evaluation of brain connectomes on GPUs. 100x speedups. Identifying connectivity signatures in Alzheimer's.

**Sridharan Devarajan (CNS) + Partha Talukdar (CDS), AAAI (2019)**

Degeneracy (structurally different elements performing same function) in concomitant emergence of place cell responses & intrinsic neuronal properties



**Object recognition:** Signals related to identity & other attributes are combined multiplicatively in single neurons in higher visual areas for better decoding.

**GP Arun (CNS)**

Special support for this area from **Pratiksha Trust (Mr. Kris Gopalakrishnan & Mrs. Sudha Gopalakrishnan)** through 3 Chair Professorships, Postdoctoral fellowships, seed grants, etc.

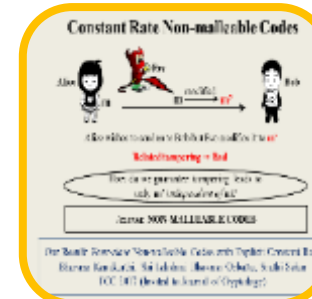


# Cyber Security

20 faculty members working on various areas

IISc designated as **Anchor Institution for Karnataka State CoE in Cyber Security**: Interactions with Bangalore startups, capacity building, outreach and raising awareness on cyber security-related issues

Breakthrough work on secure multiparty computation. Published in tier-1 venues: NDSS, CRYPTO, ACM CCS.  
**Arpita Patra (CSA)**



Important advances in non-malleable codes: Preventing tampering of encoded messages.  
**Bhavana Kanukarthi (CSA)**  
TCC (2017), EuroCrypt (2018)

Cloud platform security

Security for IoT & CPS

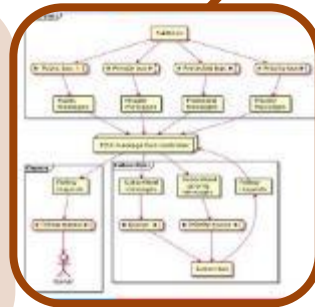
Classical & post-quantum cryptography

Automated program analysis & repair

Information theoretic security

Statistical inference & privacy

Security for Smart Cities: secure data collection & analysis, access control & app development  
**Bharadwaj Amrutur (RBCCPS)**  
Ongoing research



New techniques using trusted hardware for regulating smart devices in restricted spaces.  
**Vinod Ganapathy (CSA)**  
ACM MobiSys (2016)



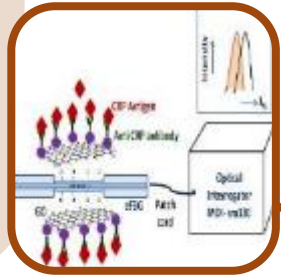
# Sensors

Pressure & gas sensors for strategic applications.  
Deployed in LCA & ALH (HAL).

**KN Bhat, MM Nayak, Rudra Pratap (CeNSE)**

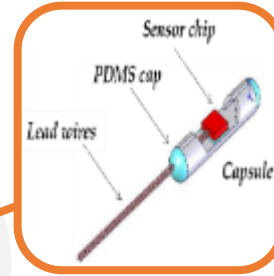
Optical FBG sensors for detecting  
blood glucose and C-reactive  
protein for diagnostic applications.

**Ajay Sood (Phy) + S Asokan (IAP)**  
*Biosensors & Bioelectronics (2015)*  
*BioPhotonics (2015)*



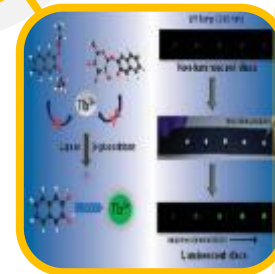
Sensor for detecting changes in  
intracranial pressure. Diagnosing  
head injuries in hospitals.

**GK Ananthasuresh (ME) + Navakanta Bhat  
& KN Bhat (CeNSE)**  
*Ongoing collaboration with NIMHANS*



Conducting polymer-based sensors to  
detect nitrate ion (pollutant) in  
potable water.

**Praveen Ramamurthy (MatE)**  
*ECS Journal of Solid State Science and  
Technology (2018). Patent filed.*



Low-cost, user-friendly paper  
biosensor that rapidly detects the  
presence of lipase. Higher levels of  
lipase indicate damage to pancreas.

**Uday Maitra (OC)**  
*ACS Sensors (2016)*



# Biomedical Systems & Devices

Real-time monitoring of new-born babies using IoT-based wearable sensors

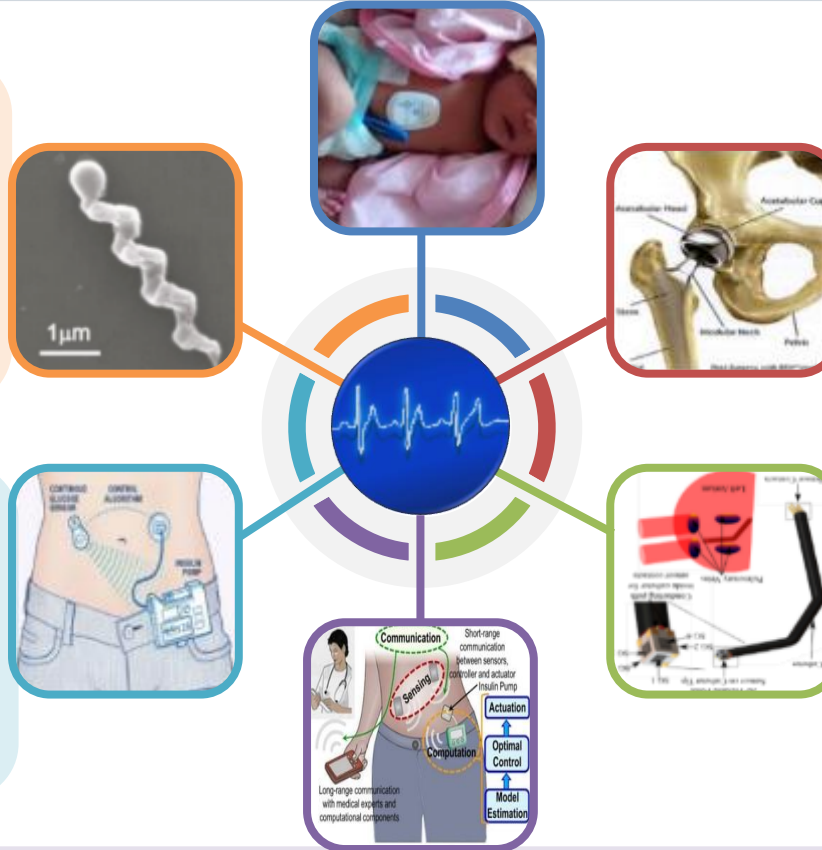
**Bharadwaj Amrutur (RBCCPS)**

*IEEE Sensors (2018), Pilot & Feasibility Studies (2018), BMJ Innovations (2018)*

Nano-motors steered by magnetic field for drug delivery inside living cells, measuring flow properties

**Ambarish Ghosh (CeNSE)**

*Adv. Materials (2018), ACS Nanolett. (2017)*



Biomaterials for orthopedic and dental applications: bone fracture, arthritis, etc.

**Bikramjit Basu (MRC)**

*Technology transfer, Centre of Excellence*

Assistive technologies for diabetic patients & elderly

**GK Ananthasuresh (ME), Siddharth Jhunjunwala (BSSE)**

*Ongoing research*

Smart catheters for blocking abnormal signals in veins

**Hardik Pandya (DESE)**

*IEEE Journal of MEMS Systems (2017)*

Artificial pancreas for Type-1 diabetes

**Radhakant Padhi (AE), KVS Hari (ECE), Manish Arora (CPDM)**

*IMPRINT project with MS Ramaiah Medical College. Papers at IDS-2019, ATTD-2019. Patent being finalized.*



# Visual Analytics

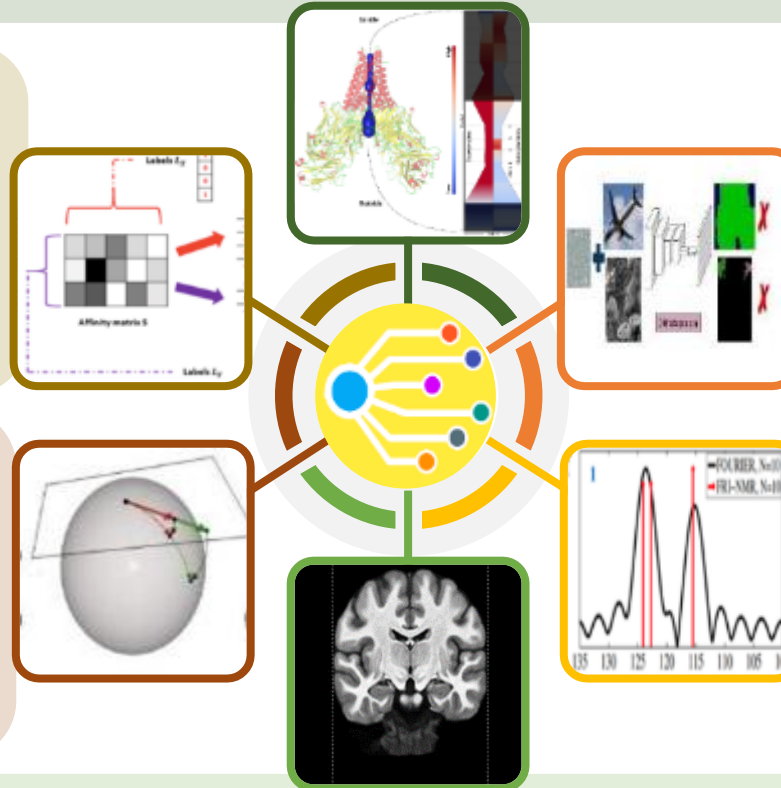
**ChExVis:** Biomolecular channel extraction & visualization framework.  
Publicly hosted, used by several research groups, 3000+ submissions.

**Vijay Natarajan (CSA) + Nagasuma Chandra (BC)**

*BMC Bioinformatics (2015)*

Novel algorithms for cross-modal retrieval. Applications in surveillance, forensic analysis.

**Soma Biswas (EE) + Kunal Chaudhury (EE),**  
*IEEE Transactions on Image Processing (2019)*



Novel tool to 'fool' Deep Neural Networks. Testing vulnerability for decision-making applications.

**Venkatesh Babu (CDS),** *IEEE Tran. Patt. Anal. & Machine Intelligence (2018)*

Novel motion-averaging 3D vision framework. Used in commercial products & open source packages.

**Venu Madhav Govindu (EE),** *IEEE Tran. Patt. Anal. & Machine Intelligence (2018)*

Surpassing resolution barrier in NMR spectroscopy. Accurately estimating chemical shifts.

**Chandra Sekhar Seelamantula (EE) + HR Atreya (NRC),** *Scientific Reports (2017)*

India-specific brain templates (developed with NIMHANS).  
Assessing dementia, schizophrenia & bipolar disorders.

**Phaneendra Yalavarthy (CDS)**

*Psychiatry Research: Neuroimaging (2017)*

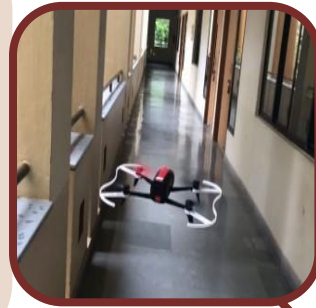


# Guidance & Control for Autonomous & Aerial Vehicles

*Much of the work by this group is supported by DRDO, ISRO, and several government and private industries such as HAL, Intel, TCS*

Drone research: obstacle avoidance, 3D maps, agri applications, etc.

**SN Omkar (AE), Bharadwaj Amrutur (RBCCPS), Chiranjib Bhattacharya (CSA),**  
*Ongoing research*



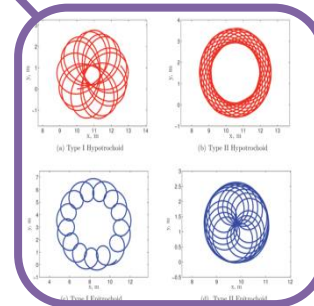
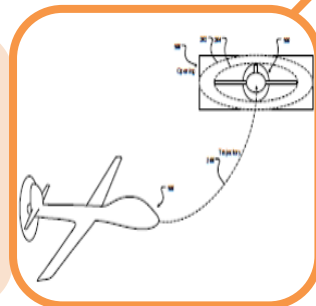
Autonomous soft landing of Lunar lander of Chandrayaan-2 mission of ISRO

**Radhakant Padhi (AE)**  
*Unmanned systems (to appear in 2019)*



Autonomously guiding vehicles through orifices

**Debasish Ghose (AE)**  
*US Patent Appl (2018)*



UAV search patterns for autonomous agents

**Ashwini Ratoo (AE)**  
*IEEE Control Systems Letters (2018)*



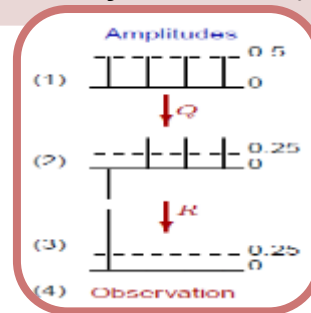
# Quantum Technologies

*Initiative aimed at quantum enhanced technologies.*

*Experimental work will include superconducting qubit devices, sources and detectors for quantum communications, and quantum sensors.*

Quantum Algorithms and Simulations: Work on Grover's database search, with wide-ranging applications from amplitude amplification to catalysis and genetic languages.

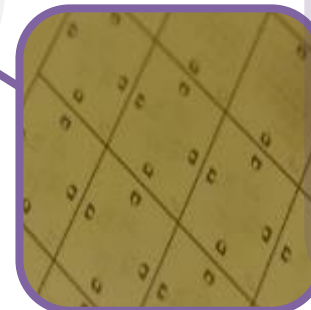
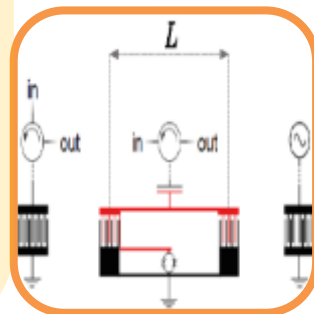
**Apoorva Patel (CHEP)**, *Int. J. Quantum Information (2018), Quantum Inf. Comput. (2018)*



Quantum Information  
Processing using  
Superconducting circuits:  
Quantum optics &  
acoustics, scalable quantum  
computing

**Baladitya Suri (IAP)**

*arXiv 1812.01302 [quant-ph]*



Developing small scale  
quantum processors based on  
superconducting qubit  
technology, hybrid  
optomechanical systems

**Vibhor Singh (Physics)**

*Ongoing research*



# Materials Informatics Initiative of IISc (MI<sup>3</sup>)

*Using artificial intelligence in materials science for guided and expedited discovery and characterization of materials.  
Generation of structural, functional and biological data and hosting these on a database.*

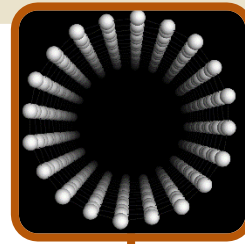
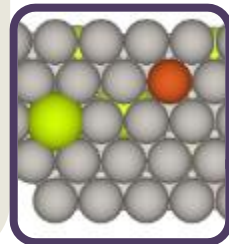
**aNANt**: a functional materials database - first computational materials database from India.  
Machine learning-assisted accelerated prediction of band gaps and edges of materials

**Abhishek Kumar Singh** (MRC)

*<http://anant.mrc.iisc.ac.in>, Chem. Mater. 30, 4031 (2018), J. Phys. Lett. (In press)*

Machine learning-guided synthesis  
of multicomponent nano-alloys for  
catalytic application

**Abhishek Kumar Singh** (MRC), **N. Ravishankar**  
(MRC) and **Abhik Choudhury** (MatE)

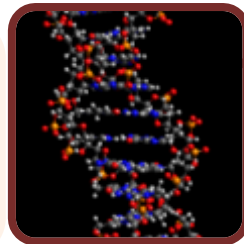


Microstructure engineering via  
image processing: process  
structure property linkage (PSP)  
**Abhik Choudhury** (MatE), **N. Ravishankar** (MRC)  
and **Abhishek Kumar Singh** (MRC)

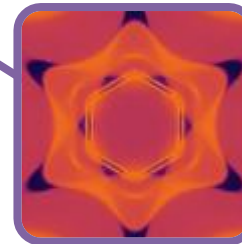


Informatics-assisted DNA packing  
in a cell nucleus

**Govardhan Reddy** (SSCU),  
**Subinoy Rana** (MRC)



Data-driven search for quantum &  
topological phases of materials  
**Tanmoy Das** (Physics), **Manish Jain** (Physics) and  
**Abhishek Kumar Singh** (MRC)



Application of artificial intelligence to design-discovery of functional materials and their characterization

**Manish Jain** (Physics) and **Abhishek Kumar Singh** (MRC)