

DEAN'S MESSAGE



Dear Alumnus,

Warm greetings from IIT Bombay, reflecting the springing up of spring, simmering of the summer as a harbinger of the monsoon, and the heating up crescendo building up to end semesters and graduation. I am certain that our students would have spared no effort for the end semesters, and they will come out with flying colours.

Last month, we officially concluded our annual GO IIT Bombay Campaign. The fundraising under the GO IIT Bombay Campaign, along the four core causes, received an excellent response from the alumni. I would like to profusely thank all the donors who have contributed to the causes, which will go a long way in promoting these defined causes at the Institute.

I would also like to sincerely thank the faculty members who came forward to appeal about the causes to alumni at large.

I would like to take you through some of the key events that took place at the Institute over this past month:

1. Our very distinguished alumni Mr. Sharad Kumar Saraf (B. Tech, Electrical Engineering, 1969) and Mr. Sudarshan Kumar Saraf (B.Tech., Mechanical Engineering and Manufacturing Engineering, 1970), donated generously to establish the Technocraft Centre for Applied Artificial Intelligence (TCA2I) at IIT Bombay. A key vision of TCA2I is to become a dominant force in Artificial Intelligence (AI) and Machine Learning techniques that can help resolve many of our world's most crucial issues.
2. TCA2I and the Centre for Machine Intelligence and Data Science (C-MInDS) at IIT Bombay partnered on a workshop series called "AI.Impact". It featured presentations and discussions on advances in 'Artificial Intelligence (AI) for causes of social impact'. We are pleased that the workshop proved to be very successful and was attended by eminent academics and industry stalwarts.
3. Our esteemed colleague, Prof. Devang Khakhar (former Director, IIT Bombay) was selected as the Indian National Academy of Engineering (INAE) Chair Professor from April 01, 2022, to March 31, 2025. My heartiest congratulations to him on this well-deserved honour.
4. It is a matter of immense pride when our students are acclaimed for their work and bring accolades to the Institute. Aneesh Bapat, B. Tech, Engineering & Physics, discovered electrostatically tunable topological transitions in a new mixed state of light and matter called "biaxial hyperbolic polaritons". His work is published in the prestigious journal Nanophotonics. I wish him continued success and even higher accomplishments and innovations in the future.
5. It was heart-warming to see our campus come to life in April with many of our flagship events like the Annual Insync Dance Showcase, Surbahaar, Dharohar, and Annual Stand-up Comedy Showcase returning to the offline format. April also saw the return of Techfest, revival of the Performing Arts Festival, along with Robowars and AutoExpo, to campus. I look forward to welcoming you for many such upcoming events.

As we approach the end of the current semester, I am looking forward to our upcoming events in May such as the Institute's Valedictory function. I would particularly like to highlight our annual Faculty Alumni Network (FAN) meeting to be held on May 14, 2022 at Ohio State University, Columbus, Ohio. I would like to welcome all of you to this exciting event that is being revived after the two years of pandemic. (Kindly check upcoming event section for the registration link)

IIT Bombay is really proud of its vibrant and involved alumni community that has contributed so immensely to its advancement. I would like to thank you for your continued support and generosity.

Sincerely,
Prof. Ravi Gudi
Dean ACR

FACULTY INTERVIEW



Prof. Milind Atrey: Changing the Dynamics of Academia-Industry Alliances

IIT Bombay's mission to create tangible academic and societal change in the world is made possible by its brilliant students, faculty members and researchers. One such outstanding faculty member is Prof. Milind Atrey, Dean (R&D), IIT Bombay, and Institute Chair Professor, Department of Mechanical Engineering, who has added many laurels to his name over the years. He

continues to advocate for stronger academia-industry alliances so that products created in a laboratory make a seamless transition to the marketplace and are utilized to solve real-world societal issues.

It was an incredible honour to speak with him as he traces his career journey with us.

- **As India is slowly leaving the pandemic behind and bouncing back to normalcy, we're still grappling with the ravages of Covid 19. Over the past two years, as we battled with a shortage of medical oxygen, you and your team came up with an ingenious solution - converting a nitrogen unit into an oxygen generating unit to address this severe shortage. How did you come up with such an innovative solution, and what were the challenges you faced?**

Prof. Atrey: The second wave of COVID -19 created havoc in our country. We struggled with an unprecedented surge in demand for medical oxygen and witnessed heart-breaking scenes of thousands of our countrymen standing in long queues waiting for oxygen cylinders for their loved ones. We knew we had to come up with a solution to this crisis and realised the answer was right in front of us. When we conduct experiments in our labs, we liquefy nitrogen after separating it from air and let the oxygen go back into the atmosphere. Our solution was to reverse this process - save the oxygen and let the nitrogen go back to the atmosphere. We explored the functions of Pressure Swing Adsorption (PSA) and discovered that the filter unit and the corresponding valves play a crucial role. Our solution was to change this filter element and let the oxygen pass through and push out the nitrogen. Also, modifying the PSA is not permanent and owners of the nitrogen-producing plants can revert to their original purpose once the emergency producing medical oxygen for our country is over. We knew we needed an industry partner who would convince these owners to convert their generators. Right from the beginning we collaborated with TATA Consulting Engineers and Spantech Engineers. TATA Consulting Engineers eventually took over the project and taught numerous nitrogen plant owners across the country to modify their existing generators to produce oxygen. We also uploaded the procedure onto the website for the benefit of the public. We could successfully convert around 300 existing nitrogen plants and help 20,000 citizens. Our Director, Prof. Subhasis Chaudhuri also helped by connecting us with several alumni and the public at large. While this conversion wasn't a huge invention, it was a very timely intervention.

- **As you've outlined above, your team from the Institute partnered with industry and is a perfect example of the synergy between academia and the corporate world. How important are these alliances, and how can academia create more such fruitful partnerships?**

Prof. Atrey: Industry and academic alliances are the need of the hour. Often, innovations sit in the lab for years and never see the light, but an alliance between industry and academia can change the scenario. Our alliance with TATA Consulting Engineers, and Spantech Engineers is a pertinent case study that highlights the impact of such partnerships. It's a shame that 70-80 percent of inventions which are capable of creating a significant difference to our societal needs are restricted only to the four walls of the laboratories. They need industry intervention/collaboration to increase Technology Readiness level (TRL). I was fortunate to work with proactive organisations that helped smoothen and execute the process of taking an invention from the lab to the open market. More such alliances are the need of the hour.

- **You have contributed to building the modern Magnetic Resonance Imaging (MRI) system. Can you describe how you developed this life-changing technology?**

Prof. Atrey: Let me break down the science behind the crux of the technology first. Technically speaking, 60% of the cost of the Magnetic Resonance Imaging (MRI) machines is that of the magnet box. One MRI machine can cost anywhere between Rs. 5-10 Cr. depending on its magnetic field. A high magnetic field is needed when a patient is inside the machine and is effective only when the magnet is maintained at a very low temperature. The magnet is typically maintained at -269°C and needs liquid helium to maintain the temperatures at this low level. That's why it's called a superconducting magnet. Liquid helium is key to the success of this technology but it's a rare gas, expensive, and requires manual power to pour 1000 litres of liquid helium into the MRI machine once every 3 to 6 months. To overcome all these challenges, we developed a technology to recondense the boiled-off helium and set up a cryocooler that actively cooled and condensed the helium vapours and then brought it back to a liquid state. We did the same experiment with Nuclear Magnetic Resonance (NMR) also. This technology eliminated the need for periodic replenishment of liquid helium. This technology is a game-changer and allowed tier 2 and tier 3 cities to have MRI machines in their hospitals and helped millions of patients who can now get treatment locally. Currently, I am also involved with our government's initiative to build indigenous MRI machines in India. Our goal is for our country to manufacture the MRI machine locally and cut down on the high costs of imports.

- **You received your Ph.D. in cryogenics and are considered a specialist in cryogenic engineering. Can you share your career trajectory before you came to IIT Bombay in 2005?**

Prof. Atrey: I'm originally from Nagpur and an alum of Visvesvaraya National Institute of Technology (VNIT). After my Ph.D. in cryogenics from IIT Bombay I joined TATA Research & Development Centre in Pune, and later moved to Germany. After a few years abroad, I joined the Department of Atomic Energy at Raja Ramana Centre for Advanced Technology (RRCAT) to work on cryogenics technology in India, which was then under sanctions. After five years of working at RRCAT, I moved to Oxford Instruments, United Kingdom, where I contributed to the development of the technology required for MRI/NMR machines. After five years there, I made a career shift and joined IIT Bombay as a teacher and it's been an incredible journey so far. I enjoy reading, teaching, and learning new things.

- **You were appointed as Professor-in-charge at Society for Innovation and Entrepreneurship (SINE), IIT Bombay's incubation cell. What (if any) were some of the challenges you faced heading SINE since it combines pure science and innovation with business?**

Prof. Atrey: I loved my 7-year stint as head of the Society for Innovation & Entrepreneurship (SINE). There were plenty of challenges, especially in the Indian landscape, where bringing together science, innovation, and business under one roof was a concept that was way ahead of its time. Due to the government's push for start-ups, the Indian landscape started to change dramatically. Back then most professors and students were unaware of SINE and start-ups were hardly an option. Changing the mindset about start-ups was a tough grind. Our team would go to hostels after 9:00 pm and pitch SINE to our students.

The Government of India also realised the power of start-ups and allocated funds for start-ups. Soon, unexpected external factors boosted emerging concepts, and that's what the movie 3 Idiots did for start-ups in India. The movie featured one of the most successful start-ups under the SINE umbrella, ideaForge, which initiated the technology of unmanned aerial drones. The movie gave a much-needed boost to IIT Bombay. Soon, SINE had a few successful ventures under its belt. Our alumni members started to invest time in SINE and its many ideas. SINE CEO, Ms Poyini Bhatt, has been instrumental in building SINE into what it is today. We broke many stereotypes at SINE and left our mark and created a pathway for the future generation of students from IIT Bombay to achieve their dreams.

- **As the current Dean of Research & Development, IIT Bombay, what is your vision for R&D at the Institute?**

Prof. Atrey: I would like to see different departments coming together for multidisciplinary and interdisciplinary research. All of the IITs have adopted this trend and we are witnessing emerging verticals such as Digital Healthcare, Quantum Computing, Semiconductor Research, Security, Net Zero Solution, etc., which are the future of research. Ideally, we should connect with as many industries as

possible, understand their issues and share them with our professors for solutions. I know the power of the IITs and their ability to bring about societal impact.

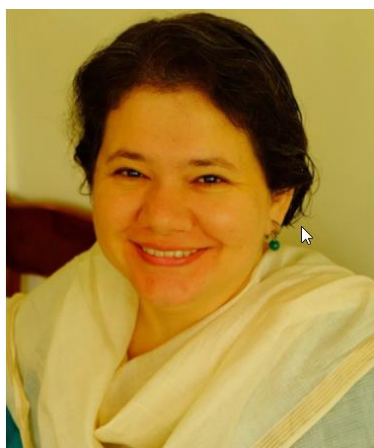
- **Finally, how can young students translate their ideas into real-world solutions? Any advice for our upcoming innovators and researchers at the Institute?**

Prof. Atrey: Students should form groups of at least three members, each with a distinct strength. One member should have a strong technological know-how, one should focus on market trends, and the third should have excellent management and/or networking skills. Each group member should pitch in equally and understand the fundamentals of entrepreneurship and that will result in a successful start-up and/or business idea.

Unfortunately, in our existing scenario, the measure of success is one's financial remuneration. I don't agree with that marker of success. While IIT Bombay needs to focus on creating employment opportunities for its students, our students should think of the big picture and focus on looking beyond their personal desires and work towards creating a change in our society that will benefit our future generations and mankind itself. Our students must focus on addressing issues such as Climate Change, Disaster Management and Renewable Energy.

What an amazingly comprehensive interview that was! We thank Professor Atrey for his time and his detailed responses that really provide clarity on all the issues raised. He is truly an inspiration to students, faculty members and researchers, both in academia and industry.

CONVERSATION WITH ALUMNI



Zenobia Driver - A Trip Down Memory Lane: Finding Herself at IIT Bombay – Part 1

IIT Bombay alumna, Ms. Zenobia Driver (M.Sc., Chemistry, 1998) wears many hats – successful entrepreneur, committed and tireless cheerleader of the Institute, key member of IIT Bombay Alumni Association and more. We are delighted to speak to her and in this two-part conversation she takes us on a nostalgic journey back in time to when she was a student at IIT Bombay in the 1990s and the many lessons she learned, highlights the many hang-out spots of the Institute, gives us a firsthand insight into how the Institute and the campus made her feel safe, gives us a crash course on some of IIT Bombay's slang, and elaborates on the difference between how the Institute was back in the 90s to how it is today.

In part one of the conversation, apart from taking us back in time to when she was a student at IIT Bombay, Ms. Driver reflects on her career trajectory and becoming an entrepreneur since she graduated from the Institute. In part two of the conversation (to be published in the Dean ACR June 2022 newsletter) she will take us through her journey as an alumni volunteer and her hopes and dreams for her very cherished alma mater.

Q: Hello, Ms. Driver. Thank you for taking the time to talk to us. You graduated with your Master's degree in Chemistry from IIT Bombay in 1998. Can you take us back in time and describe a little bit about the Institute and your time as a student at the Institute back in the 90s?

My student days on campus can be encapsulated into three words - learning, friendships, fun – albeit, in varying degrees. Even now, I have to only step back onto the campus and start walking from the Main Gate towards H10 and Gulmohar to feel instantly energized and rejuvenated.

One disappointment from my student days still persists though. In spite of my many visits to campus during the last few years I still haven't spotted a leopard on campus! Aside from that species, though, life as a student on campus gave me an invaluable opportunity to observe specimens of every type – from the manic muggoo to the loitering lukkhaas, the CC ka chappal chor etc.

IITB was a place you reached thinking that you'd made it, and then realised that 9/10th of the iceberg was still underwater. It took the first year to figure out how to stay afloat, make peace with what I could and couldn't learn, and what all I wanted to do at IIT Bombay. And there was a surprising amount to do outside the classroom as well. To start with, there was a whole new language to learn - NBD, lukkhaa, khaach and a host of other

words entered my vocabulary. Apart from a gazillion cack sessions in the hostel, there were the cult competitions to watch or participate in during the first sem, MI in December, PAF in the second sem. And time to be whiled away doing nothing at Chinkos, Vihar Lake, coffee shack and Chea Canteen.

What stands out for me most about IITB are two things though. One, a deep respect for logic and reasoning that was instilled in me. While my profession today is far removed from science and technology, I think that sentiment is still a part of my very being.

Second, a vibe – a chilled-out, tolerant, accepting vibe. Perhaps that came from the wide variety of specimens on campus and the diversity they represented, who knows? Plus, the favoured untidy clothes and hawaii-chappal-with-safety-pins stereotype ensured that it erased most of our differences anyway. All that mattered was what you said or did, not where you came from or how much wealth your family possessed. I find this aspect of the vibe still persists among most alumni today – a grounded, chilled-out attitude, though the hawaii chappals have tragically given way to more respectable footwear!

Q: Can you address issues of gender equality on campus when you were a student? What were some of the highlights and some of the challenges you faced?

For a kid who'd mostly lived in small towns prior to entering IITB, studying at the Institute was quite a liberating experience. I recall that during the first sem, some of my friends in H10 would occasionally wake me up late at night and we'd walk down to the Main Gate or Convo or Powai Lake, simply because it was late at night and we could step out without worrying, and so, why not? That feeling of being safe and protected outside the hostel - versus the norm of shutting girls in at night for their own safety – is something I cherished and that I've always been grateful to the Insti for.

I also remember participating in an inter-hostel debate during the first few weeks – the topic was something along the lines of how girls invite unwelcome attention due to the way that they dress. The debate was conducted rather well by the seniors who'd organised it. While at the time the topic completely irritated some of us in H10, in hindsight, I think it was a good idea to bring such a topic up for open discussion.

Campus in the 90s was a reflection of India itself – a raucous, boisterous, carnival, where pretty much everything and everyone was accepted, mostly. In the classroom, gender didn't seem to matter much beyond some general belly-aching about it. Overall, people were friendly and chilled out, and some strong friendships were forged.

There were some undertones of sexism, but those were much milder compared to what I had seen and heard outside campus, and easily ignored. Graffiti on walls or etchings on tables might have made one squirm, but small towns teach you to ignore these minor ugly details. The only thing that unnerved me was during my initial weeks as a freshie – the hooting when we passed by guys' hostels on our way to Vihar Lake, that would make me want to shrivel up and sink into the tar of the road. Looking back, I suppose that undoubtedly helped me develop a thick skin, a necessary survival trait in the corporate world, yet it was one lesson I'd have happily done without.

Q: Are there any fond memories or Institute hang-out spots that you recall spending time in during your student days? Also, we heard that you loved hiking and bird-watching. Did those interests develop while you were a student at the Institute?

There are too many fond memories and hang-out spots that I recall spending time in during my student days – it'd take a second interview to describe all those! Apart from the Hostel, there was the CHEA Canteen, Coffee Shack, Chinkos, the steps of the old Guest-House that faced Powai Lake, Vihar Lake etc.

While I was on campus, I wasn't conscious that I'd developed a liking for nature and nature-related hobbies. I only went for 3-4 treks during the years on campus; though I enjoyed those thoroughly, I don't think they left that deep an impact on me.

But I think being immersed in a green environment, walking all over campus, and escaping to the banks of either Vihar Lake or Powai Lake after tough mid-sems / end-sems, made me positively disposed towards greenery. And once I graduated from IITB, I had to seek out the same green environment that I took for granted during my student years, and that's probably a large part of what attracts me towards bird-watching, walking etc. today.

Q: After graduating from IIT Bombay, you worked in sales and marketing before you set up your consulting firm, Escape Velocity. Can you take us through your career trajectory? What made you set up Escape Velocity?

After 5 years in the Integrated M.Sc. program at IITB, I took a turn towards management and enrolled at IIM Bangalore. I began my career in a line role in Johnson & Johnson, India, in Sales and Marketing. After a few job changes over the next 6 years, I moved to become a tiny cog in the wheels of a large consulting firm called The Monitor Group.

Two years of consulting in a large consulting firm, and I decided that I was ready to start a ‘real’ business, manufacturing and selling products. The naivety of youth, right? It was matched only by enthusiasm. I had no clue about the nature of products that I wanted to sell or how to set up a firm, but I was quite clear about the type of organisation that I was going to create and I wrote a short charter describing it.

I gave myself a year to experiment, and to balance adventure with financial stability, I signed up as an independent consultant with two firms. I enjoyed that experience so much that in August 2009, I founded Escape Velocity, a boutique Market Strategy and Marketing consulting firm.

The same year, I also joined my friends who were forming an NGO called TREE (Training Resources for Enabling Enterprises) Society, to which they intended to devote a couple of weeks a year. TREE Society equips rural micro-entrepreneurs with appropriate business skills. I am the co-owner of the Sales & Marketing module of these programs, and devote a few days of my time every year to this initiative.

Q: You are a role model to many young students on campus, as well as young alumni members. What advice would you give them about pursuing their dreams and the concept of philanthropy?

On the concept of either philanthropy or volunteering, I think my advice would be to jump in whenever and wherever you have the ability to contribute by way of money or time, and hear of an avenue to do so. Get your feet wet, don’t worry about the quantum of contribution or scale of impact, that comes later. Typically, in my volunteering work, I’ve focused on getting involved in work that I found fun to do and people that I liked working with; no matter how worthy the goal, enthusiasm fizzles out unless you’re enjoying doing what you do.

As for pursuing your dreams, go for it, and all the best. I’m not sure I’m the right person to share any advice about how to do so. While I was quite clear about which domain I wanted to focus on in the long-term, I meandered my way through the first decade of my career. I often made decisions based on what I did not want to do in the future, or the types of people I wanted to work with. I was lucky enough to stumble onto the right track eventually, work with some wonderful people and have a great time doing so.

Looking back, there were a few simple points that I think I understood quite early on. You should balance the pursuit of dreams with your desired standard of living. Ensure that you enjoy at least a portion of the work that you do (and accept that each day some boring admin tasks will pile-on), and make sure you work with people you like and from whom you can learn something because that makes a huge difference to the quality of your life.

On that pertinent piece of advice, we’re signing off this month. The second part of our conversation with Ms. Driver will be published next month on the Dean ACR June 2022 Newsletter where Ms. Driver talks about the importance of volunteering and giving back to one’s alma mater and her dreams and goals for her beloved and cherished Institute. See you then!

CORPORATE COLLABORATION



IIT Bombay and L&T Collaborate to Develop Green Hydrogen Technology

IIT Bombay, India’s premier technology and research institution, signed a Memorandum of Understanding (MoU) with Larsen & Toubro (L&T), an Indian multinational conglomerate, specialising in EPC projects and hi-tech manufacturing and services, towards making Green Hydrogen the preferred next generation fuel for a wide

variety of activities. IIT Bombay's cutting-edge research in hydrogen technologies and L&T's engineering expertise, product scale-up and commercialization know-how will help this partnership accomplish its goal.

In February 2022, the Central Government announced the Green Hydrogen policy aimed at boosting production of Green Hydrogen and Green Ammonia to help the nation become a global hub for the same. Developing economies like India spend significantly more on importing oil and gas. Developing Green Hydrogen technology locally will provide India with crucial energy security and reduce its overall dependence on fossil fuels.



IIT Bombay signs MoU with DMART Foundation

IIT Bombay signed a Memorandum of Understanding with DMART Foundation to promote education, scientific research, and entrepreneurial talents at the Institute. The DMART Foundation is committed to contributing to local communities, even as it focuses on sustained economic development. The foundation's mission is to enrich the lives of marginalized communities and promote social stewardship.

The collaboration has identified the following objectives:

- To provide scholarship support to undergraduate students and fellowship support to M. Tech and Ph.D. students of IIT Bombay, with the goal towards developing human resources in the field of advanced science and technology.
- To nurture ideas for start-ups and promote entrepreneurial talents at IIT Bombay.

The MoU outlines the terms and conditions under which the DMART Foundation and IIT Bombay will engage with each other to promote education, scientific research and other associated activities in line with aforesaid objectives.

NEWS FROM IIT BOMBAY



Mr. Raj Subramaniam, CEO, FedEx visited IIT Bombay

IIT Bombay's distinguished alumnus, Mr. Raj Subramaniam (B. Tech, Chemical Engineering, 1987), who recently took over as CEO of FedEx (where he will be responsible for providing strategic direction to all of FedEx's operating companies) visited IIT Bombay on May 4, 2022. During his

visit, Mr. Subramaniam interacted with students and faculty members from the Department of Industrial Engineering at the Institute.



IIT Bombay alumni featured for developing green commute

IIT Bombay alumni Nishith Parikh and Rajkumar Kevat, both from M. Des, Industrial Design Centre (IDC), Class 2017, were recently featured in The Indian Express, a leading English daily, for developing a foldable e-bicycle. The e-bicycle is said to be the world's first full-sized folding electric bike.



IIT-Bombay to submit interim report on Connaught Place Smog Tower

IIT-Bombay is undertaking a two-year study to assess the performance of the Connaught Place Smog Tower installed by the Government of Delhi near the Shivaji Stadium metro station.

A total of ten monitoring stations have been installed within a 1-km radius of the tower; these include the YMCA building, a police booth near the Hanuman mandir, an NDMC public toilet and residential quarters on Ashoka Road. The tower is operational for 12 hours every day between 9:00 am to 9:00 pm and collects data from these stations and monitors particulate matter (PM) concentration.



Prof. Devang V. Khakhar, former IIT Bombay Director, selected as INAE Chair Professor

Prof. Devang Khakhar has been selected as the Chair Professor of the Indian National Academy of Engineering (INAE) between April 1, 2022 – March 31, 2025. Prof. Khakhar has served as Professor-in-Charge of IIT Bombay's Continuing Education Program from 2001-02, as HoD, Chemical Engineering, from 2002-04, and the Dean of Faculty Affairs from 2005-08. He was appointed as the Director of IIT Bombay in 2009 and served in this role for two terms, in which he helped the Institute soar to much greater heights of achievements and excellence.

INAE instituted the INAE Chair Professorship as a way to encourage engineers/technologists with outstanding research contributions to promote long-term participation in academic research and enhance

research standards in academic institutions.



SONAE EV collaborates with IIT Bombay E-Cell for Electric Bike Design Challenge

SONAE EC, an electric mobility company co-founded by Shubham Deshmukh and Abhijeet Yejge, hosted the SONAE E-Bike Design Challenge in collaboration with IIT Bombay's Entrepreneurship Cell (E-Cell). The

challenge fosters innovation and research to build a commercially viable E-bike while testing students' skills and thinking abilities. The winners of the challenge were felicitated in the presence of Subhash Desai, Minister of Industries, and Aditya Thackeray, Minister of Tourism and Environment, for the Government of Maharashtra.

A total of 212 teams from across India participated in the challenge, and after multiple rounds of scrutiny and feedback, Team Starker of Pillai College of Engineering, headed by Captain Tanmay Tune and his teammates Abhay Teli, Kevin Vora, Tejas Shetty and Pranav Unde, were declared winners and awarded the first prize of Rs. 1,00,000/-. Team Godspeed of the National Institute of Engineering, Rourkela, led by Arun Mohapatra, and Team Voltrix of MIT Institute of Design led by Chinmay Gajre were declared runners up.

INSTITUTE HIGHLIGHTS



TCA2I – CMInDS Come Together for Workshop Series

The Technocraft Centre for Applied Artificial Intelligence (TCA2I) has been established through the generous donation made by the Institute's distinguished alumni Mr. Sharad Kumar Saraf (B. Tech, Electrical Engineering, 1969) and Mr. Sudarshan Kumar Saraf (B.Tech., Mechanical Engineering and Manufacturing Engineering,

1970) through their publicly-listed company, Technocraft Industries India Limited.

TCA2I was formally inaugurated on April 8, 2022 by the Chief Guest for the event, Padma Vibhushan, Dr. Anil Kakodkar, Chancellor, Homi Bhabha National Institute; Chairman, Rajiv Gandhi Science and Technology Commission; and Member, Atomic Energy Commission. Also present on the occasion were Prof. Subhasis Chaudhuri, Director, IIT Bombay, and the Saraf brothers.

The Centre's vision is to leverage Artificial Intelligence (AI) and Machine Learning techniques to solve society's most pressing challenges. The Centre will create a platform that can enable academia and industry sectors to leverage the benefits of Artificial Intelligence and Machine Learning techniques in various domains, with a focus on the defence sector to build AI-enabled military equipment. The Centre has brought IIT Bombay one step closer to its goal of emerging as a global leader in AI and facilitating transformational change in the world.



TCA2I – CMInDS Come Together for Workshop Series

The Technocraft Centre for Applied Artificial Intelligence (TCA2I) and the Centre for Machine Intelligence and Data Science (C-MInDS) at IIT Bombay partnered on a workshop series called “AI.Impact,” which featured presentations and discussions on advances in Artificial Intelligence (AI) for social and security applications.

As part of this initiative, the Centres conducted their first workshop that explored collaborations with AI for social impact on April 8 & 9, 2022. The workshop was a huge success and attended by several eminent industry experts and academicians.

The four topics covered in the workshop included:

Defence and Cybersecurity, explored academia and industry collaborations to leverage Artificial Intelligence/ Machine Learning (AI/ML), and which will benefit the defense and cybersecurity sectors.

Public Data, highlighted research challenges around collecting, cleaning, organising, and integrating multi-modal data from diverse government and public sources.

Indian Language & Speech Technologies, inspected challenges and opportunities in building speech and language technologies for Indian languages.

Vision and Image Processing, discussed implementation and challenges of visual recognition and perception algorithms using deep learning techniques for diverse domains.

ALUMNI INITIATIVE



IIT Bombay alumnus, Mr. Rajendra Gandhi, endows scholarship for women students

IIT Bombay alumnus, Rajendra Gandhi (B.Tech., Metallurgical Engineering and Material Sciences, 1971) has graciously committed to a scholarship endowment for women students at IIT Bombay. The scholarship titled “Bhanu” in memory of Mr. Gandhi's late mother will support women students who face financial constraints and are often discouraged to pursue their education in the STEM field.

Mr. Gandhi credited his personal and professional growth to the top-quality education he received at IIT Bombay. This motivated him to give back to his alma mater, and support deserving women students at the Institute.

Mr. Gandhi's generous donation adds to the Institute's overall mission of providing a world-class education to economically-challenged and meritorious students.

SHOW YOUR SUPPORT <https://portal.iitbacr.com/payments>

UPCOMING EVENTS



IIT Bombay Alumni Interactive Dinner in Boston

IIT Bombay Chapters are established across the world and have been instrumental in establishing local communities for the welfare of the IIT Bombay Alumni. In the month of May 2022, a team from IIT Bombay, led by Director, Prof. Subhasis Chaudhuri, is visiting Boston to meet with alumni in the region.

Day & Date: Wednesday, May 19, 2022

Time: 6:00 pm - 9:00 pm EDT

Venue: Boston Marriott Burlington, Burlington, MA

Faculty Alumni Network (FAN) Meeting to be held at Ohio State University

The Institute's FAN (Faculty Alumni Network) meeting is being revived after a two-year hiatus due to Covid. The 2022 edition of the FAN meeting will be held in collaboration with Ohio State University (OSU) at the latter's campus in Columbus, Ohio, USA, on May 13 and 14, 2022.

This edition of the FAN meeting is aligned along the Institute's core theme of "Institute of Eminence (IoE)" and will be graced by eminent academicians and industry practitioners who will come together to discuss emerging technologies and develop mutually beneficial and transformative initiatives and their applications in the real world.

Day & Date: Friday & Saturday, May 13th & May 14th, 2022

Time: 8:30 am - 9:00 pm (EST)

Venue: Ohio State University (OSU), Columbus, Ohio, USA



Changing Role of Chemical Engineers: Medical Technologies: Online Panel discussion by IITB Chemical Engineering Alumni

IIT Bombay's Chemical Engineering alumni, who have grown to become industry experts and leaders, will come together to explore the current trends and future directions of important science- and technology-driven industries and the role that IIT Bombay can play in shaping these trends.

The latest in a series of panel discussions will focus on medical technologies and examine the state of the industry at the national and global level, explore current trends and future directions, analyse the role played by chemical engineers in developing and deploying relevant technologies and more.

The panel discussion will feature eminent experts in medical technologies. They include:

1. Dr Kalyan Handique (ChE 95), VP, Adv Tech, BioRad Laboratories
2. Dr Nirupama Kenkare (ChE 92), Head of MS&T, Alcon
3. Joydeep Goswami (ChE 93), Chief Strategy & CDO, Illumina
4. Prof Santosh Noronha, IIT-Bombay
5. Moderator: Dr. Sanat Mohanty (ChE 95), VP, Operations, Senseonics

Day & Date: Saturday, May 21, 2022

Time: 7:00 PM – 8:30 PM

Venue: Virtual



Low-Cost Diagnostics for Affordable Healthcare

Wadhvani Research Centre for Bioengineering at IIT Bombay is organizing a one-day event on “Low-cost diagnostic for affordable healthcare.” The event seeks to brainstorm ideas with various stakeholders involved in the development of technology and develop low-cost diagnostic solutions. This program will include a few short talks, dedicated networking and brainstorming sessions

and a panel discussion on ‘Bottlenecks and potential solutions to translational innovation in low-cost diagnostics’, which will be moderated by Dr Abdur.

Kindly note all participants are requested to present a poster of their projects to initiate the discussion.

Day & Date: Friday, June 03, 2022

Time: 9.00 am to 5.30 pm

Venue: Victor Menezes Convention Centre, IIT Bombay

INNOVATIVE PRODCUT AND TECHNOLOGY

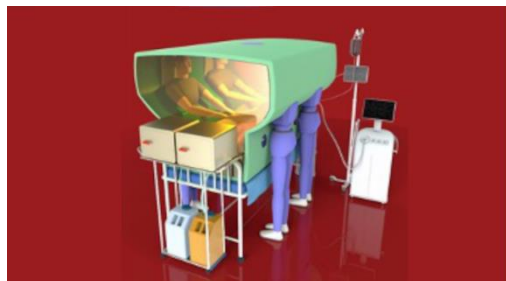


Biomedical Engineering and Technology Innovation Centre (BETIC)

Medical devices are critical for healthcare. Local and indigenous development of novel, suitable, reliable, and affordable medical devices change lives and impact the world around us, even as they create new jobs.

Since its inception in 2014 at IIT Bombay, the Biomedical Engineering and Technology Innovation Centre (BETIC) has built an ecosystem which is essential to develop local medical devices by connecting the key stakeholders in the medical and healthcare industry – government, academia, medical community, industry, investors and facilitators. Over the past few years, the team has met with several hundred doctors, identified over 400 unmet needs, created 200 novel concepts, and filed 50 patents. They’ve also developed 20 devices, incubated 15 start-ups, licensed five items to industry, and launched a few products directly into the marketplace.

The following start-up that BETIC supports reflect its core vision – which is to create global success stories of indigenous medical devices by providing the necessary guidance and reinforcement needed to med-tech innovators.



PORTABLE STERILE ENCLOSURE

Inventors’ name: Mr. Dinoj Joseph, IIT Bombay

Indian Patent Filing: 201821030523, Clean Room Assembly for Patient Treatment and General Surgical Procedures, 202121062048 – 31 Dec 2021

Technology/ Product: Affordable Isolation Room for Burns patients. Portable sterile enclosure with the necessary facilities

for surgical procedures in remote areas.

Every year, around 7 million Indians suffer injuries from burns while 10% of these patients require intensive treatment. But the demand for sterile hospital beds far outnumbers the supply. The gap between the number of patients sustaining burns every year and the number of beds available for treatment is getting wider. In 2022, there are still only 1400 beds available for burns patients in India.

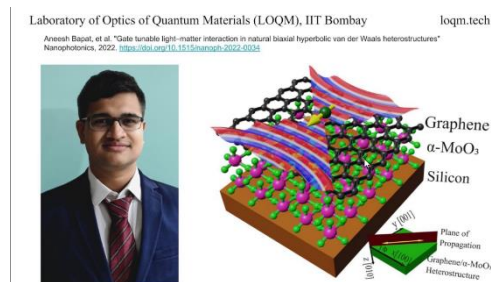
The proposed solution consists of a portable and quickly deployable pre-sterilized isolation unit (Sterile Enclosure) which can be mounted onto each bed. This unit can convert any bed at the general ward/ICU in a hospital into an isolation unit. This will reduce the possibility of patients getting infected during treatment. Special ports of entry are designed on either side of the enclosure for medical personnel to access their patients, treat the burns sustained and dress their wounds. Also, the transfer box attached on either side helps swiftly transfer sterile/contaminated materials in and out of the enclosure.

SPECIAL FEATURE

<https://youtu.be/wXhdrpkirjU>

The Technocraft Centre for Applied Artificial Intelligence (TCA2I) was inaugurated on April 8, 2022 at IIT Bombay. The Centre's vision is to leverage Artificial Intelligence (AI) and Machine Learning techniques to solve society's most pressing challenges. Watch this exciting video of the TC2AI website launch.

SUCCESS STORIES



This is just the beginning for Aneesh Bapat

IIT Bombay's Aneesh Bapat (B.Tech, Engineering And Physics) recently discovered electrostatically tunable topological transitions in a new type of mixed state of light and matter called "biaxial hyperbolic polaritons" His discovery was published in the prestigious journal Nanophotonics (impact factor = 8.45).

We'd first like to congratulate Aneesh on his remarkable achievement. Despite his already hectic and challenging academic schedule at IIT Bombay, Aneesh was still able to pursue his research on the side and make a significant discovery in Physics and one that has the potential to impact the world. We're sure that his dedication, work ethic and success will inspire and ignite the passions of his peers and fellow students on campus. We look forward to hearing more about his amazing discovery and his future plans.

Hello, Aneesh. Firstly, many congratulations on your astonishing achievement. You have made the Institute very proud. Can you explain more about your discovery for those of us who aren't physicists?

Aneesh: The discovery deals with an interesting phenomenon that occurs in a nanoscale device that can be used for applications in infrared light technologies. It also involves two interesting materials - MoO₃ and Graphene. MoO₃ behaves like a one-directional insulator and metal when required, whereas, in the other direction, it will act as a conductor in the infrared regime. Although this behaviour provides fascinating directional properties to devices created with MoO₃, they lack active tunability. Graphene does not show any directional behaviour, but the voltage can control its optical properties.

Given their complementary advantages and shortcomings, we planned to investigate the device while MoO₃ and Graphene were included. We were able to examine the interaction of infrared light with such a device and explore the utilisation of various properties to create a quantum function at room temperature and control by voltage.

What are the implications of your discovery in our day-to-day life? How will it help the world around us?

Aneesh: The discovery can be used to support several real-life applications. We can build efficient on-chip infrared lasers and light sources that will help create several user-friendly, affordable, and compact devices that can be coupled with other infrared components. Most objects emit infrared radiation at room temperature and are visible through thermal imaging cameras. Similarly, many biomolecules also emit infrared light. The device can detect the presence of these biomolecules via infrared light and its orientation, which, in turn, can help detect drugs, and can also be used in medical diagnostics.

As artificial intelligence gains momentum, more complex neural networks will require extensive computational resources. Cooling these electronic chips is critical, and this device will enable the cooling down of computer

chips by channeling heat in specific directions. Also, it takes us one step closer to achieving room-temperature quantum computing, which is considered the holy grail of quantum computing and has the potential to make it accessible to all.

The schedule at IIT Bombay is extremely rigorous, with academics and research occupying most of your time. How did you manage to work on a project of this scale and magnitude despite such a demanding schedule?

Aneesh: There's a famous adage called Parkinson's Law which says, "Work expands to fill the time allotted for its completion." The trick, therefore, is to include additional projects and activities as part of your regular daily routine and then it becomes easy to handle. Most students at IIT Bombay are involved in numerous extra-curricular activities such as sports, inter-IIT preparation, and cultural clubs. Our passion outside of academics extends our horizons and when you love something, you make time for it. The key is to identify a worthwhile pursuit and utilise your time appropriately.

How did IIT Bombay's ecosystem support your project? What kind of assistance did you receive from your faculty members?

Aneesh: This project would not have been possible without the support and guidance from the Laboratory of Optics of Quantum Materials (<http://loqm.tech>), especially Prof. Anshuman Kumar and Dr. Saurabh Dixit (postdoctoral fellow in Prof. Anshuman's group). My professors patiently walked me through and clarified most of my doubts. During the initial phase of my research, I'd set up a simulation that failed repeatedly. I re-examined the entire software documentation hoping to find a solution but failed. I finally confided in my professor who went through my research calmly and pointed out that I'd made an incorrect fundamental unit conversion in one of the parameters. It was a silly mistake, but I learned a valuable lesson that, "Often, humongous challenges arise from the most trivial errors."

IIT Bombay also provided me with access to various simulation software and research articles via our central library, which proved immensely useful for the project.

The pandemic has affected millions across the globe, and the student community was particularly affected over the past two years. What were some of the challenges you faced during this period?

Aneesh: While it was very challenging during the initial days of the pandemic, I, like everyone else, slowly got used to the 'new' normal. My family supported me whole-heartedly and I was lucky that none of my family members faced any medical emergency during this period. However, some of my collaborators weren't so lucky and faced medical emergencies which impacted the progress of the project. Being away from campus also made it difficult to communicate and coordinate with my co-workers.

Nonetheless, I was able to wrap up the project remotely because of my mentor's constant encouragement. The thought of creating a difference in the real world through my project kept me going, despite being away from campus. And all the hard work paid off. I am confident that this discovery within the field of infrared technology can be used to diagnose or develop a treatment for life-threatening diseases such as COVID-19.

Your work has been published in the prestigious journal, Nanophotonics, a peer-reviewed open access scientific journal, published by De Gruyter and Science Wise Publishing. How did that come about?

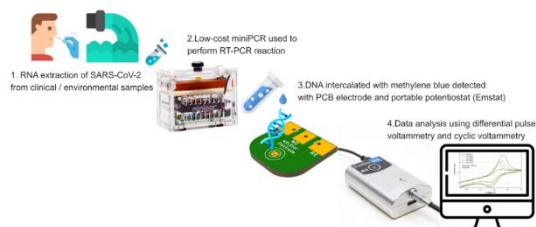
Aneesh: The peer-review process is more or less similar among all journals. Once the research paper is submitted to the journal, it's vetted by the editor and anonymous 'peer reviewers', i.e., scientists working in the same field. They're also allowed to ask you for clarifications on any issue that may not have been addressed accurately in the manuscript and suggest modifications to the project, as well. I am happy that our work was able to meet the bar for a prestigious journal like Nanophotonics.

While the sky's the limit for you, Aneesh, what are your plans after you graduate from IIT Bombay?

Aneesh: I'm interested in pursuing a postgraduate degree in device physics in the future. However, I am still unsure whether my interest lies in experimental or theoretical work in the future. The best part of being a student at IIT Bombay is that it provides us with many opportunities as undergrads to explore our interests before making a final decision. I will spend the rest of my time as an undergrad and explore other interesting research domains before making my final decision.

Aneesh Bapat is truly an exceptional student. We wish him the very best with the rest of his academic life at the Institute. We have no doubt that there will be many more inventions and discoveries from him that will help society and mankind, and, of course, make our Institute proud. Once again, congratulations, Aneesh.

STUDENT RESEARCH ARTICLE



Sensors for Widespread Monitoring of COVID-19

The COVID-19 pandemic has posed a tough challenge to the global economy and to the world in general. Effective screening and testing people for the presence of the SARS-CoV-2 virus, wearing masks when they're in public and avoiding social gatherings in the presence of multitudes of people, are some of the ways that the world has been able to

curtail and contain the rapid growth of the virus and save lives. Unfortunately, even these bare-minimum steps are extremely difficult to implement in a large country like India. Much of the country is dependent on small businesses for their survival and that requires being in public, socializing with vendors, wholesalers and customers on a day-to-day basis. Enforcing social distancing norms under such a scenario is extremely difficult. Also, despite undertaking large-scale vaccination programs, there is always the fear of the emergence of outbreaks driven by other variants, and the potential of future pandemics due to other pathogens.

Therefore, it was mandatory to find other ways to curb the rise of the deadly SARS-CoV-2 virus in our country. One of the ways to curb the virus is by using wastewater-based epidemiology (WBE) which is widely recognised as a surveillance tool to track the prevalence of the SARS-CoV-2 virus in a particular area. However, the standard qPCR technique requires expensive laboratory infrastructure to perform the virus screening test.

Taking into account the cost vs. benefit ratio, population density and better containment of the virus, a group of scientists from IIT Bombay and the University of Strathclyde jointly developed a low-cost biosensor, which can detect genetic material of the SARS-CoV-2 virus in wastewater. Compared to testing people individually, the biosensor is more affordable and is able to identify and map COVID-affected areas and its spread over a large geographic area much faster.

The biosensor is capable of detecting the virus at concentrations as low as 10 pg/ μ l. The biosensor is based on a portable printed circuit board (PCB) and its electrodes are reusable, easy to clean, and have a long shelf-life. The estimated manufacturing cost is as low as \$0.55 (equivalent to Rs. 40) per electrode, for quantities of 100. All of these factors make the electrochemical biosensor extremely attractive to researchers and industry.

The workflow implemented in this research for SARS-CoV-2 nucleic acid detection

Work on the project began in the Electrical Engineering department in collaboration with the Biosciences and Bioengineering department at IIT Bombay during the lockdown in May 2020. M. Santosh Kumar, Ph.D. student, BSBE, said, "The waste water sample was collected from Chembur, Mumbai, and processed to extract the genome of the SARS-CoV-19 dead virus. Since there was a total lockdown at the time, our resources were limited. But despite these adverse conditions, Kirti Megha, post-doctoral fellow, BSBE, wore a complete PPE kit and collected the sample and isolated the genome." Shailesh B. Lad, Ph.D. student, conceptualized and directed the project, even as he helped amplify the DNA fragments.

SARS-CoV-2, the virus responsible for the COVID-19 disease, is a single-stranded RNA virus. Prof. Kiran Kondabagil, BSBE, and his biosciences group successfully isolated the viral RNA from waste water, converted it into a double stranded DNA and performed the amplification of genetic material to detect the virus. Following this, the processed sample (DNA fragment) was ready for electrical characterization with the help of PCB electrodes.

Despite adverse conditions, the experiments followed standard protocols. This part of the project was kicked off by Prof. Siddharth Tallur from the Electrical Engineering department along with Maheshwar Mangat and Mahesh A. Bhaganagare from the Wadhvani Electronics Lab (WEL). Ruchira Nandeshwar, a Ph.D. student with Prof. Tallur said that they tested the processed sample (amplified DNA fragment) with the developed sensors.

The PCB electrodes were designed by Maheshwar Mangat (WEL). He was responsible for programming the controller and implementing the sensor and also assisted the group with the electrical characterization of the sensor. Initially, the work was started with commercially available sensors which were expensive (₹500 to 700 per piece) to test the feasibility of the project. But once the electrodes were developed internally the cost went down to Rs. 40 per piece.

The team faced many obstacles trying to obtain raw materials (reagents for PCR reaction) during the lockdown. However, they were able to manage with the resources that were available and accomplished the unbelievable just by using available materials. Ruchira Nandeshwar is grateful for the continuous support the team got from Prof. Tallur and Prof. Kondabagil and is thrilled to be a part of this project.

Finally, Prof. Siddharth Tallur said, “The method we have developed is not just applicable to the SARS-CoV-2 virus. It can be applied to any other virus and this makes it very versatile. In the future, we’ll focus on optimising the assay further to increase accuracy and also integrate the assay with a portable platform to handle both PCR reaction and electrochemical measurement.”

*A modified version of this article appeared previously in the Electrical Engineering department’s Background Hum (student magazine) website:

<https://www.ee.iitb.ac.in/~bh/pages/articles/Solution-to-Widespread-Monitoring-of-COVID-19.html>