Honey bee Network

SITARE

GYTI 2021

Gandhian Young Technological Innovation Awards

TECHNOLOGICAL INNOVATION

by Young Creative Minds

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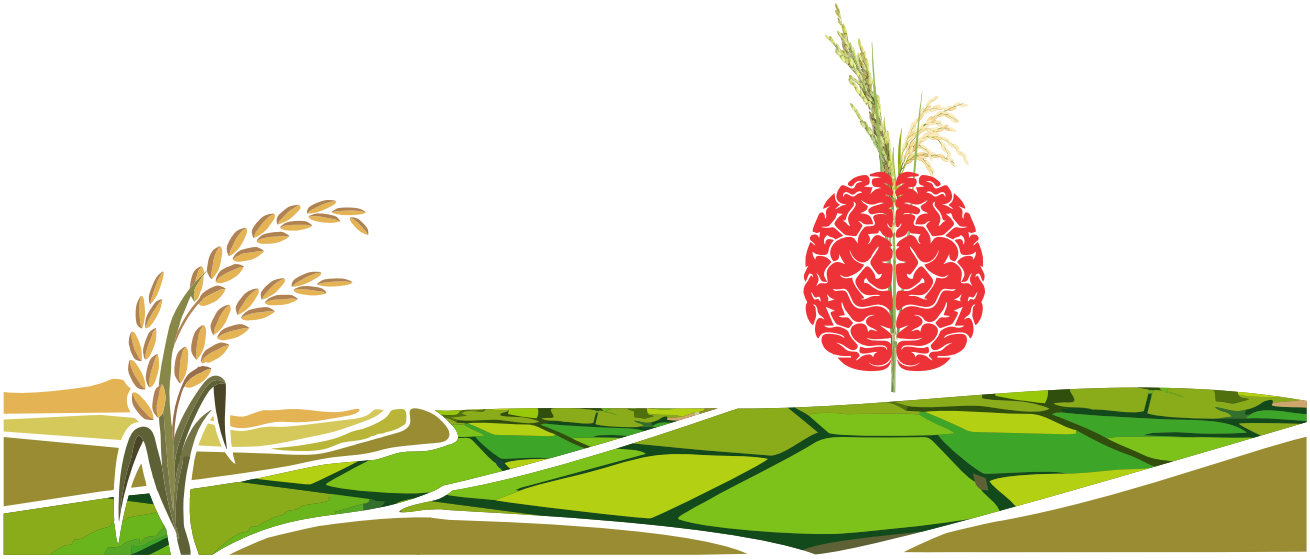
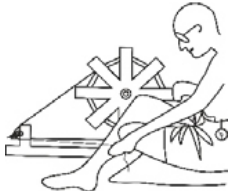


Sprouts of ideas need nurturing, they need fertile ground to grow, good climate of trust & transparency to flourish & Cool breeze of helpful risk finance to diffuse widely



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Gandhian Young Technological Innovation Awards

GYTI - 2021

Gandhian Young Technological Innovation Awards (GYTI)

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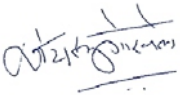
It gives me immense pleasure to know that the efforts made by Biotechnology Industry Research Assistance Council (BIRAC) towards promoting Gandhian Young Technological Innovation Prize (SITARE-GYTI Prize) for postgraduate students in life science have resulted in creating an innovative entrepreneurial funnel in the country. Conventionally, most students choose to pursue post-doctoral studies and then seek academic positions. This programme is a channel for nurturing and encouraging the entrepreneurial spirit in enthusiastic youngsters. There are many unmet social needs for which constant efforts must continue so that innovative and affordable solutions can be found expeditiously. BIRAC has launched multiple schemes to meet this goal and collaborated with multiple partners. This partnership, between BIRAC and SRISTI, a Honey Bee Network institution, has helped in uncovering numerous outstanding solutions to the contemporary problems of our society, including during recent pandemic times.

I am happy to know that during the period of 2015-2020, around 80 patents have been granted/filed with 132 publications, 38 additional grants received by about half the awarded students, and 26 enterprises were set up and with 17 under progress. I am sure that BIRAC team in partnership with various stakeholders will continue to push the frontier of solution science and technological innovations in the country.

I congratulate all the prize winners and others who participated in the competition. I hope that they will continue to address the unmet needs of our society to realise the dream of a developed nation in the next 25 years.



(Dr. Rajesh S. Gokhale)
Secretary
Department of Biotechnology (DBT),
Ministry of Science & Technology,
Government of India

Preface

Honey Bee Network and SRISTI have been at the forefront of triggering inclusive innovation movement in India for the last 30 years along with GIAN, a sister institution. They have looked at the innovations from and for grassroots, both. I am delighted to see that many innovations this year are focusing on health and diagnostic issues in the context of COVID19 pandemic. I hope that we will continue our stress on what I call as 'affordable excellence' in the years to come.

Shodhyatras have been undertaken by SRISTI and Honey Bee Network (HBN) volunteers through remote areas of every state not just once but now in many states twice. They found many creative community members including children and innovators during the last two 46 and 47 shodhyatras in Amreli and Rameswaram, respectively.

I am very happy to note that during the latest Shodhyatra in Tamilnadu, the HBN paid special attention to fishing communities and their knowledge system. Having come from one such village in Goa, I am aware of how much potential exists to empower the fishermen, particularly women, in adding value in local knowledge and resources including fish waste, water lilies in the ponds, sea weeds etc. The fact that the SY ended at Dr A P J Abdul Kalam's memorial was even more praiseworthy. Dr Kalam was a strong supporter of HBN and grassroots innovation movement. We continue to draw inspiration from him.

From this year, the SITARE GYTI awards have recognized student innovations with translational potential, boosting the emphasis on triggering startups. It is in this context that the role of tech youth becomes very important. Unmet needs in health, water, environment, sanitation, energy, food and nutrition, small enterprises etc., become more important. No less important is to recognize the technologies on the edge at an early stage. They may take long to become useful products but if we don't encourage such exploration on the edge, we will always remain a country of followers and not leaders. What we require is a balance of talent, technology and trust.

I will plead with the PSA that he may have regular interactions with young Science and Technology innovators which SRISTI-GYTI and BIRAC team can spot and organize. This way these students will get charged and they will remember for their life that this country cares for the dedicated talent in technology and other fields. Biotech start-up expo was very well organized this year. In future, we may have special sessions for those awardees who wish to license their technologies to other start-ups or entrepreneurs. It is understandable that some of the awardees will pursue academic career and encourage future student based start-ups.

There are several challenges they face: Public procurement is a major driver for promoting innovations around the world. But it needs reasonable evidence at larger scale for assuring public authorities of the validity of innovation. but for young student entrepreneurs, generating such data without public grant funding is impossible.

I appreciate that Honey bee network is encouraging both IP protected and also open access innovations so that Indian dream of fulfilling the spirit of vasudhev kutumbakam, speading global inclusivity is fulfilled

I congratulate all the students once again and hope that we will be able to create an ecosystem in which these stars, as the sitare program envisages, will shine brighter than ever before.

Dr Raghunath Mashelkar, FRS,
Former DG, CSIR and Secretary, DSIR

Acknowledgments:

Heartily Congratulations to all of the SITARE and SRISTI-GYTI awardees, as well as the appreciated students of 2021. Congratulations to all other students who have not been awarded but who submitted ideas and innovations through the SRISTI and SITARE GYTI. The partnership between BIRAC and SRISTI for recognizing student innovations with the potential to launch BIOTECH start-ups is significant. Early-stage recognition of outstanding innovations requires the support of reviewers who are well-versed in the field. We are grateful to the hundreds of scholars from across the country and abroad who have supported us in this labour of love. The partnership between SRISTI and BIRAC in 2015 resulted in the BIRAC - SRISTI GYTI awards in life sciences, which are now known as SITARE-GYTI awards. This was the third year that all entries for life sciences under SITARE-GYTI were submitted through the BIRAC portal. The rest of the technology entries were submitted to the GYTI Techpedia portal.

We would like to express our gratitude to Dr. Renu Swarup, Former Secretary of DBT and Chairperson of BIRAC, for her invaluable assistance in carrying forward the initiatives of SITARE (Students Innovations for Translation and Advancement of Research Explorations) and the collaboration of BIRAC and SRISTI in recognizing innovative students and start-ups through the GYTI platform.

We would like to acknowledge and thank Dr. Manish Diwan, Head, SPED, BIRAC, Dr. Shilpy Kochar, SPED, BIRAC, and Mrs. Taranjeet Kaur, SPED, BIRAC for their continuous support in all aspects of the GYTI Award process and streamlined coordination with the SRISTI team.

SRISTI Research Advisory Committee and mentors of SIIE-SRISTI Bio-NEST incubator including Dr. Rakesh Mishra (Director, Tata Institute for Genetics and Society, Bangalore), Dr. V. M Katoch (Former DG, ICMR, New Delhi), Dr. Anil Koul (Johnson and Johnson), Dr. Kiran Kalia (Ex-Director NIPER, Ahmedabad), Dr. Shashi Bala Singh (NIPER, Hyderabad), Dr. Mrutyunjay Suar (KIIT University, Odisha), Dr. Mahesh Chhabria (L. M. College of Pharmacy, Ahmedabad), Dr. Jitendar Sharma (AMTZ, Visakhapatnam), Dr. Shirshendu Mukherjee (DBT, New Delhi), Prof. Amit Karna (IIM, Ahmedabad), Prof. Debi P Sarkar (Former Director, IISER Mohali, Delhi University), and Dr. Vipin Kumar (Director, NIF) deserve endless gratitude for supporting SRISTI and its related activity.

This year, more emphasis was given to online reviews than offline. By the SRISTI Techpedia team members, entries were sent to the subject matter experts. The final evaluation of the shortlisted entries was undertaken by the experts of review committee members. The esteemed experts were part of the final jury included Prof. Seyed E. Husnain (VC, Jamia Hamdard New Delhi), Dr. B. Ravi (BeTic, IIT Bombay), Prof. P V M Rao, Head (Department of Design, IIT Delhi), Dr. Renu John (IIT Hyderabad), Dr. Premnath Venugopalan (CSIR - NCL Pune), Dr. Taslimarif Saiyed (CCAMP Bangalore), Dr. Vidya Gupta (Chair, Division of Biochemical Sciences, NCL, Pune), Dr. Syed Shams Yazdani (Group Leader, Microbial Engineering Group, ICGEB), Dr. Ambuj Chaturvedi (IKP Knowledge Park), Dr. VS Reddy (Regional Centre for Biotechnology), Dr. K. K. Narayan (Metahelix Life Sciences, Bangalore), Dr. Bharat Char (Mahyco Seeds Ltd.), Dr. K. K. Pant (IIT Delhi), Prof. Neeta Singh (AIIMS Delhi), Prof. Jay Dhariwal (IIT Delhi), Prof J. Ramkumar (IIT, Kanpur), Dr. Arnab Mukhopadhyay (NII, New Delhi), Prof Sushil Jha (JNU, New Delhi), Mr. Atual Bhargava (STMicroelectronics).

We are also grateful to all of the SRISTI team members who worked tirelessly day and night to complete the GYTI review process on time, including Dr. Richa Gupta, Dr. Premalata Pati, Er. Digvijay Singh Rajpurohit, Ms. Venushree Patel and Er. Yash Patel. The Honey Bee Network volunteers, including Harshvardhan Tiwari, and other colleagues at SRISTI, including Mr. Ramesh Patel, Mr. Chetan Patel, Mrs. Sumitra Patel, Mr. R Baskaran, and other team members, are also thanked.

Further to that, and most importantly, we are grateful to all of the reviewers who participated in the GYTI review process by reviewing and providing valuable inputs online or via email. All reviewers are listed in the annexure.

Introduction:

The SITARE-Gandhian Young Technological Innovation Awards (SITARE-GYTI) have come a long way since 2015 when the partnership began between Honey Bee Network, SRISTI and SITARE program of BIRAC. The purpose was to recognise the talent of post graduate life sciences students working in health care, drug discovery, diagnostics, agriculture, and other related areas of industrial applications. The GYTI 2021 Awards are being presented in the midst of ongoing pandemic, though the worst seems to be over. The challenge before young students is even more acute because of numerous associated problems that may have arisen among Covid19 affected people. The scientists are still trying to estimate the long term effect of Covid19 infection even after recovery from the same. The need for strong public health infrastructure is being felt more than ever before. The development of affordable and accessible diagnostic, treatment approaches and other devices has become more urgent. The purpose of SITARE-GYTI Award has been made sharper this year with the focus on those technologies which have potential for eventual establishment of biotech start-ups. The SRISTI-GYTI Award for other engineering disciplines continues its focus on technological innovations which are frugal, on technological edge and have social applications. This being a transitional year when all the life science entries were to be submitted at BIRAC portal, several students submitted the same at GYTI site. Some of the outstanding ones are being recognised as SRISTI-GYTI award without any financial component. We hope that from the next year onwards, all students with life science and related backgrounds having innovations with translational potential will submit applications only at BIRAC's portal (www.birac.nic.in).

The aim of identifying early-stage innovations is to create a pipeline for bigger grants and investment opportunities from BIRAC as well

Table 1: SITARE GYTI Progress Report 2015 - 2020

Year	Awards (A)	Appre-ciation (B)	Total Recog-nitions (A+B)	Patent Granted/ Filled	Patent Under Pro-cess	Pub-lica-tions	Major Awards & achieve-ments after GYTI	Enterprise Set-up or Tech Licensed to third party	Grant & In-vestment mobilized (In Lakh)	Enterprise Under Planning	Employ-ment/jobs Generated
2020	14	11	25	7	7	18	2	3	-	1	5
2019	15	-	15	3	15	26	10	6	84.6	1	62
2018	15	-	15	17	3	28	18	6	406.0	9	10
2017	17	-	17	10	2	29	5	3	121.0	3	10
2016	12	-	12	8	2	26	3	5	234.0	2	-
2015	5	-	5	4	1	5	--	3	200.6	1	-
Total	78	11	89	49	30	132	38	26	1046.2	17	87

Table 2: SRISTI GYTI Progress Report 2012-2020

Year	Award	Appre-ciation	Total Rec-ognition	Patent Granted/ Filled	Patent Under Process	Publi-cation	Major Award and Achieve-ment after GYTI	Enter-prise Set-up	Enterprise Under Planning	Employ-ment Generated	Grant and Investment mobilised (In Lakh)
2020	7	16	23	8	6	37	15	3	1	22	38.0
2019	6	23	29	17	9	215	55	11	1	10	-
2018	8	29	37	13	3	181	90	5	1	1	348.0
2017	6	17	23	19	4	418	104	3	2	-	120.0
2016	8	20	28	36	6	183	92	12	3	260	1041.0
2015	12	27	39	35	-	183	85	8	-	-	101.0
2014	13	27	40	44	10	178	63	6	-	-	548.9
2013	22	24	46	4	2	17	30	1	-	-	-
2012	14	-	14	7	-	38	10	1	-	-	4.0
Total	96	183	279	183	40	1450	544	50	8	293	2200.9

as other science and technology bodies. It is hoped that incubators founded by CSIR, DST, BIRAC, and DBT will be open to student innovations recognised through GYTI awards and appreciation. The pursuit of Atmanirbharta: the self-sufficiency in India will be strengthened as more technological and scientific minds develop solutions that address unmet needs not only in India but globally.

It is commendable that student innovators have raised more than Rs 10 crore in investment and grants in the last five years. With over 100 publications, approximately 35 start-ups have been established or are in the process of being established, and in some cases, innovations have been licenced to third parties. A total of 49 patents have been filed, with yet another 30 in the works. Thirty-eight students have received other awards after being recognised through GYTI and this trend is continuing year after year.

The Table 2 shows a year-by-year progress report for SRISTI-GYTI awarded and appreciated students during the last eight years. It is remarkable that student innovators have mobilised more than Rs 20 crore in investment and grants during this period. With over 1000 publications, approximately 58 start-ups have already been founded, or are in the process of being set up. Some innovations have been licensed to third parties in some cases. So far, 183 patents have been filed, with 40 more under process.

Four student teams received BIG Grants from BIRAC worth around Rs. 50 lac each, and another four applied for the same. Dr. Vikas Pandey and his team have received Rs.50 lac grant from the Bill & Melinda Gates Foundation, BIRAC, and IKP as part of the Grand Challenge Exploration programme. He established Valetude Primus Healthcare Pvt Ltd.

Mr. Ravi Prakesh, the SITARE-GYTI awardee, has received a $25,000 grant from the BRICS Young Innovator Prize-2019, presented by the Ministry of Science, Technology, Innovation, and Communications of Brazil. He was also honoured with the DST-Lockheed Martin-Tata Trusts IIGP (India Innovation Growth Program) Award for 2019 (10 Lac INR research grant from DST, Govt. of India). Some of the students have not only published in prestigious journals, but have also received international acclaim for their contributions. Mr. Prasanta Kalita was awarded a DST Nanomission grant (90 lakhs) for the development of a multi-marker test kit, as well as an IMPRINT grant (1.5 crore) for optical reader development and pilot scale testing. He also received a 25,000 GBP Longitude Discovery Award and a 100,000 GBP Longitude Discovery Boost Grant. Dr. Shibu Chameettachal, 2018-GYTI Awardee, has been awarded with Rs. 3 Crore SreePVF Sree Ramakrishna Paramahamsa Research Grant in Biomedical Sciences-2021 to conduct clinical trials for this project. GYTI-2020 awardee Mr. Vaibhav Shitole established a start-up namely IOTA Design & Innovations Lab Private Limited. Mr. Anil Vishnu G K, GYTI-2020 awardee at IISc Bangalore, received a SERB Core Research Grant for the clinicopathological side of the work, and he recently published a paper in Microsystems and Nanoengineering, a Nature engineering journal.

One notable example of early stage talent is a young undergraduate student named Narayan Lal Gurjar and his team. In 2018, he received GYTI Appreciation along with Shashi Pratap and Ankit Jain for developing an eco-friendly water retention natural polymer. He had conducted research in the open spaces surrounding his hostel. Out of 1756 teams from 39 countries, he was chosen for the Okinawa Japan Startup Accelerator Programme. The winner would receive a prize of 10 million Japanese yen. They have already established a company namely EF Polymer Private Limited and started selling their product in India. Mr. Jayesh Kumar Sevantilal Mevada, a SITARE-GYTI 2019 awardee, was nominated for the United Nations Global Restoration Program-2020. He was a finalist for the United Nations' Young Champion of the Earth Award-2020. In addition, he was invited to the G20 Youth Summit. He was appointed Chief Technological Officer of Stagot Potatoes Products LLP in Gujarat (A large producer of native potato starch company).

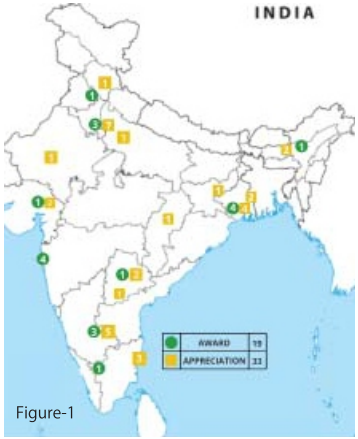


Figure-1

SITARE-GYTI 2020-2021 Award City-wise

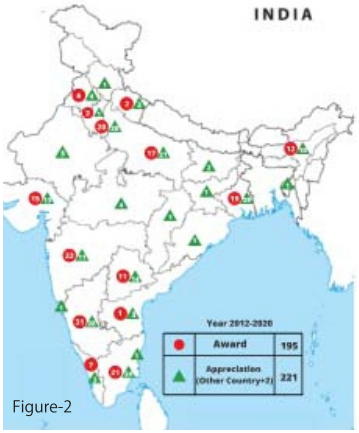


Figure-2

GYTI (2012-2021) Award & Appreciation State-wise

From 2012 to 2020, IIT Delhi, IIT Kharagpur, IIT Bombay, IIT Madras, IIT Guwahati, IISc Bangalore, and IIT Kanpur received the most awards and recognition. In many states, no student has received an award, but instead has received only appreciation. We hope that more students from tier two and tier three institutions and cities will excel and overtake the top institutions in the future.

As GYTI Awards also feature cutting-edge technologies, we anticipate that they will thrive as scholars. Two GYTI Awardees published in Nature in 2017, and one GYTI Awardee published in 2021. GYTI Awards have developed a strong reputation both within and outside of the country in just eight years. IIT Delhi has received the most GYTI Awards so far (13 awards and 18 appreciations), followed by IIT Madras, IIT Bombay, and IIT Kharagpur. The distribution of awards and appreciation paints a highly positive picture of excellence and scholarship. Indeed, the number of non-elite institutes among awardees is relatively low, especially after 2015. This is serious concern because the gap in research quality and entrepreneurial development between top schools and tier two and three institutions does not appear to be decreasing as quickly as it should. Every year, SRISTI and GIAN host a Summer School on Inclusive Innovation to address the consistently unaddressed issues of underprivileged people and regions. SRISTI intends to bring some of the BIIS participants to the summer school in the future so that they can focus their ideas.

During 2021, 499 entries were received under the SITARE GYTI program, of which 455 were eligible. A total of 455 ideas were evaluated by online experts, featuring 55 projects receiving three positive remarks during the online review process. Only 34 students were shortlisted for the award based on the time remaining to complete their educational program, and 21 were shortlisted for appreciations. Ten students were selected for the award, while 15 were appreciated. For the SRISTI-GYTI Award, 618 entries were received with 9 students selected for the award and 16 appreciated this year. We have made every effort to encourage as many students as possible. There is no doubt that in some circumstances, our judgment may have differed from that of the concerned students. Some flaws persist in any review process, but the fact that all of the reviewers took time to evaluate the entries and, in some cases, make comments to improve the work demonstrates that the process was quite empathetic without compromising creativity and significance of the possible impact.

We believe that the spirit of the Honey Bee Network, which promotes idea of cross-pollination and bridge between the formal and informal sectors of the knowledge system, with due benefit sharing with knowledge providers, will proliferate among young scientific and technological students. We also hope that students will continue to spread the message about the GYTI competition. The country's start-up movement must be fuelled further by Biotech and other student entrepreneurs as was apparent at the recently held Biotech Start-up Expo showcasing 750 products and services. I hope all the successful students will stay in touch and maintain their curiosity, compassion, and hope for a better and more inclusive future.

Please encourage your peers and juniors to apply for SITARE-Gandhian Young Technological Innovation Awards at www.birac.nic.in and for other disciplines at www.gyti.techpeida.in.

Anil K Gupta

CSIR Bhatnagar Fellow 2018-21
Founder, the Honey Bee Network, SRISTI, GIAN & NIF,
Visiting Faculty, IIMA, IITB, NIPER-A and
Academy Professor, AcSIR

Highlights:

The Gandhian Young Technological Innovation Awards 2021 include 10 students who have been recognized through SITARE-GYTI awards and 15 students whose technology has received SITARE-GYTI appreciation. These awards are part of the Biotechnology Industry Research Assistance Council's (BIRAC) Students Innovations for Translation & Advancement of Research Explorations (SITARE) scheme and are given in partnership with SRISTI through SITARE-GYTI awards. Each awardee receives Rs 15 lac as a two-year grant for translational progress. It is hoped that these awardees will be inspired to become biotech entrepreneurs and apply for BIG and other larger grants in the future. SRISTI recognizes students pursuing outstanding work in various disciplines through SRISTI-GYTI awards, as these awards are intended to support innovative students working towards biotech start-ups. This being a transition year of applications at the BIRAC portal, some students applied for life science innovations at SRISTI's gyti.techpedia.in site also. We have awarded 9 students and appreciated 18 others in the SRISTI-GYTI Awards category. While the majority of awardees come from prestigious institutions such as IITs, IISc, JNCSAR, NIPERs, IISER, ISCSRM, IBAB, BITS-Pilani, and others, some outstanding projects from other institutions and universities were also received. The awards are given to innovative students from various disciplines in categories ranging from healthcare to agriculture and waste management.

The SRISTI-GYTI awards do not provide financial assistance. The students in the appreciation category, under both schemes, do not receive any monetary award.

SITARE-GYTI 2021

Awards:

Healthcare Devices and Diagnostics: Arjun B. S. of IISc, Bangalore, aims to develop an intraoperative probe for brain tumor margin delineation. An intraoperative probe with MEMS-based force sensors, microelectrode arrays, and micromachined ultrasound transducer arrays for brain tumor delineation has been proposed and is being developed. An integrated physical properties-based assessment using three different modalities will provide helpful information for neurosurgical decision-making. Alekya B. and her team from the same institute, IISc, Bangalore, propose to develop a microsensor-integrated intubation catheter for chronic airway management. This is a sensor-enabled diagnostic tool and is used to manage pathological airways and consists of an array of micromachined flow and force sensors mounted on the catheter's distal end. The invention adds a new dimension to handheld diagnostic tools with the potential to accelerate technological advancement in pediatric airway management. Pankaj Shivhare and his team at IIT Bombay developed a hollow polymeric microneedle for controlled drug/vaccine delivery. Their invention is a low-cost and simple solution for fabricating the microneedles patch without the use of a clean room. They used FDA-approved biodegradable materials such as PVA and PVP. The microneedle tip size was confirmed by ESEM images to be approximately 25µm. They also demonstrated the drug release capacity and degradability of the drug-loaded microneedles patch using the porcine skin model. They demonstrated that the mechanical strength of the developed microneedles patch is comparable to the force required to penetrate human skin. Deepika N P and her coworkers at JSS College of Pharmacy in Ooty have created environmentally-

friendly antimicrobial phytoabsorbent pads for sanitary and hygiene products. This invention was designed and developed by Indian and international standards, as part of the Swachh Bharat Mission 2014, which aims to protect the health of all citizens. Phytoabsorbent was used to increase absorption and antimicrobial property. The biodegradable material used in the process ensures its degradability six months after disposal. The team is in the process of filing a patent. Ruchira Nandeshwar and her team at IIT Bombay invented Pro-Care, a prognostic point-of-care monitor for cardiovascular disease management. In this project, they proposed a low-cost point-of-care (POC) electrochemical sensor solution for directly measuring MPO concentrations in blood samples which is an inflammation-associated biomarker. The system thus envisioned is affordable, robust, and compact, and it meets the ASSURED criteria established by the WHO for POC tests. Using cationic multifluorescent carbon quantum dots (cCQDs), Barkha Singh and her team at IIT Bombay developed a fluorometric probe for the rapid detection of bilirubin. Their invention is a diagnostic device or kit for visual bilirubin detection using microwave irradiation. The cCQDs have a narrow size distribution of 2-10 nm, a high quantum yield (approximately 46 percent), and a bandgap of 2.75 eV. Amazingly, the cCQDs also evidenced bright solid-state fluorescence, which could be used to create a paper-strip-based fluorescent probe for bilirubin detection. This device had a very short response time of 30 seconds, low sensitivity of 0.1M, and selectivity over other common interfering agents, making it an excellent bilirubin sensing agent.

Agriculture: Asharani Patel and her team at IARI, Delhi, have developed a strategy for managing rice blast disease through genetic characterization and the development of endophytic micro bacterium-based bioinoculants. Endophytic Microbacterium isolated from the rice phyllosphere was identified taxonomically and tested for its ability to suppress *M. oryzae* invitro and rice blast disease in plants. The goal of this project is to better understand the tri-trophic interaction between endophytic *Microbacterium,* Rice, and *Magnaporthe oryzae* to develop an eco-friendly biostimulant against rice blast disease for future commercially viable organic rice farming systems.

Food technology: Sukirti Joshi and her team at IIT Delhi have developed a protocol to digitize the manufacturing process of Indian sweetmeats with tailored functionality to improve food safety and quality. Their research will look into the possibility of using three-dimensionally extruded dairy derivatives to create discernible printed food to replace traditional manufacturing operations by providing a platform for 'single on-demand automated and digitized unit production of traditional Indian sweetmeats. Furthermore, the use of dairy products as a building medium is highly novel, and when combined with a robust 3D printing production method, it has the potential to create a sustainable source of food for the world's growing population. Siddharth Vishwakarma, an IIT Kharagpur student, has produced a process technology for instant soluble skim milk tablets. By optimizing the condensation and compression conditions, a novel product, 'skim milk powder (SMP) tablet' was created. In terms of handling, storability, hygroscopicity, stickiness, and quantification, SMP tablets outperformed milk powder. The technology can also be used to establish instant beverage tablets containing tea, coffee, and fruit powder. Similarly, SMP tablets can be used as a food vehicle to fortify and microencapsulate various micronutrients, antioxidants, and probiotics to prevent malnutrition and maintain good health.

Industrial Biotechnology: Moumita Roy and her team at IISER Mohali plans to enrich methane content in biogas through CO2 conversion into acetic acid via microbial electrosynthesis. Methane can be enhanced in biogas by electricity-driven CO2 reduction with the help of microbial catalysts using the proposed approach of utilizing the microbial electrosynthesis (MES) process. The CO2 that was not used in other scrubbing processes will be used in this process to produce valuable chemicals. This project's successful demonstration will not only purify the biogas but also produce value-added chemicals such as acetate as a by-product.

Appreciation:

Healthcare Devices and Diagnostics: Rajeev Naren and his workmates at the S V S Group of Institutions in Mahbubnagar invented a low-cost automated bone mill for delivering graft particles of specific sizes. This device aims to generate grafts of various particle sizes from various materials and will be a welcome addition to a dentist's arsenal. In this context, an automated milling system capable of producing particles of two distinct sizes was developed. Chandan Kumar Jha, an IIT Gandhinagar student, has devised a project to create a highly sensitive and robust fiber-optic glove capable of tracking hand movement with high accuracy. The glove is used in conjunction with virtual reality game-based exercises to make rehabilitation more engaging and enjoyable for stroke patients. The glove will also be useful for a variety of biomedical research purposes. Divya Baskaran, an IIT Madras student, designed and developed a phased array (PA) applicator for the treatment of locally advanced breast cancer with hyperthermia. When compared to the state-of-the-art algorithm, the proposed PA induces 4 times more power in cancer than in healthy tissues, with good tumor coverage, fewer healthy tissue hotspots, and only 50% power consumption. Sujay Kumar Biswas and his team members at IIT Kharagpur have developed a piecewise isothermal nucleic acid test (PINAT) as a platform technology for diagnosing pathogen-associated infections, aided by a novel methodology based on DNA-mediated specific probing for detecting specific genes. When subjected to standard validation protocols at ICMR-NICED followed by a field setting coordinated by the IIT Kharagpur, the test results of this device demonstrated high sensitivity and specificity from 1000+ patient samples. Govindkumar Balagannavar of IBAB, Bangalore, and his team members designed a diagnostic kit to reduce risks associated with micro-TESE procedures while distinguishing nonobstructive vs. obstructive azoospermia. Their research found promising molecular markers for the condition known as nonobstructive azoospermia (NOA) and the absence of testicular sperm. Priyanshu Srivastava, an IIT Jodhpur student, has produced a 'Novel Jaw Rehabilitation Device' that can overcome the limitations of existing devices and exercise the jaw, increase muscle strength for mastication, and aid in the rehabilitation of patient's jaws. In terms of functionality and cost-effectiveness, his device bridges a significant functional and economic gap between an ideal rehabilitation device and existing solutions. Ashutosh Tiwari of IIT Delhi proposed a novel ultra-low-cost instrumented foot pressure insole for gait rehabilitation in locomotor dysfunction in differently-abled and other clinical populations. When compared to commercially available insole systems on the market, the cost of the insole system was reduced by at least tenfold. Using the Bluetooth wireless technique, this system collects real-time data during free walks. Furthermore, the designed system offers optimized performance such as a high signal-to-noise ratio, durability, and a long battery backup. Surjendu Maity and his team members at IIT Guwahati created a microfluidic immunosensor for point-of-care testing of Beta-2-

microglobulin in tears. This biosensor is made up of an aqueous suspension of gold nanoparticles (AuNPs) that have been coated with anti-β-2-microglobulin (anti-B2M) using a linker and exhibits a specific coloration due to AuNPs' Localized Surface Plasmon Resonance (LSPR). The data obtained by calibrating the resistance of the LDR with different known B2M loadings are used to detect the unknown B2M level in the tear. Swetha Menon and her team at IIT Madras have developed a point-of-care device for detecting heavy metal ions in body fluids. This is a handheld device for detecting and analyzing heavy metal ions in drinking water on-site. As a potential probe selective for heavy metal ions (Cr6+, Cu2+, Pb2+) detection in water, a fiber optic absorbance-based chemical sensor coated with metal-organic frameworks (MOFs) was developed. The MOF sensor probe detected Cr6+ ions as low as 1 ppb, whereas the WHO-recommended detection limit in drinking water and blood serum is 50 ppb and 1.4 ppb, respectively. Rathin Joshi of IISc, Bangalore, invented a Neonatal Hearing Screening headband to extract brainstem and cortical responses. He hopes to create a non-invasive, low-cost bimodal system that combines cortical (MMN-Mismatch Negativity) and brainstem evoked potential (ABR) imaging to scan the entire auditory system in newborns. The system development process includes the generation of auditory stimuli, the acquisition of biopotentials, the extraction of responses, and the design of system embodiments. WIPAD is a device developed by Yogesh Singh of IIT Gandhinagar. It is a wearable and portable device that can intervene to prevent the onset of freezing episodes and also serve as a training device for Parkinson's disease patients to improve gait variability. Patients can also record their medication details and receive feedback on their gait characteristics using the device.

Healthcare Drugs: Isha Rana of ISCSRM in Bangalore discovered a PAI-1 to develop a potential therapy for fibrotic diseases. Plasminogen Activator Inhibitor Type I (PAI-1) was found to be involved in the development of fibrosis and targeting PAI-1 can be used to prevent or reverse the development of fibrosis. Akshay Hegde of the same institute proposed a method for treating chronic diabetic wounds. His research has revealed that this pathway is disrupted in the type II diabetic mouse model. They used genetic manipulation in mice to intervene with Caspase-8 regulation to heal chronic wounds. They also intend to create hydrogels and ointments containing siRNA or ProTac probes against Caspase-8 for topical use in the treatment of diabetic chronic wounds.

Industrial Biotechnology: Parag Jain and his team members at the Columbia College of Pharmacy in Raipur have created a novel herbal formulation for tick eradication. Dr. Akanksha Jain of the Shri Shankaracharya Mahavidyalaya in Bhilai extracted herbal oil from the seeds of *C. limetta* collected as waste from juice corners. The acaricidal formulation was effective in reducing the population of ticks. Falguni Pattnaik of IIT Delhi designed a project on the technological transformation of an integrated biomass conversion process in a rural context for the production of handmade paper from locally available common reed Phragmites karka in Odisha's Chilika Lake. To make the handmade paper, the cellulose fiber obtained from the integrated process was treated with 5-15 % starch.

SRISTI-GYTI 2021

Awards:

Biomedical Engineering: Ketaki Bachal and his team at IIT Bombay have created a microfluidic device for drug discovery. To

create this low-cost, customizable, and lithography-free device, they used Saffman-Taylor instability in a lifted Hele-Shaw cell. Rahul Agarwal and his team at IIT Kharagpur built a point-of-care spinning disc for complete blood count (CBC). This innovation solves the problem by spinning a low-cost plastic compact disc on a basic rotational setup. This could be used at health kiosks or health camps organized by charitable organizations.

Chemical Engineering: Harini Gunda from IIT Gandhinagar has innovated solid propellants used in missiles and rockets for defense and space applications. Her team developed a new class of boron-based nanomaterial at IITGN that can serve as a single substitute for multiple additives. Adding one weight percent of their nanomaterial increases energy by 78% and reduces fuel decomposition temperature by 73°C. This will reduce the total cost of solid propellant by several orders of magnitude, allowing for more payload and faster travel over long distances.

Food Engineering: Arun Kumar Gupta, a Tezpur University student, has invented a device that could be used in the field to determine the maturity of citrus fruit in a non-destructive manner. It is a low-cost sensor for determining the maturity of pomelo/citrus fruits. The developed device debittered the citrus juice, reducing the naringin content by up to 53% in 3 minutes.

Nano Science and Engineering: Chandantaru Dey Modak and his team members devised a drop impact printing technique that is inexpensive, simple to use, and suitable for a wide range of applications. This technique has been demonstrated for a variety of applications, including printing biological cell solutions for various bio-based applications, general electronic circuit lines, and 3D structure pillars. Jayapiriya U. S., a BITS-Pilani student, has made an entirely 3D-printed microfluidic device with reusable bioelectrodes for enzymatic glucose biofuel cell applications. There are numerous opportunities to advance the output power to feed various biomedical devices, including implantable ones, by utilizing the proposed methodology.

Electrical, Instrumentation & Related Fields: Moupali Chakraborty, an IIT Kharagpur student, has built a low-cost milk tester that determines the fat content and presence of adulterants in milk at the same time and is less expensive than the existing commercial milk analyzers. It has low-cost polymer-coated sensors, which make the instrument affordable. The 'Milk tester' does not use any external chemicals and requires no prior technical knowledge to test, making it user-friendly. Sanjeev Kumar of IIT Kharagpur devised a low-cost pocket-sized digital microscope. This method of lensless microscopy uses image processing algorithms to reconstruct high-resolution images comes from wave-field data. Low-cost, compact, and portable hardware with features such as large field-of-view, multi-depth imaging from a single shot, and similarly phase imaging from a single shot; the latter is useful for imaging transparent or nearly transparent samples. This microscope is appropriate for remote telemedicine applications.

Textile: Mukesh Bajya and his team at IIT Delhi have proposed a research idea to reduce dependence on imported high-performance fibrous materials used in soft body armor without sacrificing protection level. This innovation demonstrates the use of a native material (polycarbonate sheets) and a native technology (compressed unidirectional laminates) to strategically substitute high-performance fibers from the rear layers of a soft body armor panel. This invention has the potential to reduce the

cost of current armor by up to 38% while maintaining excellent protective performance.

Appreciation:

Biomedical Engineering: B. Sri Sai Ramya of IIT Hyderabad is working on developing an osteoinductive composite biomaterial that can support and augment the bone repair process during craniomaxillofacial reconstruction. To make the composites, *Bombyx mori* and *Antheraea mylitta* silk fibroin microfibers were prepared and mixed separately with PCL. The use of autologous GMSCs (gingival mesenchymal stem cells) isolated from the patient's gingival tissue and integrated into 3D-printed scaffolds/ implants is a unique feature of the project. Chiranjib Bhowmick of IIT Kharagpur designed a transillumination imaging system to detect breast cancer and correlate the results with mammograms. This technology's image processing algorithm will be interfaced to mark the region of abnormalities in the image. Anusha Vupputuri, an IIT Kharagpur student, developed a deep learning technique for automated ischemic stroke detection, which aids radio diagnosis for reperfusion therapy. As it is trained and tested on a higher computation platform before deployment, the innovation can also be deployed onto scanner software at a low cost.

Food Engineering: Chirasmita Panigrahi, an IIT Kharagpur student, invented a novel low-cost non-thermal process technology for producing shelf-stable sugarcane juice. The developed technology consumes less energy, is highly scalable, and is economically viable. This has enormous potential to sustain future crop trade profitability through entrepreneurship development.

Nano Science and Engineering: Sumit Kumar and his coworkers at IISc, Bangalore, have created an electro-lithography tool for high throughput pattern generation. The potential for low-cost, green, and sustainable tool development, as well as easy handling, demolishes all existing technologies in the field of small-scale pattern generation. Ankit Nagar, an IIT Madras student, has devised a portable and non-portable greywater sink. Greywater recycling technologies have not been widely adopted due to the need for significant space in a household, a high initial cost, and significant variation in wastewater quality. To overcome these obstacles, the team proposes creating a 'greywater sink,' which consists of a compact treatment system that can fit under a sink and is capable of treating light greywater, which may contain ingredients such as soaps, shampoos, shaving waste, hair, toothpaste, oil, body fats, health care products, cosmetics, urine traces, and so on.

Bioengineering / Biotech: Rishabh Shukla, an IIT Delhi student, has developed a technique known as the Modified Trickling Filter (MTF) - a solution to India's water crisis. This innovation was created to remove both traditional and emerging pollutants from urban sewage.

Electronics, Communications & related fields: Abhranila Das of the IIEST in Shibpur has devised a low-cost smartphone interfaced handheld potentiostat. In biochemical laboratories, the potentiostat is the most commonly used electrochemical analyzing instrument. Most handheld commercial potentiostats currently available have a limited current measurement range, are expensive, and do not support online laboratory sessions. These gaps have been attempted to be filled by this innovation. To broaden the scope of experimentation, the upper limit of current measurement has been increased by 50 times when compared to previous reports. A custom-designed app has been created that allows the

experimental waveforms to be viewed in real-time and saved for future analysis, not only by the operator but also by students from various geographical locations. Bhaswati Chakraborty of IIEST, Shibpur established a ZnO-based field-effect transistor biosensor with coplanar electrodes for the first time using low-cost screen-printing technology and simple wet chemical processing on low-cost substrates. The fabrication of a one-of-a-kind electrode configuration on a ZnO nanorod FET sensor has reduced the detection limit of biomolecules by several orders of magnitude. With sub-femtomolar detection limits, an electronic readout has been integrated to detect viruses and cancer biomarkers. Prakash Rewatkar of BITS-Pilani Hyderabad campus illustrated customized printed electrodes with a MnO2-modified origami array-type microbial fuel cell (MFC). As a practical application, the energy harvested from MFC has been used to power a digital watch via a DC-DC booster, paving the way for future breakthroughs in the Internet of Things (IoT) applications via wireless data transmission with cloud technology. Gautam Rituraj, an IIT Guwahati student, invented a method for arranging unipolar transmitter and/or receiver coils in the WPT system to improve k when compared to a conventional coil system with the same self-inductances and outer dimensions. Abhinav Gautam of IIT Dhanbad devised an optical Respiration Rate measurement system that makes use of a Fiber Bragg Grating (FBG) as an optical sensor. These sensors are impervious to electromagnetic interference and can easily operate in a potentially explosive environment. As a result, it may be critical to monitor respiration rates in extreme conditions where electronic sensors cannot be used. Aryadip Sen, an IIT Delhi student, has developed a solar photovoltaic (PV) array-fed brushless DC (BLDC) motor-coupled irrigation pump system that is ideal for rural areas due to its high efficiency and low operating costs when compared to traditional induction motor-based water pumping.

Aerospace Engineering: Vijay Shankar Dwivedi of IIT Kanpur developed the "Auxiron" control surface intending to eliminate sideslip angle in flight with a non-zero bank angle. In addition, a solar-powered aircraft called "Maraal" has been developed to serve as a testbed for various experiments.

Textile: Ankit Kumar Singh, an IIT Delhi student, has created multifunctional disperse dyes. The project focuses on the synthesis of novel multifunctional disperse dyes (mosquito repellent, antibacterial, and UV protective). Even after 20 washes, the dyed fabric retained a significant amount of mosquito repellency. The dyes were also found to have high antioxidant activity and low algal toxicity. Hardeep Singh of IIT Delhi set up Metal-Organic Framework (MOF) functionalized smart textiles for environmental air purification, anti-odor, and anti-microbial applications. Furthermore, the developed technique for producing these Smart textiles is simple, quick, eco-friendly, water-based, cost-effective, and commercially viable. Shounak Roy and his team at IIT Mandi have produced a 2D-material (MoS2) modified fabric/textile that is bactericidal, washable, reusable, and photothermally disinfectable using sunlight. The MoS2 nanosheet-modified polycotton fabric can be used as a protective layer of clothing in the fabrication of antibacterial face masks without compromising the masks' particle filtration efficiency or breathability.

Materials Science: Hema Garg, an IIT Delhi student, has designed a smart polymer that responds to human body temperature. Their breakthrough will benefit a wide range of products, including self-fitting masks, biomedical sutures, orthodontics, and SMP-based prosthetics.

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SRISTI-GYTI APPRECIATION 2021

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SITARE - GYTI 2021

Arjun B S

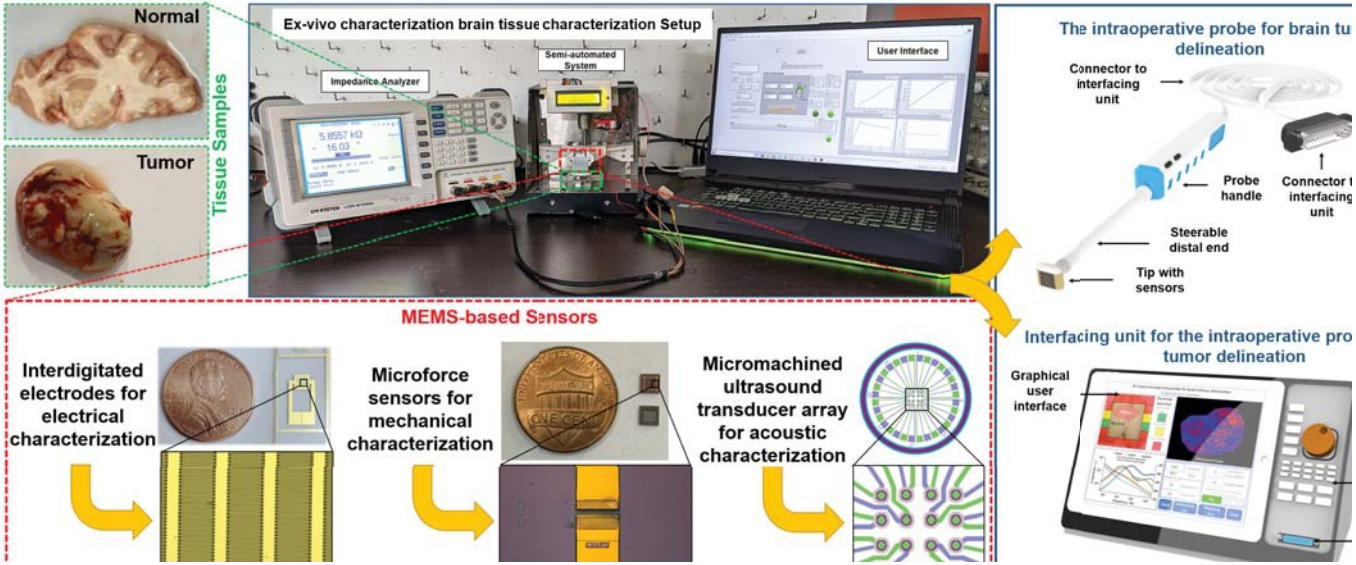
An Intraoperative Probe for Brain Tumour Margin Delineation

Arjun B S
Indian Institute of Science, Bangalore

Guide:
Dr. Hardik J Pandya

Tumors affecting the brain are known to have a high incidence, mortality, and morbidity in patients. The accuracy and efficacy of tumor resection during surgery strongly influence the effectiveness of chemotherapy and radiation. Hence, a conservative resection can lead to a significant residual tumor, leading to progression and recurrence. In contrast, excessive resection can lead to neurological impairment due to the removal of adjacent normal tissues. Discrimination of tumor from normal is usually based on the color, angiogenesis, hemorrhage, and consistency of the tissues. However, the margins of diffuse tumors are poorly defined as the alterations in color and angiogenesis are subtle even when viewed under a microscope. Hence, various intra-operative techniques are used to map the eloquent areas of the cortex during surgery. These techniques are essential as the pre-operative imaging tools are rendered ineffective due to the brain's plasticity and brain shift. However, various studies have highlighted the limitations of existing intraoperative techniques such as low resolution, difficulties in visualizing low-grade tumors, low sensitivity, long measurement times, high cost of infrastructure, etc.

Thus, there is a need to develop an intraoperative tool to augment brain tumor resection to overcome these limitations. We hypothesize that ultrasound imaging, viscoelastic characterization, and electrical impedance spectroscopy can be combined to overcome the limitations of the existing intraoperative tools. The work focuses on developing an intraoperative probe integrated with custom fabricated MEMS-based force sensors with microelectrode arrays and micromachined ultrasound transducer arrays (MUTs) for brain tumor delineation. An integrated physical properties-based assessment using three different modalities will provide valuable insights for neurosurgical decision-making.


Normal
Tumor
Tissue Samples
Ex-vivo characterization brain tissue characterization Setup
Impedance Analyzer
Semi-automated System
User Interface
The intraoperative probe for brain tu
delineation
Connector to interfacing unit
Probe handle
Connector t interfacing unit
Steerable distal end
Tip with sensors
MEMS-based Sensors
Interdigitated electrodes for electrical characterization
Microforce sensors for mechanical characterization
Micromachined ultrasound transducer array for acoustic characterization
Interfacing unit for the intraoperative pro
tumor delineation
Graphical user interface

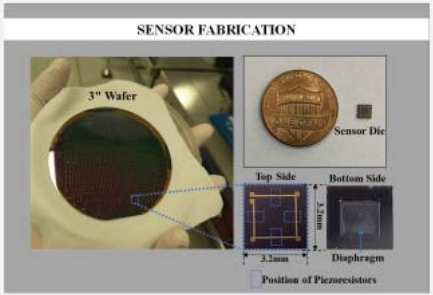
Alekya B

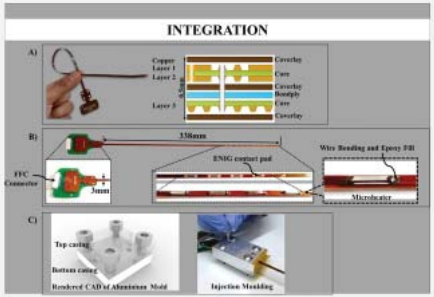
Microsensor Integrated Intubation Catheter for Chronic Airway Management

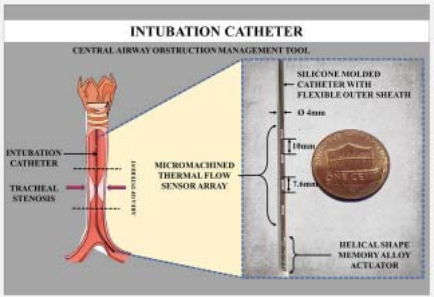
Alekya B
Indian Institute of Science, Bangalore

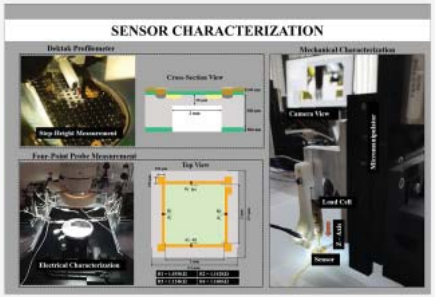
Guide:
Dr. Hardik J Pandya

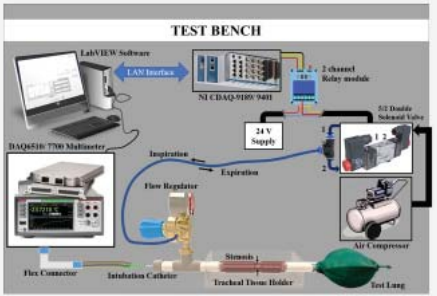
Central airway obstruction (CAO) refers to constriction in the trachea and main-stem bronchi of the respiratory tract. CAO can be acquired or congenital, benign or malignant, and can be acute or chronic, with dynamic or fixed obstruction, causing respiratory distress in both adult and child populations. Management of CAO remains a diagnostic and therapeutic challenge due to the variability in the presentation of clinical symptoms. Severely constricted airways often warrant careful monitoring to determine an appropriate management strategy. Diagnostic workup often involves collective decision-making by a diversified team of clinicians as the complexity in anomalies demands patient-centric management. Apart from a clear and thorough understanding of the underlying cause of the disorder, timely diagnosis depends on the availability of a multidisciplinary team with experience in the use of sophisticated tools such as endoscopy, imaging along with expertise in relevant surgical tools and technology. Although the information on localized airflow patterns is a direct measure of airway caliber, only imaging modalities have seen significant technological evolution. Information on the location/site of obstruction can be discerned quantitatively using airflow patterns generated within the tracheobronchial tree. Alterations in the pattern can be used to delineate healthy and stenosed airways. As of today, there is no tool to measure and objectively describe tracheobronchial obstruction. A technology/ method to delineate mild, moderate and severe airway constrictions can improve CAO management and is an area of active research. Described herein is a sensor integrated diagnostic tool for managing pathological airways. The invention relates to a system and method for characterizing the tracheal obstruction, such as stenosis, of varying grades and anomaly types. The tool combines an array of micromachined flow and force sensors mounted on the distal end of the catheter. The flow sensor array yields airflow patterns across various segments of the tracheobronchial tree, and the force sensors are designed to distinguish between a malacic and healthy tissue, thereby facilitating multiple information without the need for catheter exchanges.

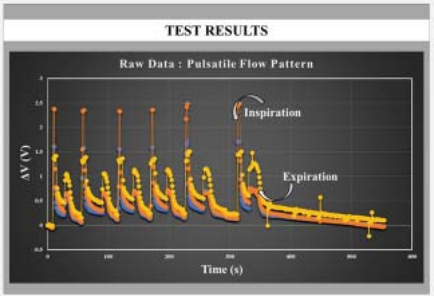

SENSOR FABRICATION
3" Wafer
Sensor Die
Top Side
Bottom Side
3.3mm
3.2mm
Diaphragm
Position of Piezoresistors


INTEGRATION
A)
Copper
Layer 1
Layer 2
Layer 3
Coverlay
Core
Coverlay
Bondply
Core
Coverlay
B)
338mm
ENIG contact pad
Wire Bonding and Epoxy Fill
FFC Connector
3mm
Microheater
C)
Top casing
Bottom casing
Rendered CAD of Aluminium Mold
Injection Moulding


INTUBATION CATHETER
CENTRAL AIRWAY OBSTRUCTION MANAGEMENT TOOL
SILICONE MOLDED CATHETER WITH FLEXIBLE OUTER SHEATH
Ø 4mm
10mm
7.4mm
INTUBATION CATHETER
TRACHEAL STENOSIS
MICROMACHINED THERMAL FLOW SENSOR ARRAY
HELICAL SHAPE MEMORY ALLOY ACTUATOR


SENSOR CHARACTERIZATION
Delta Profilometer
Step Height Measurement
Cross-Section View
Four-Point Probe Measurement
Top View
Electrical Characterization
Mechanical Characterization
Camera View
Microactuator
Load Cell
Z Axis
Sensor


TEST BENCH
LabVIEW Software
LAN Interface
NI CDAQ-9189/ 9401
2 channel Relay module
3/2 Double Solenoid Valve
24 V Supply
DAQ6510/ 7700 Multimeter
Inspiration
Expiration
Flow Regulator
Air Compressor
Stenosis
Flex Connector
Intubation Catheter
Tracheal Tissue Holder
Test Lung


TEST RESULTS
Raw Data : Pulsatile Flow Pattern
Inspiration
Expiration
ΔV (V)
Time (s)

Pankaj Shivhare

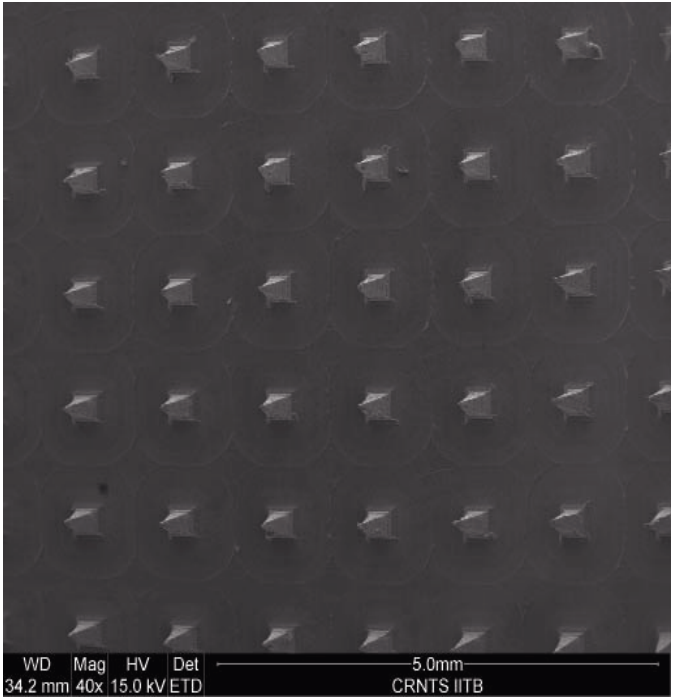
Design and Development of Hollow Polymeric Microneedles for Controlled Drug/Vaccine Delivery

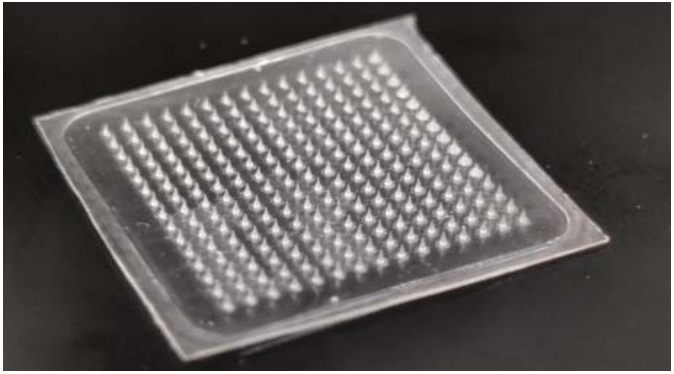
Pankaj Shivhare
Indian Institute of Technology, Bombay

Guide:
Prof. Rohit Srivastava

Microneedle patches are the most promising minimally invasive alternative to painful hypodermic needles. Biodegradable polymer microneedle patches are the recent advancement towards transdermal drug delivery (TDD) which can ensure the controlled and sustained release of drugs/vaccines for a prolonged period. However, the development of canonical shape or bespoke microneedle for smooth skin penetration requires a clean room and complex microelectromechanical (MEMS) fabrication processes such as photolithography, reactive ion etching (RIE), deep reactive ion etching (DRIE), Electroplating, etc., which are expensive. Here, we have developed a low-cost, simple and sustainable solution for the fabrication of the microneedles patch without cleanroom and sophisticated fabrication or micromachining processes. We have fabricated the master template of stainless steel using precision CNC machining. We have fabricated two different shaped microneedle templates; one is conical, and the other is pyramidal shaped. The stainless-steel template is used as the master mold for the fabrication of microneedles. We have developed the microneedles patch using polyvinyl alcohol (PVA) and Polyvinylpyrrolidone (PVP), FDA-approved, renewable, biodegradable, thermoplastic materials. The fabrication process is highly affordable, simple, rapid, and can be implemented with other polymeric materials. Environmental scanning electron microscope (ESEM) images confirm that the needle tip size is approximately 25µm, and the microneedle patch successfully penetrated the porcine skin during testing. We have tested that the developed microneedles patch mechanical strength is comparable to the force required for penetrating the human skin. Using the porcine skin model, we have also demonstrated the drug release capacity and degradability of the drug-loaded microneedles patch.

Other Contributor:
Vedika Shirirang Choudhari


WD
Mag
HV
Det
5.0mm
34.2 mm
40x
15.0 kV
ETD
CRNTS IITB



Deepika N P

Environment Safe Antimicrobial Phytoabsorbent Pads For Sanitary & Hygiene Products

Deepika N P
JSS College of Pharmacy, Ooty

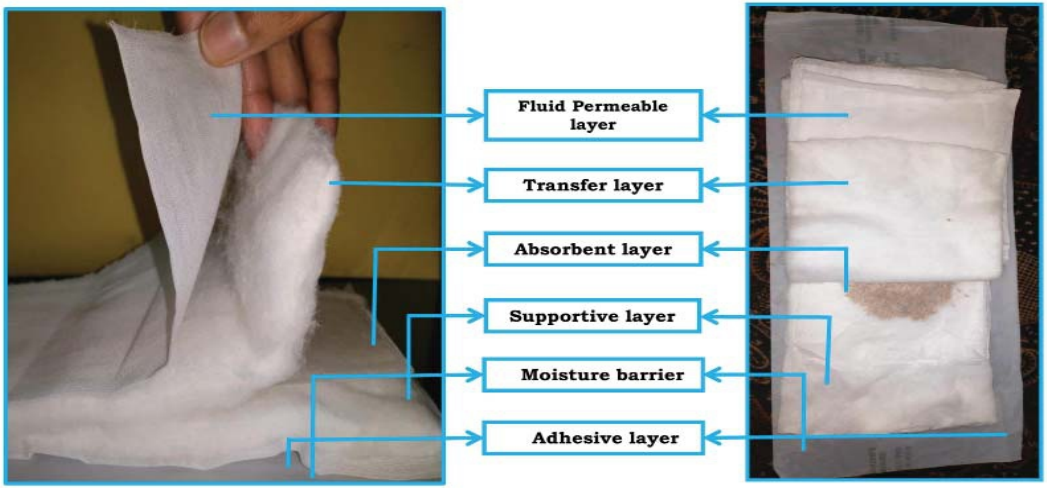
Guides:
Dr. B. Duraiswamy,
Dr. Suresh K Mohan Kumar

Disposable absorbent sanitary products, covering baby diapers, feminine hygiene pads/ napkins, adult diaper/ incontinence pads, and bed pads, are of great convenience and are designed to absorb and retain body excrete. The major constitutes of the absorbent hygiene products share similar functions. Due to user convenience in terms of high absorbability and sterility, commercial disposable sanitary products became a more usable product in the market.

Commercial baby and adult diapers/ incontinence pads are the most extensive single disposable product in landfills, representing about 4% of total solid waste. A single woman uses approximately 4500 pads over her lifetime and generates 125 kg of disposable waste. According to "Environment Portal Down to Earth", in India alone, 432 million pads are disposed of every month and are made up of 90% plastic non-biodegradable materials. These solid wastes stay in landfills for about 800 years, affecting the soil microflora, favoring pathogenic 'microbes' growth, and blocking the sewage with toxic menstrual and faecal debris. Moreover, during the slow decay process, the above wastes release harmful methane and other poisonous gases into the environment. In addition, incineration of this waste exacerbates air pollution as well. Thus, there is an urgent need to develop innovative user and environment-friendly sanitary products to ensure hygiene and limit the substantial risk of pollution and health hazards.

Considering the above-mentioned concerns, we designed and developed eco-friendly phytoabsorbent* sanitary pads with antimicrobial properties. The incorporation of phytoabsorbent was to improve the antimicrobial property and to enhance the absorption. The moisture barrier and adhesive layer were made of biodegradable material, and thus it would decay within six months of disposal. The pads were essential oil-scented and sterilized under UV. The prepared pads were then tested for physical, biological, and biodegradability parameters based on the Indian and International Standards. We envisage that this new eco-friendly product will help restore the atmosphere from pollution, protect children, women, senior health, and help Women SHG's improve their economy. These efforts will fulfill the dreams of the Prime Minister's Swachh Bharat Mission 2014.

*The details of phytoabsorbent are protected as we are in the process of filing the patent.


Fluid Permeable layer
Transfer layer
Absorbent layer
Supportive layer
Moisture barrier
Adhesive layer

Ruchira Nandeshwar

Pro-Care: Prognostic Point of Care Monitor for Cardiovascular Disease Management

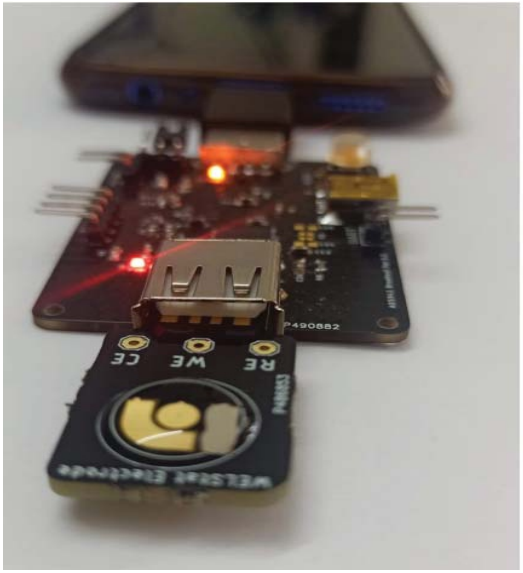
Ruchira Nandeshwar
Indian Institute of Technology, Bombay

Guide:
Prof. Siddharth Tallur

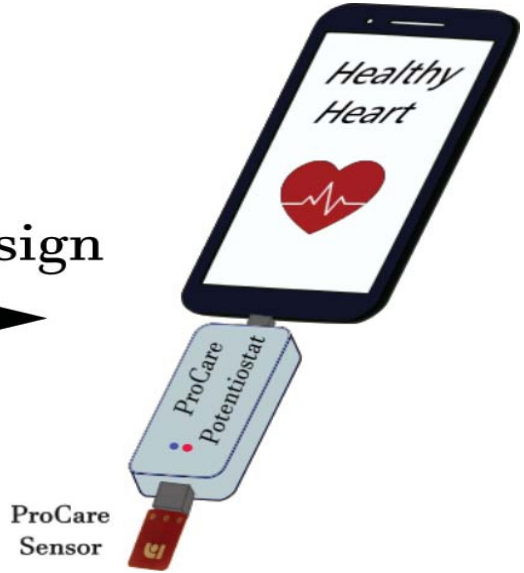
Cardiac Vascular diseases (CVDs) are a major cause of death worldwide and caused by non-infectious diseases and were responsible for 27% of total deaths (WHO, 2019) indicating a significant increase since 2000. Recently there has been a lot of work on the development of biosensors for several biomarkers associated with CVDs, such as C-Reactive Protein, B-type Natriuretic Peptide, cardiac Troponin I, myoglobin, etc. These can be used to diagnose a chest pain episode as a heart attack but are not useful as early warning signs to take preventive measures. On the contrary, myeloperoxidase (MPO) is a CVD and inflammation-associated biomarker whose concentration starts elevating in the bloodstream with the onset of inflammation in arteries, months in advance of heart attack, and can therefore be used as an early warning indicator. Presently there are very few FDA-approved tests for MPO, and most research-grade reports use expensive reagents and laboratory equipment operated by skilled personnel. Hence, another significant technology driver must be the development of point-of-care devices that are easy to use and do not require extensive training, and high-cost reagents or laboratory consumables.

In this project we propose a point of care electrochemical test strip to detect MPO concentration in a blood sample, delivering a user experience similar to glucose test strips. The proposed concept leverages commercially printed circuit board (PCB) manufacturing techniques to realize low-cost and robust sensor strips. Combining the PCB manufacturing process with dip-coating processes, the sensor thus realized can directly detect MPO in the blood sample. The test strips will be interfaced with a low-cost portable potentiostat to perform voltammetry measurement for MPO concentration estimation. The key innovation in this proposal is the development of a highly sensitive, stable, and easy to use MPO sensor that could have a disruptive impact on the health screening of individuals plus large scale testing at government or NGO medical camps, in resource-constrained sites.

Other Contributors:
Mr. Vivekanand Dakane, Mr. Maheshwar Mangat and Mr. Mahesh Bhaganagare



Final design



Barkha Singh

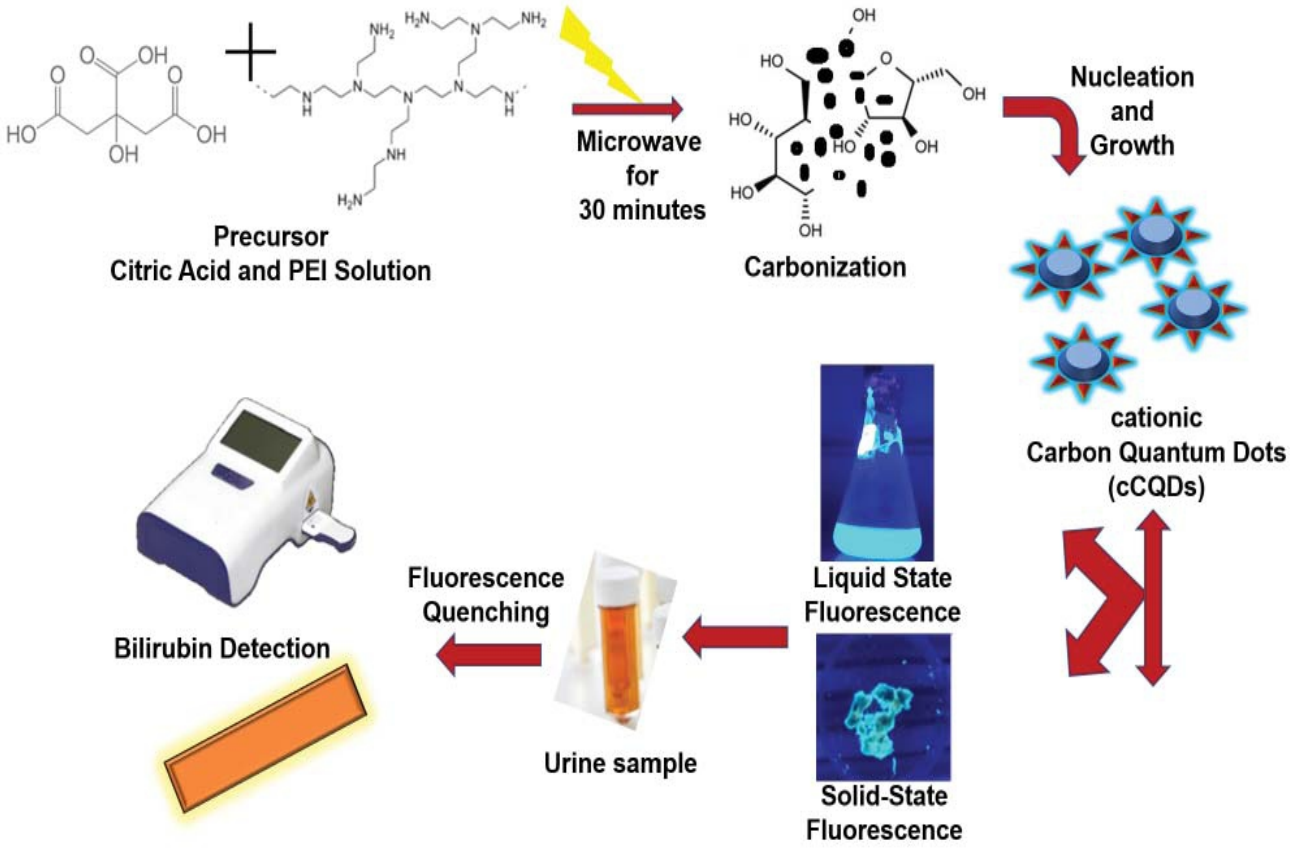
Rapid Detection of Bilirubin Using Cationic Multifluorescent Carbon Quantum Dots as a Fluorometric Probe

Barkha Singh
Indian Institute of Technology, Bombay

Guide:
Prof. Rohit Srivastava

Bilirubin is a yellowish pigment in blood that is formed after red blood cells break down, and it travels through the liver, gallbladder, and digestive tract before being excreted. Higher than normal levels of bilirubin may indicate different types of liver or bile duct problems. Many babies are also born with high bilirubin, causing a condition called newborn jaundice. Mostly, Bilirubin testing is done using a blood sample which is invasive, time taking, and costly. While there is a urine test for bilirubin, it is less accurate and often falsely positive. So, there is a need for a diagnostic system that can detect bilirubin rapidly and accurately using a urine sample. The fluorometric probe is gaining tremendous popularity as a nanosensor because of its excellent optical properties. In contrast to colorimetric sensors, fluorescent sensors have negligible interference issues. We report the synthesis of Carbon Quantum dots (cCQDs) using a very simple precursor i.e., citric acid, and passivating it simultaneously with Polyethylenimine (PEI) using the microwave. The synthesis method is one pot, solvent-free, facile, inexpensive, quick, high yield, reproducible, and can be easily scaled up for industrial purposes. The present invention discloses a potential diagnostic device or kit for visual detection of bilirubin. The high quantum yield (46%) of Carbon quantum dots will provide a broad detection range compared to conventional fluorophores, high detection reliability, and ultra-low detection limit. demonstrating its potential use as an excellent visualization sensor of bilirubin in liquid assay, as well as to a paper-based test stripe as a point of care device. The cCQDs can be utilised to test the bilirubin levels using urine samples.

Other Contributor:
Rohan Bahadura


Precursor
Citric Acid and PEI Solution
Microwave
for
30 minutes
Carbonization
Nucleation
and
Growth
cationic
Carbon Quantum Dots
(cCQDs)
Liquid State
Fluorescence
Solid-State
Fluorescence
Fluorescence
Quenching
Urine sample
Bilirubin Detection

Asharani Patel

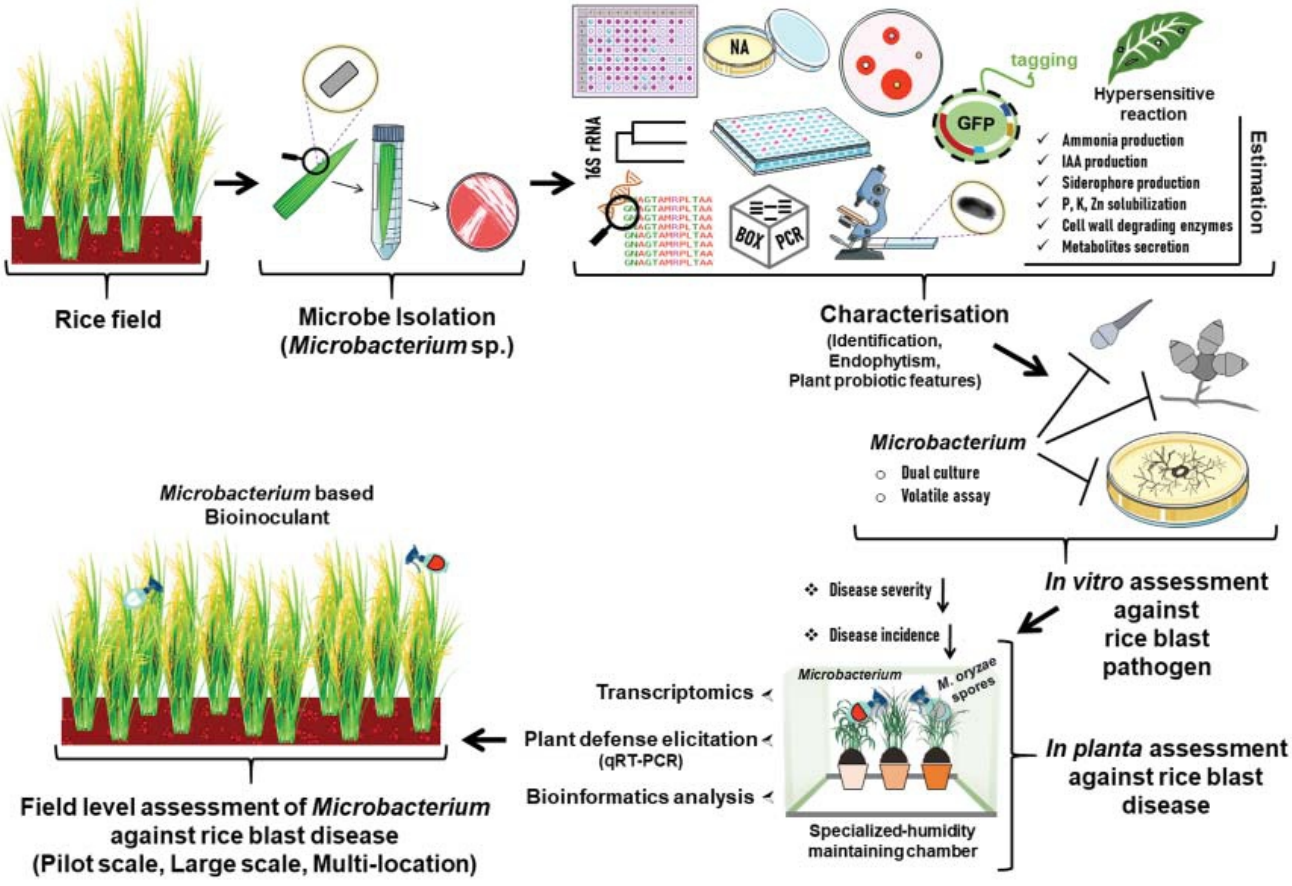
Genetic Characterization and Development of Endophytic Microbacterium Based Bioinoculant for Rice Blast Disease Management

Asharani Patel
Indian Agricultural Research Institute, Delhi

Guide:
Dr. Aundy Kumar

Rice (*Oryza sativa* L.,) is one of the most important staples for more than half of the global population. Rice production impacted by *Magnaporthe oryzae* incited blast disease is the most destructive and reported to hamper rice cultivation in all rice-growing regions in the world. Two major strategies currently used for blast management are i. host resistance, and ii. fungicides; both of them are not adequate to contain the disease effectively. While fungicide tricyclazole based disease management is under scanner due to its toxic nature, the host resistance is unstable. Therefore, alternative approaches have to be developed to manage rice blast disease for sustainable rice production. To address this problem, we have analysed endophytic *Microbacterium* isolated from the rice leaf. The polyphasic taxonomic analysis revealed its species identity as *Microbacerium testaceaum*. The in-depth functional analysis revealed multipronged pathogen antagonistic and plant probiotic features of *Microbacterium testaceaum*. The bacterium not only expressed secreted and volatile metabolite mediated antifungal activity on *M. oryzae* in vitro but also suppressed rice blast disease in planta. Interestingly, the bacterium was able to induce rice defense genes upon leaf bacterization as revealed in our qPCR and transcriptome studies. Other key features of *Microbacterium testaceaum* are its endophytism on rice (gfp tag-based endophytism assay), and non-pathogenic on plants (tobacco-infiltration assay). The blast suppressive activity of *Microbacerium* could be attributed to the combined effect of direct-antagonism as well as indirect-host defense activation. Therefore, the project aims to translate the endophytic *Microbacerium* based biostimulant as a safe alternative to the fungicidal spray schedules to combat blast disease. The outcome of the project would be useful as an agro-input for the organic rice cultivation system in the future.

Other Contributors:
Mr. Kuleshwar Prasad Sahu and Dr. Mukesh Kumar


Rice field
Microbe Isolation
(Microbacterium sp.)
NA
16S rRNA
BOX PCR
tagging
GFP
Hypersensitive reaction
Ammonia production
IAA production
Siderophore production
P, K, Zn solubilization
Cell wall degrading enzymes
Metabolites secretion
Estimation
Characterisation
(Identification, Endophytism, Plant probiotic features)
Microbacterium
Dual culture
Volatile assay
In vitro assessment against rice blast pathogen
Disease severity
Disease incidence
Microbacterium
M. oryzae spores
Specialized-humidity maintaining chamber
In planta assessment against rice blast disease
Transcriptomics
Plant defense elicitation (qRT-PCR)
Bioinformatics analysis
Microbacterium based Bioinoculant
Field level assessment of Microbacterium against rice blast disease
(Pilot scale, Large scale, Multi-location)

Sukirti

Digitization of Manufacturing Process of Indian Sweetmeats with Tailored Functionality for Harnessing Food Safety and Quality

Sukirti
Indian Institute of Technology, Delhi

Guides:
Dr. Jatindra K Sahu,
Prof. Satyanarayan Naik

The pattern of utilization of milk indicates that about 50-55% of milk produced in India is converted into a variety of traditional Indian milk sweetmeats that are an integral part of our daily lives and have a strong foothold in the Indian market as well as a great export prospect across the globe. However, the existing manufacturing practices of dairy sweetmeats are multi-operational, labour-intensive, and non-standardized, and largely regulated by the unorganized sector, leading to a wide variation in the quality and composition of raw materials and final products. The produced sweetmeats are often subjected to adulteration during peak seasons, thereby questioning their safety. The growth of the Indian dairy processing industry is thus hindered. Therefore, the project is intended to tackle the prevailing drawbacks of traditional manufacturing processes like adulteration and the absence of regulatory standards for the raw materials used, process of production, and the final quality of the traditional Indian sweetmeats. The augmentation of 3D printing technology as a 'single on-demand' unit operation for optimized, automated, digitized, and consistent production of traditional Indian sweetmeats with a unique texture, structure, functionality, and nutritional profile is a step towards sustainable food production. The innovation will complement the recent slogan of Aatmanirbhar Bharat in the spirit of being vocal for locals. The formulation of standardized 'food ink' for the product would prevent adulteration and result in the consistent quality of the product. Hence, the innovation provides a novel rapid production method to replace the traditional manufacturing operations of dairy sweetmeats using design modelling thereby elevating the product profile with customized structure, texture, nutrition, and functionality at reduced cost and energy fitting with sustainable development agenda.

Other Contributors:
Bareen M A and Satheeshkantha S S M

Siddharth Vishwakarma

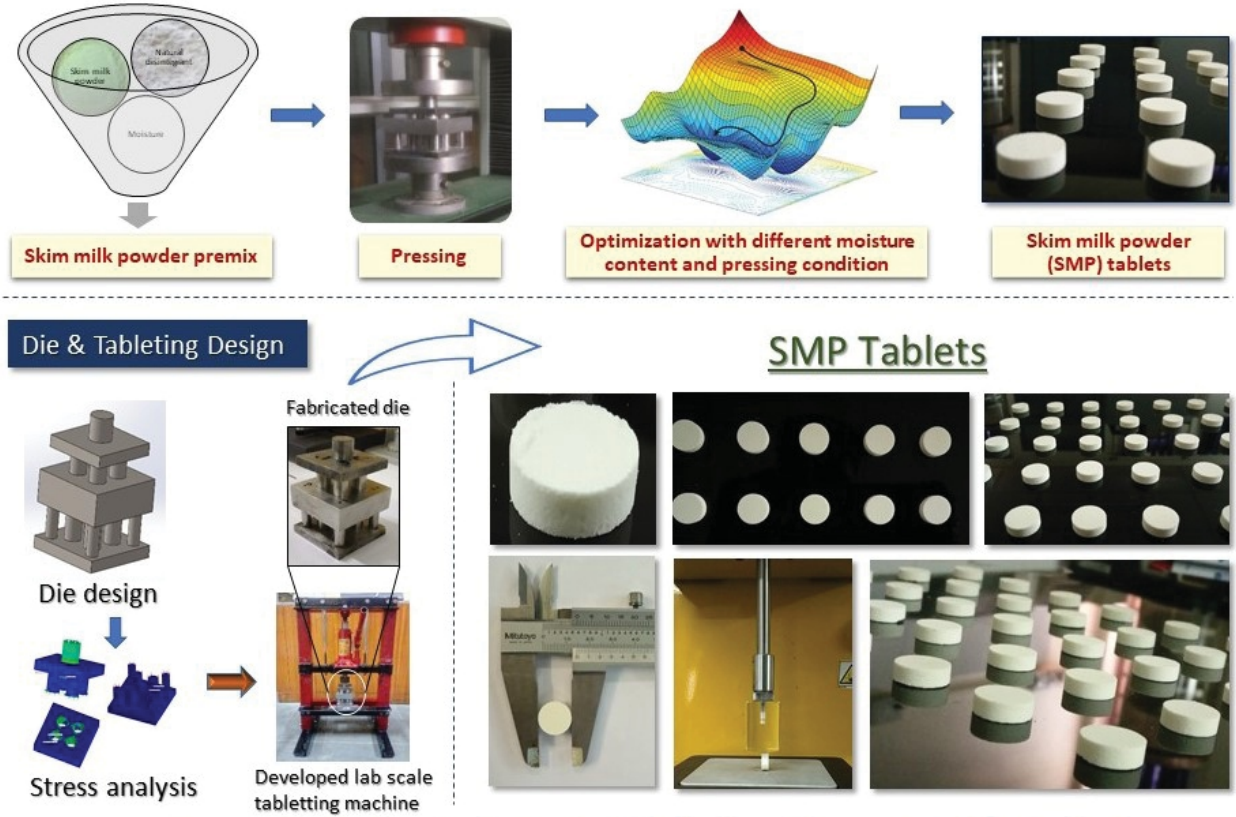
Development of Process Technology for Instant Soluble Skim Milk Tablets

Siddharth Vishwakarma
Indian Institute of Technology, Kharagpur

Guide:
Prof. Hari Niwas Mishra

The innovation involves designing and optimizing the process technology for manufacturing instant soluble skim milk powder (SMP) tablets. The powdered form of skim milk has several issues of quick moisture absorption (leads to solubility loss), difficulty in quantification, and sticky nature. These challenges are tackled by decreasing the exposed surface area of SMP and presenting it in some easily quantifiable form. The research team of Food Chemistry and Technology Laboratory, Agricultural and Food Engineering Department, IIT Kharagpur, introduced a novel compressed form of skim milk powder. The technology includes two simple operations of condensing and compressing the milk powder at optimum condition. The SMP tablet, thus, produced, have better handling, lower hygroscopicity, lower stickiness, ease in quantification, and higher shelf life than milk powder. These tablets can be consumed directly and reconstituted for milk. A natural disintegrating agent was introduced and added in optimum quantity for lowering solubility time. A suitable die and hand-operated hydraulic pressing machine were further designed to develop the SMP tablets at home and local scales. The developed technology for SMP tablets is simple, reliable, and commercially viable for the dairy industry. The involvement of mere two-unit operations has given it an edge of high translational potential.

The validated optimum conditions in the proposed technology can be useful for developing novel refreshing products like instant tea tablets, instant tea-milk tablets, instant tea-sugar tablets, instant tea-milk-sugar tablets, fruit powder tablets, and so on. The technology also provided a great platform for fortifying multiple micronutrients (iron, vitamin A and D) and microencapsulation of antioxidants (vitamin C & E) and probiotics. This innovation has already been patented and communicated in a peer-reviewed international journal.


Skim milk powder premix
Pressing
Optimization with different moisture content and pressing condition
Skim milk powder (SMP) tablets
Die & Tableting Design
Fabricated die
Die design
Stress analysis
Developed lab scale tabletting machine
SMP Tablets
Process Technology for Instant soluble skim milk powder (SMP) tablets

Moumita Roy

Enriching Methane Content in Biogas Through CO_2 Conversion into Acetic Acid via Microbial Electrosynthesis

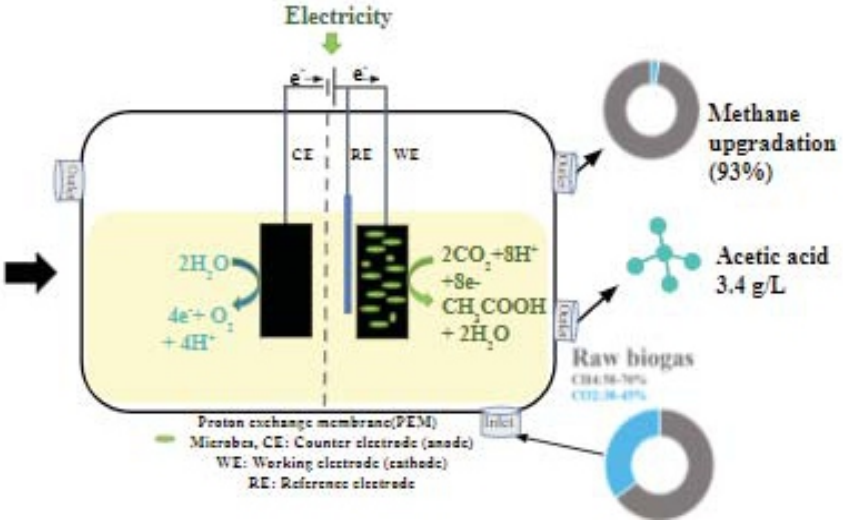
Moumita Roy
Indian Institute of Science Education and Research, Mohali

Guide:
Dr. Sunil A Patil

Due to industrialization and rapid economic growth, fossil fuel depletion has become one of the pressing problems of mankind. A more sustainable approach is needed to shift the fossil fuel-based economy to a sustainable economy. In this scenario, biogas has the potential to solve the fuel depletion problem. The two major components of biogas are CH_4 and CO_2. Methane is a biofuel but due to the presence of CO_2 in biogas, the calorific value of biogas decreases. Biogas up-gradation has been a crucial topic for quite a long time. Upgraded methane can be utilized as Compressed Biogas (CBG). CBG has been enlisted as one of the advanced biofuels in the National Policy on Biofuels 2018. This suggests that biogas has a huge market. Some biogas up-gradation processes are available like absorption, adsorption, membrane separation but these processes are not sustainable. Hence, there is a need for a more sustainable, eco-friendly route of biogas up-gradation. In this situation, the proposed approach that utilizes the microbial electrosynthesis (MES) process, offers a promising solution. MES is electricity-driven CO_2 reduction with the help of microbial catalysts. By using MES, CO_2 can be sequestered from the biogas to value-added products and the concentration of methane can be enhanced. The most attractive part of the process is that the CO_2 that was not being used in other scrubbing processes is being utilized for the production of other useful chemicals like acetate. Overall, the successful demonstration followed by large-scale implementation of the process has the potential to establish an eco-friendly and sustainable route for biogas upgradation with simultaneous value-added product recovery.

Other Contributor:
Ravineet Yadav

Biogas upgradation



Innovations matter; inclusive innovations matter more

SRISTI - GYTI 2021

Ketaki Bachal

Shital Yadav

Dr. Tanveer ul Islam

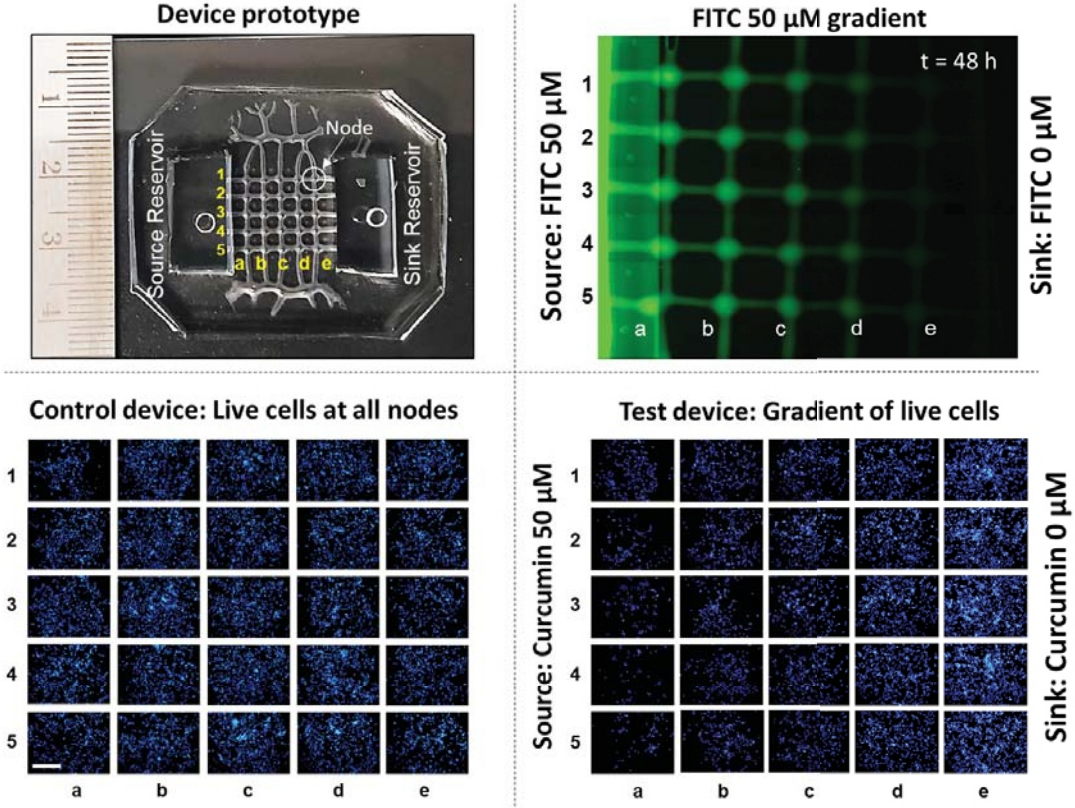
Lithography-less, Frugal and Scalable Microfluidic Device for Drug Discovery and Drug Screening Applications

Ketaki Bachal, Shital Yadav, Dr. Tanveer ul Islam and Makrand Rakshe
Indian Institute of Technology, Bombay

Guide:
Prof. Abhijit Majumder
Prof. Prasanna Gandhi

Drug screening is performed to test the efficacy of newly discovered molecules on target cell types. Conventionally efficacy of new drugs is tested using multi-well plate assays which are time-consuming, have chances of evaporation loss, and manual error due to handling of different drugs at varying ratios. Microfluidic devices involving the simultaneous flow of solutions to obtain concentration gradients are used as an alternative. However, their fabrication involves the use of photolithography which is multi-step, expensive, and requires a high level of expertise. Moreover, such flow-based microfluidic devices require accessories such as syringe pumps, tubings, customized incubators for cell-related studies, etc. Therefore, although multiple designs are established for microfluidic high-throughput drug screening, their scale-up and commercialization are still limited and under-explored. We have overcome the above-mentioned issues by designing a diffusion-based static concentration gradient generator. Here, a concentration gradient is generated by the diffusion of the drug from higher to lower concentrations. This innovation has two major advantages. First, the method of fabrication exploiting Saffman-Taylor instability in lifted Hele-Shaw cell (LHSC) is highly cost-effective without affecting the performance. Multiple templates with various designs can be fabricated at a fraction of the cost otherwise needed in conventional lithography-based fabrication methods. Second, the microfluidic-based static-gradient generator for drug screening is small, portable, and does not need costly accessories such as customized incubators, syringe pumps, controllers, valves, tubings, etc. We have validated the minimum concentration of the anti-cancer drug required to stop the cellular growth of brain cancer cells using the proposed device. To summarise, the use of such a platform will reduce time, expenditure, and resources to a great extent in drug discovery and also in devising personalized therapeutic regimes.

Makrand Rakshe



Scale bar: 400 µm, Cell line: U87MG

Acknowledgement: DST IMPRINT Project ID 6722

Harini Gunda

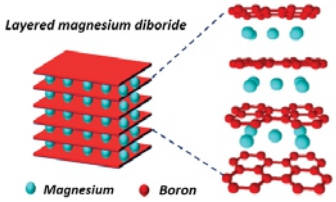
Boron Analogs of Graphene as Alternative Nanoadditives for Fuels used in Space and Defence Applications

Harini Gunda
Indian Institute of Technology, Gandhinagar

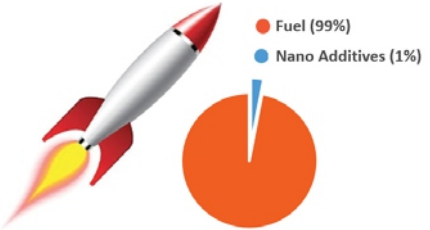
Guides:
Dr. Chinmay Ghoroi
Dr. Kabeer Jasuja

Our innovation is related to solid propellants used in missiles and rockets for defence and space applications. Traditional solid propellants require multiple additives (~30 wt.% of the total fuel weight) for efficiently releasing their energy. Several researchers are investigating the effect of nanoscale boron as an additive for improving the performance of propellants. Nanoscale boron is appealing to the scientific community because of its high theoretical energy density values. However, the potential utilization of boron is limited due to the formation of an inert boron-oxide layer. To overcome this challenge, we used a new class of boron-based nanomaterial (developed by us at IITGN) derived from layered metal diborides (LMDBs). We found that our nanomaterial can act as a single substitute for multiple additives. Adding one wt.% of our nanomaterial to Ammonium perchlorate (AP) depicts a remarkable energetic and catalytic activity by increasing the energy by ~78% and decreasing the fuel decomposition temperature by ~73°C. Our nanomaterial is not just better in terms of energy addition; it would also form a more economical alternative; it is around 40 times cheaper when compared with traditional additives. Moreover, our nanomaterial results in the highest energy enhancements among all the nanomaterial additives reported so far in the literature. The reason for such extraordinary enhancements is that our nanomaterial plays a dual role as a catalyst and as an energy additive due to its unique chemistry. This study presents a new perspective to utilize the potential of boron-based nanostructures obtained from LMDBs as an alternative fuel additive and adds an immense prospect to the field of energetic materials.

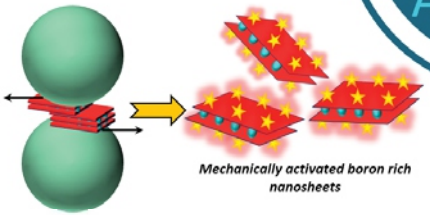
NOVEL BORON NANOADDITIVES FOR IMPROVING THE PERFORMANCE OF SOLID PROPELLANTS



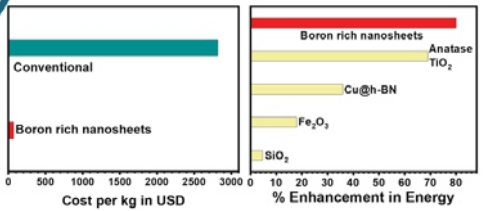
Exploring the untapped energy potential of boron rich layered magnesium diboride (MgB_2) crystals



Just one wt.% of our boron rich nanosheets substitute multiple additives and increases energy by 78%



Scalable approach for delaminating boron rich layered MgB_2 crystals using shear forces by mechanical milling



Boron rich nanosheets developed by us are 40 times cheaper than conventional additives and performs better than other nanoadditives

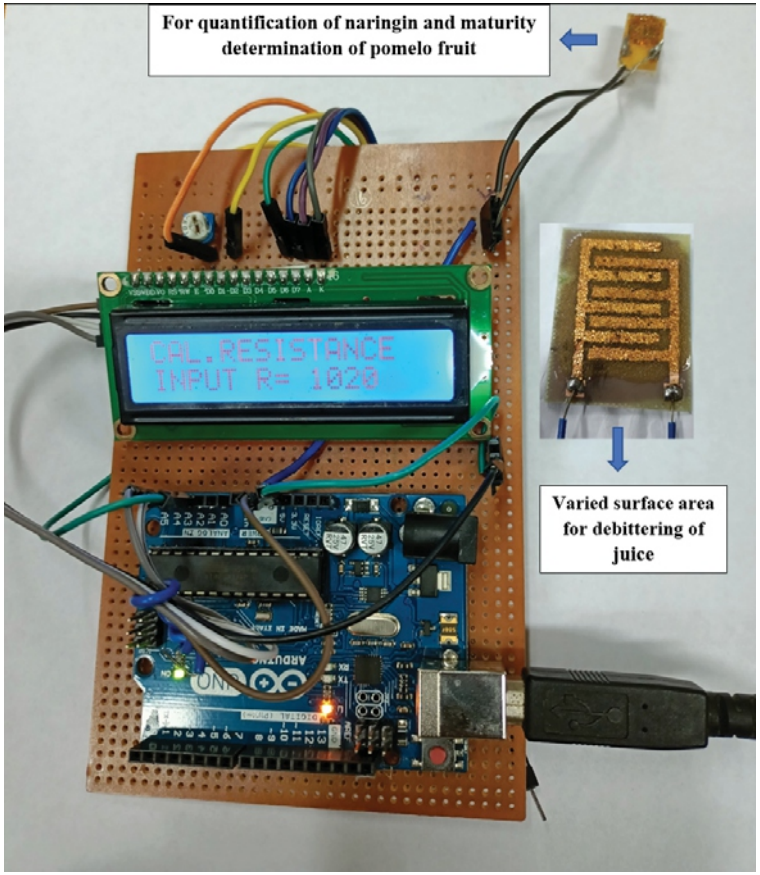
Arun Kumar Gupta

Battery Less Electrochemical Sensor for Quantification, Removal of Naringin and Determination of Maturity of Citrus Fruits

Arun Kumar Gupta
Tezpur University, Tezpur

Guides:
Dr. Poonam Mishra
Prof. PP Sahu

Citrus fruit is known for its appreciable health-benefiting properties but faulty harvesting time and excessive bitterness restrict the commercialization of the bitter variety of citrus fruits. A novel electrochemical device is developed for the selective quantification and reduction of naringin bitterness in bitter citrus fruits. The developed device used amberlite as a sensing material on the interdigitated electrode to assess the maturity of citrus fruits in a non-destructive manner as a sample amount of juice (20 µL) can easily be taken out using a sterile syringe and septum in the field and can be analyzed in 15-20 s only. The findings of the sensor are validated with HPLC for model juice and real juice with 97% accuracy. The sensor had 3.02 ×10-4 mg/mL as a limit of detection, and 0.008 µA/10 ppb of sensitivity. This investigation has overcome the shortcomings of existing methods such as %RSD, LOD, response time, cost, and shelf stability. Fruit harvested in 180-220 DAFS showed a current response in the range of 0.307-0.356 A corresponding to the reduced value of naringin content (196.6-302 µg/mL) and has an appreciable number of phytochemicals. Debittering of citrus juice using the same setup by varying surface area only of sensing layers with minimum loss of bioactive compounds may be a feasible way to increase the citrus commercialization in NE states and other parts of the country. Juice debittered from the developed device retained a significant amount of vital nutrients and it may be sensorily acceptable to the consumers. Mousambi and Pomelo juice was sufficiently debittered for commercial purposes using the device. This reduces the wastage of bitter citrus fruits and will boost the citrus industry. Thus, it is a very feasible technology for large-scale debittering of citrus juice in a short time and at economical costs.


For quantification of naringin and maturity determination of pomelo fruit
CAL.RESISTANCE
INPUT R= 1020
Varied surface area for debittering of juice

Chandantaru Dey Modak

Arvind Kumar

Dr. Abinash Tripathy

Development of Drop Impact Printing Technique: A Way Towards Clog Free Printing Technology

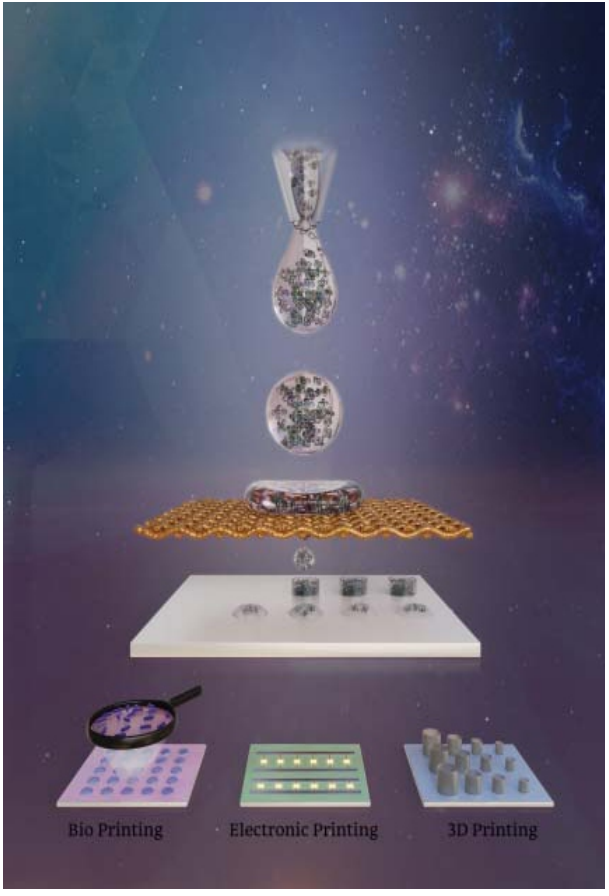
Chandantaru Dey Modak, Arvind Kumar and Dr. Abinash Tripathy
Indian Institute of Science, Bangalore

Guide:
Dr. Prosenjit Sen

Pursuit to accurately print microscale droplets is not new. However, with the advent of additive manufacturing and 3D bioprinting, research interest in this technology has been renewed. Newer applications demand the use of inks that are not well suited for conventional printers. For example, bio-printing requires dispensing live cells. The viability of cells is dramatically reduced by the thermal or piezoelectric actuation used in conventional printers. Further, printing inks with higher mass loading (i.e. larger quantity of particles or cells per droplet) is desirable but often results in clogging the nozzle. This remains a challenge that has not been addressed to date.

To address these challenges, we came up with a technique called "Drop Impact Printing (DIP)" that replaces conventional nozzle systems with a superhydrophobic sieve and prints droplets with very high accuracy. This unique breakthrough will resolve many printing fundamental problems such as generation of satellite drops, frequent clogging of printing nozzles, inability to print large beads/ particles, etc.

This technique is cost-effective, requires low maintenance, and can be accessed by a wide spectrum of fields. The cost of a single sieve (area 6 cm2) was approx. $9.4 which is very cheap when compared to existing printing nozzles (~$50). In terms of performance, the technique has a wide liquid property range and excellent resolution. The material palette is now broadened due to the ability to print large and dense beads. Additionally, we have tested this technique for different applications starting from bio-based to 3D microstructure printing. The 3D printed structures and large area droplet generations show the path of possibility for its use for such advanced applications.


Bio Printing
Electronic Printing
3D Printing

Jayapiriya U S

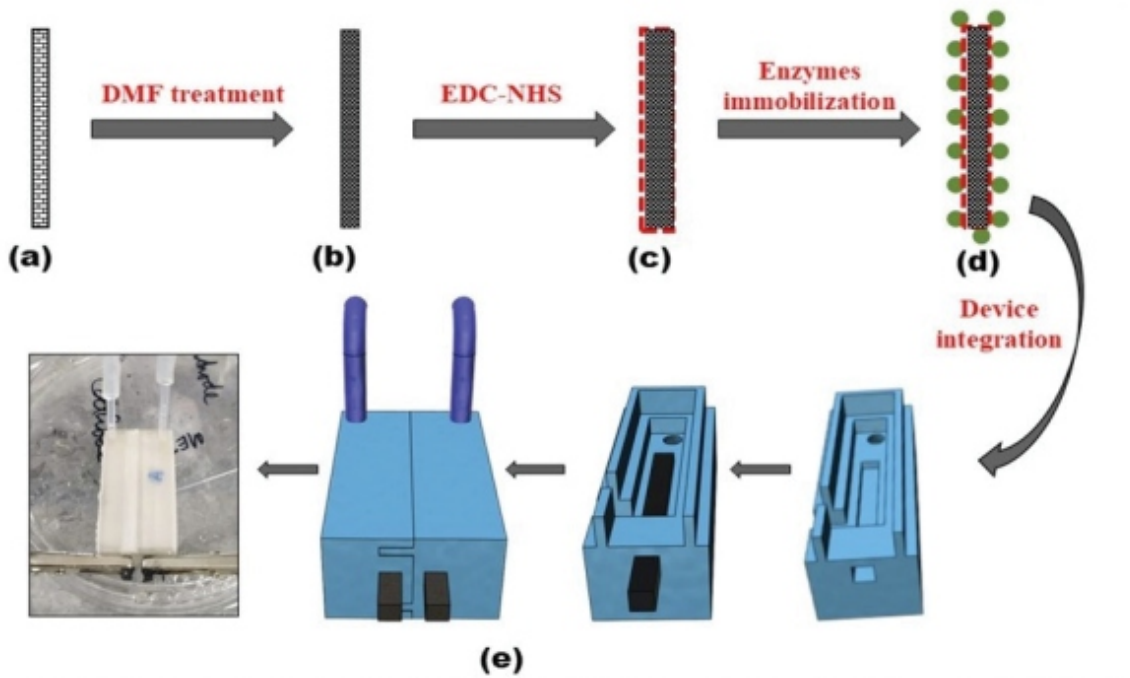
Development of Completely 3D printed Microfluidic Device with Reusable Bioelectrodes for Enzymatic Glucose Biofuel Cell Applications

Jayapiriya U S
Birla Institute of Technology and Science,
Pilani (Hyderabad Campus)

Guide:
Prof. Sanket Goel

Energy devices using electrochemical reactions are emerging as essential power sources, paving the way towards renewable and sustainable energy harvesting. Among various electrochemical energy devices, enzymatic biofuel cells (EBFC) are gaining huge attention due to the production of green energy using biocatalysts, such as enzymes and physiological fluids, as fuel. These devices are of prime importance because of their unique features, such as high energy density, biocompatibility, portability, and cost-effectiveness. But, there are some drawbacks such as precise and customized designing of devices at the microscale dimensions. This can be overcome by additive manufacturing techniques, such as fused deposition modeling (FDM) based on 3D Printing (3DP), to produce such custom-designed micro-devices using conductive filaments. This work delves upon demonstrating a completely 3DP microfluidic device prototype for the application of microfluidic EBFCs. Here, the electrodes, fabricated with conductive graphene/polylactic acid filament, were embedded in a miniaturized periphery fabricated with an ABS filament using a desktop 3D printer. Surface modification of the electrodes was accomplished using dimethylformamide (DMF), which was immobilized with the anodic and cathodic enzymes to develop the bioelectrodes. The microfluidic device was designed in a way that the device can be reused by inserting bioelectrodes into the respective compartments. The system was made membraneless by maintaining a co-laminar flow in the device by varying the device design parameters and flow rates of the electrolyte. The device was capable of generating a power density of 8.2 μW/cm2 with an open circuit voltage of 320 mV which is sufficient for a few biomedical applications like implantable devices. The work is underway to further enhance the performance by utilizing different conductive electrode materials.

Photograph of the prototype (High-resolution pic):



a) 3D printed electrode, b) DMF treated electrode, c) EDC-NHS coupling d) Enzyme bioelectrode, e) Integration of bioelectrodes into micro-device

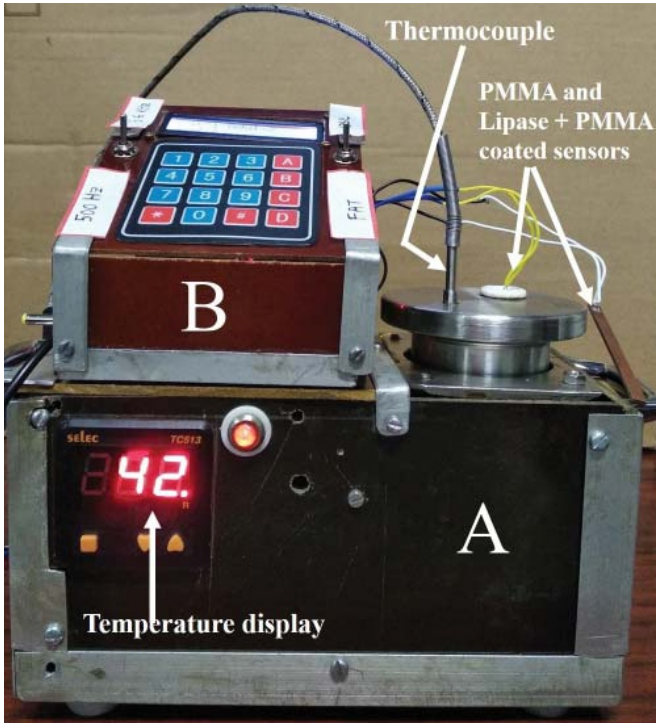
Moupali Chakraborty

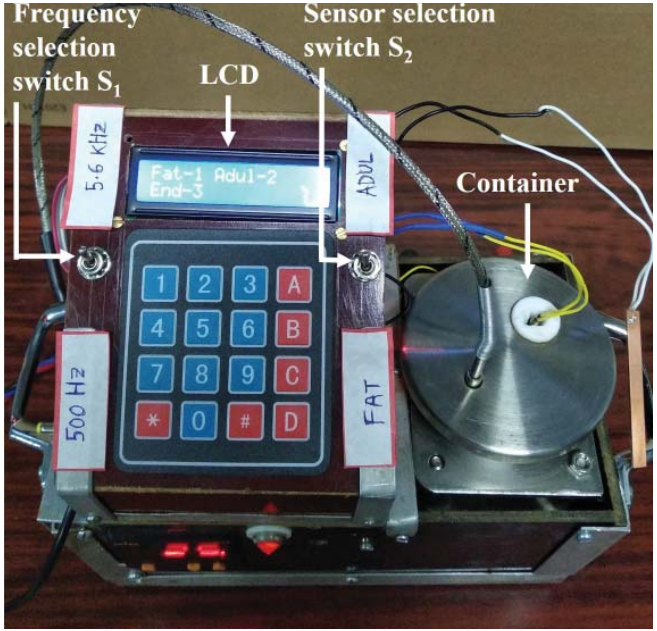
Design and Development of a Low-cost Milk Tester

Moupali Chakraborty
Indian Institute of Technology, Kharagpur

Guide:
Prof. Karabi Biswas

Milk and its by-products are highly nutritious foods that are consumed, processed, and marketed all around the world. However, they are at a higher risk of being contaminated in different stages of processing. Milk analyzers should determine the quality of milk by analyzing its purity and quantifying the presence of nutritional components in it. Most of the commercial milk analyzers measure the percentage of fat, SNF, protein, and lactose content of milk. Only three instruments are available to identify the adulteration in milk along with the fat, SNF, and protein; however, they are expensive and not suitable for the use of common people. In this context, this innovation aims to develop a 'Milk Tester' that can simultaneously determine the fat content and presence of adulterants in milk and is cheaper than the existing commercial milk analyzers. The 'Milk Tester' contains a polymethyl methacrylate (PMMA) coated adulteration detecting sensor and a lipase enzyme immobilized PMMA coated fat detecting sensor. The use of low-cost bio-compatible polymers makes the sensors inexpensive. The phase angle of the sensor impedance changes when they are dipped in different types of milk. The difference in phase angle between the milk and the reference solution is converted to a voltage by an interfacing circuit, where a microcontroller is programmed to display the quality and fat content of milk in LCD. The quality of the milk is shown as 'Adulterated Milk' or 'Pure Milk'; whereas the fat content is shown as 'LFM (low-fat milk)' or 'HFM (high-fat milk)' or 'VHFM (very high-fat milk)'. This `Milk Tester' does not involve any external chemical and no prior technical knowledge is required at the time of testing, which makes the instrument user-friendly.


Thermocouple
PMMA and
Lipase + PMMA
coated sensors
B
A
Temperature display


Frequency
selection
switch S_1
LCD
Sensor selection
switch S_2
Container
5.6 KHz
500 Hz
FAT
ADUL

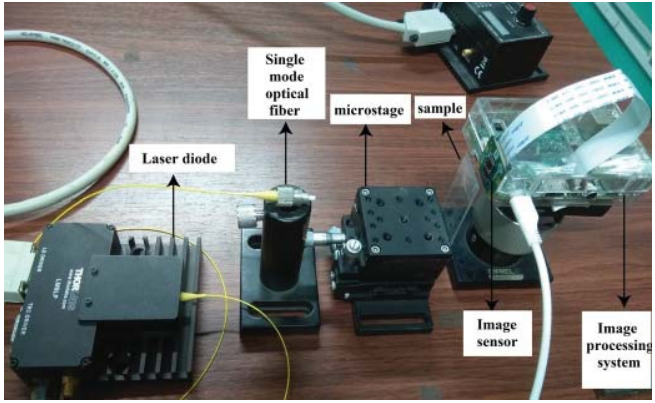
Sanjeev Kumar

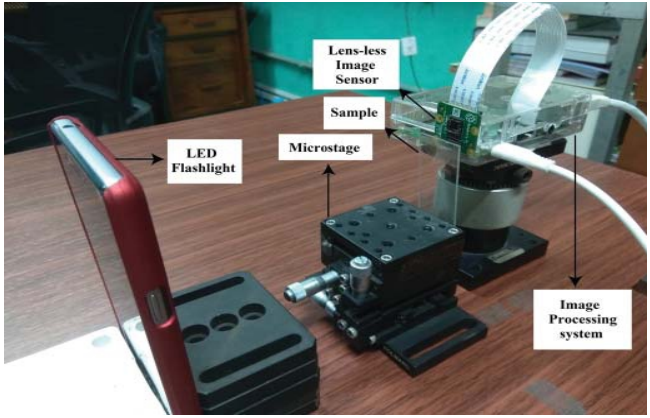
A Low Cost Pocket-Sized Digital Microscope

Sanjeev Kumar
Indian Institute of Technology, Kharagpur

Guides:
Prof. Pranab Kumar Dutta,
Prof. Manjunatha Mahadevappa

In this project, a low cost and highly compact optical microscope have been developed. The components of this microscope include a commonly available LED, an electronic image sensor (like the ones present in smartphone cameras), and a pocket-sized microcomputer raspberry pi. It does not contain any imaging lens, mirror, or any other expensive or bulky optical element of a similar kind, to focus the image or to improve the magnification. Therefore, it is completely an electronic/digital imaging technology. This particular feature makes this microscope compatible with the modern image acquisition, transmission, storage, and image analysis pipelines. This lensless microscopy methodology referred to as the lensless in-line holographic microscopy, exploits advanced image processing-based reconstruction algorithms to obtain high-resolution images from the wave-field data captured by the image sensor. The quality of reconstructed images is comparable to the images obtained in standard optical microscopes. The imaging area is several times larger than the standard optical microscopes and is limited by the sensor size and the illumination spot size. The multi-depth image reconstruction ability from a single-shot and similarly phase reconstruction ability from a single-shot are two advantages. Latter is useful in imaging transparent or nearly transparent samples such as unstained biological cells and tissues. The principles, methods, and claims have been thoroughly studied and validated through extensive numerical and bench-top lab experiments in this project. The developed microscope is suitable for telemedicine applications in remote areas. If this technology is commercialized, this pocket-sized optical microscope may find its way to every household like the digital cameras today. Its cheap and compact nature makes it a suitable candidate for the promotion of scientific curiosity and education.


Single mode optical fiber
microstage
sample
Laser diode
Image sensor
Image processing system


Lens-less Image Sensor
Sample
Microstage
LED Flashlight
Image Processing system

Point-of-care Spinning Disc for Complete Blood Count (CBC)

Rahul Agarwal, Arnab Sarkar, Arka Bhowmik and Devdeep Mukherjee
Indian Institute of Technology, Kharagpur

Guide:
Prof. Suman Chakraborty

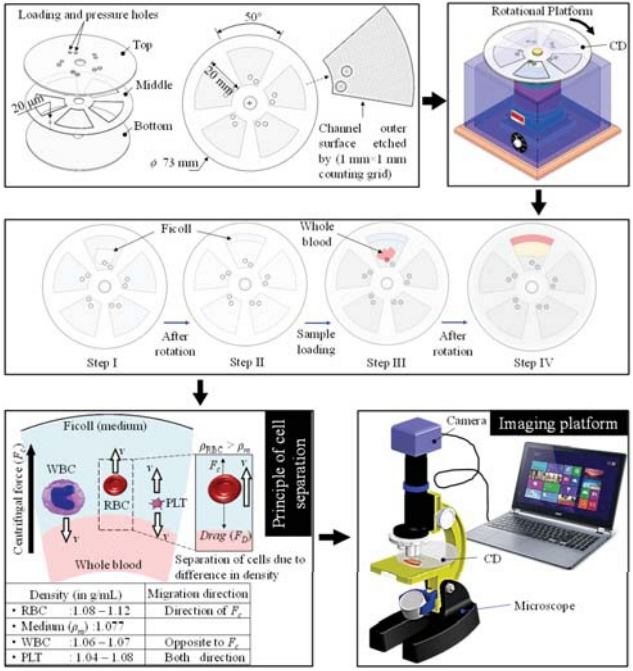
Rahul Agarwal

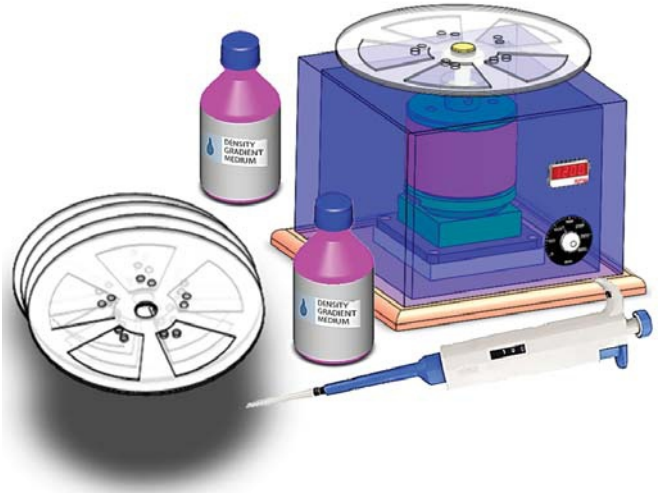
Arnab Sarkar

Arka Bhowmik

Devdeep Mukherjee

Complete Blood Count (CBC) is a collection of the most commonly required clinical data such as counts of Red Blood Cells, White Blood Cells, and Platelets, hematocrit, and hemoglobin measurement. It is often used in clinical settings to diagnose and/or monitor the state of infection, or progression of any existing pathological condition. For example, an abnormal increase of leukocytes may indicate a general state of infection or the presence of cancerous cells in the body. Similarly, an abnormally low number of red blood cells indicates anemic condition, and a high number of platelets can lead to conditions such as clot formation, stroke, and heart attack. Apart from that, total white blood cell count could reveal pathological states such as the presence of common parasitic, bacterial and viral infections, and also assist in monitoring the side-effects of chemotherapy and immunodeficiency syndromes. The existing laboratory methods for this test are quite sophisticated and require a trained person to operate often prohibitively expensive machinery. Additionally, the machinery is not easily portable thereby restricting the accessibility of such pathological laboratories. The proposed innovation overcomes the above issues of high cost and portability by using a plastic compact disc that contains microchannels for blood transport. It is spun on a basic motor setup. The basic principle of density-based cell separation is employed in separating the cells in physically well-defined locations with the help of a polymeric solution (Ficoll). Once the cells are separated, the microscopic images are captured and processed through an image analysis algorithm that provides the components of the CBC test. The measured values are benchmarked against the data obtained from an Automated Hematology Analyzer (AHA) with an accuracy >95%.


Loading and pressure holes
Top
Middle
Bottom
20 μm
50°
30 mm
ϕ 73 mm
Channel outer surface etched by (1 mm×1 mm counting grid)
Rotational Platform
CD
Ficoll
Whole blood
Step I
After rotation
Step II
Sample loading
Step III
After rotation
Step IV
Ficoll (medium)
Centrifugal force (F_c)
WBC
RBC
PLT
Drag (F_D)
Whole blood
Separation of cells due to difference in density
Principle of cell separation
Density (in g/mL) | Migration direction
• RBC 1.08 – 1.12 | Direction of F_c
• Medium (ρ_m) 1.077
• WBC 1.06 – 1.07 | Opposite to F_c
• PLT 1.04 – 1.08 | Both direction
Camera
Imaging platform
CD
Microscope


DENSITY GRADIENT MEDIUM
DENSITY GRADIENT MEDIUM

Mukesh Bajya

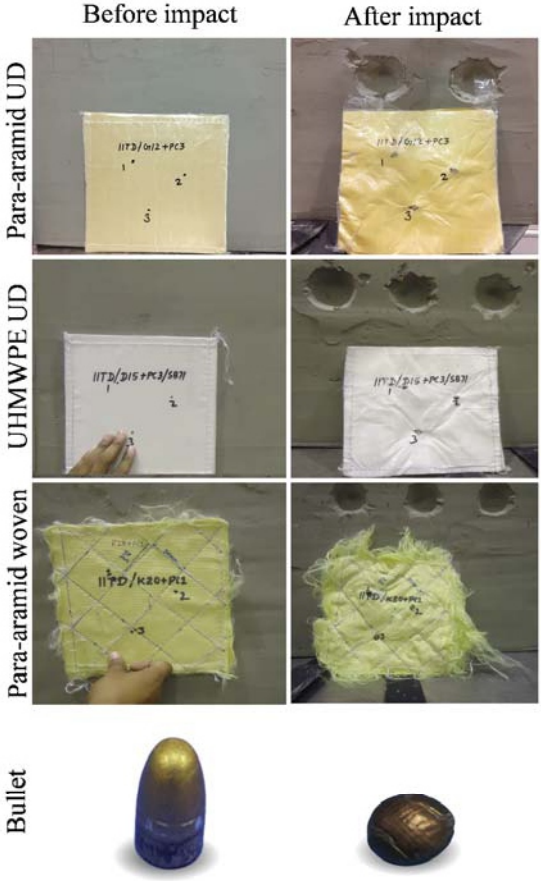
Unsanhame Mawkhlieng

Development of Light Weight Cost Effective Soft Body Armour using Indigenous Technology

Mukesh Bajya and Unsanhame Mawkhlieng
Indian Institute of Technology, Delhi

Guides:
Prof. Abhijit Majumdar,
Prof. B. S. Butola

This research provides an avenue to reduce the dependence on imported high-performance fibrous materials used in soft body armour without compromising the protection level. It demonstrates the application of an indigenous material (polycarbonate sheets) and native technology (compressed unidirectional laminates) that can be used as backing substitutes in a soft armour panel (SAP). Ballistic materials in the form of unidirectional (UD) laminates and woven fabrics were used at the strike face in combination with the new backing material alternatives. Two sets of SAPs were prepared- the first set of para-aramid structures and the second of ultra-high molecular weight polyethylene (UHMWPE). The areal density of all panels was constant (4.5-4.6 kg•m-2). The SAPs were evaluated for back face signature (BFS) against 9×19 mm bullets. It was found that all SAPs backed with the new materials outperformed the homogenous panels made completely with high-performance fibre materials. Both the para-aramid and UHMWPE panels backed with the compressed sheets of UHMWPE UD resulted in BFS of ~28 mm which is much lower than 44 mm (NIJ0101.06). SAPs backed with polycarbonate sheets (PC) resulted in even better performance, both in terms of BFS (up to 26.7 mm) and cost reduction. PC backing yielded 27% and 12-13% lower BFS with para-aramid plain-woven and UHMWPE UD laminates as striking faces, respectively. SAPs assembled from woven fabric or UD laminates backed with PC demonstrated superior ballistic performance in terms of BFS because of lower transverse deflection. The highlight of this research is the staggering cost reduction of 38% with the use of 40% indigenous materials while maintaining the same ballistic performance.


Before impact
After impact
Para-aramid UD
UHMWPE UD
Para-aramid woven
Bullet

GYTI awards
are a symbol of
extremely affordable
excellence

SITARE - GYTI 2021 APPRECIATION

Jannu Rajeev Naren

A low-cost Automated Bone Mill for Delivering Graft Particles of Definite Sizes

Jannu Rajeev Naren
S V S Group of Institutions, Mahabubnagar

Guide:
Dr. R. Viswa Chandra

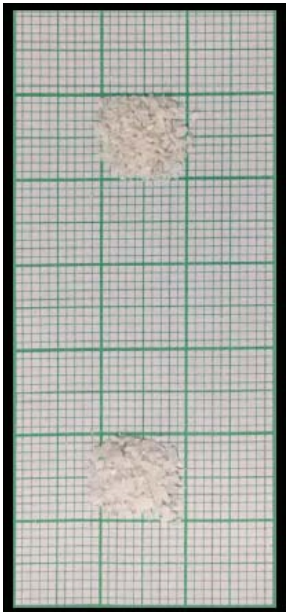
Harvesting and milling of bone substitutes is an instrument-dependent procedure. High and low-speed burs, hand chisels with the mallet, rongeurs, trephine burs, and piezosurgery have been used to collect sufficient amounts of bone from different anatomic locations. Different techniques yield grafts of varying particle sizes; at around 3-4mm, particles harvested using hand chisels are the largest and most inconsistent whereas graft particles obtained by use of high and low-speed burs are within the range 0.3-0.5 mm. The bone-forming ability is again dependent on the particle size. Depending on the size, location, and nature of the defect, particle sizes ranging from 150-600 μm to 1-2 mm are considered essential for vascularization, graft incorporation, and subsequent bone formation.

The optimum particle size however is 75-500 μm, 0.9 to 1.7 mm, 0.75-1 mm, and 250 to 650 μm for tooth-derived grafts, block allografts, xenogeneic grafts, and alloplastic blocks respectively. A device to generate grafts of different particle sizes from different materials will be a welcome addition to a dentist's arsenal, and in this context, an automated milling system capable of generating particles in two definite sizes was developed.

An automated milling system was constructed in surgical-grade stainless steel to generate graft particles between 0.5-0.8 mm and 1.0-1.2 mm. Briefly, the device has two rings (diameter: 50 mm; distance: 3 mm) of flat burrs mounted perpendicularly to the long axis, and varying the RPM enables to cut a bone substitute to precise particle size. The device was able to generate small and medium-size graft particles that can be adapted for a myriad of materials and protocols and aim to be a promising addition to the bone graft armamentarium.

Initial Prototype of the Device

The Mouth of the Device



Chandan Kumar Jha

An Intelligent Hand Rehabilitation and Assessment System for Stroke Patients

Chandan Kumar Jha
Indian Institute of Technology, Gandhinagar

Guide:
Dr. Arup Lal Chakraborty

This project aimed to develop a highly sensitive and robust fiber-optic glove that could track hand movement with very high accuracy. The glove can measure fine finger movements with a resolution of 0.1° and an accuracy of less than 1°, which will enable doctors to monitor a patient's recovery and appropriately modify the treatment regimen. The glove uses fiber Bragg grating (FBG) sensors that are known for reliability, accuracy, high sensitivity, and immunity to electromagnetic interference (EMI) to measure finger movements. Also, calibration of the developed glove is straightforward which makes it easy to use. This is due to the remarkably linear input-output characteristics of the FBG sensor. The glove gives accurate values of the finger bend angle even when it is worn by an individual who is incapable of fully stretching out the hand while wearing the glove. The performance of the glove has been rigorously tested and reported in esteemed journals and conferences. A virtual hand rehabilitation system has been designed using the glove for stroke patients to make rehabilitation a fun and engaging activity for stroke patients. The device could enable the quantitative assessment of recovery progress, helping doctors to assess the patient and suitably customize the therapy. Such a system could play an important role in making rehabilitation services accessible to rural and resource-poor areas. Furthermore, the glove will also find use in biomedical research studies, and the virtual reality gaming and simulation industry.


BACK
FLAT
FLEX
smart fibres
SmartScan
Dynamic FBG Interrogator

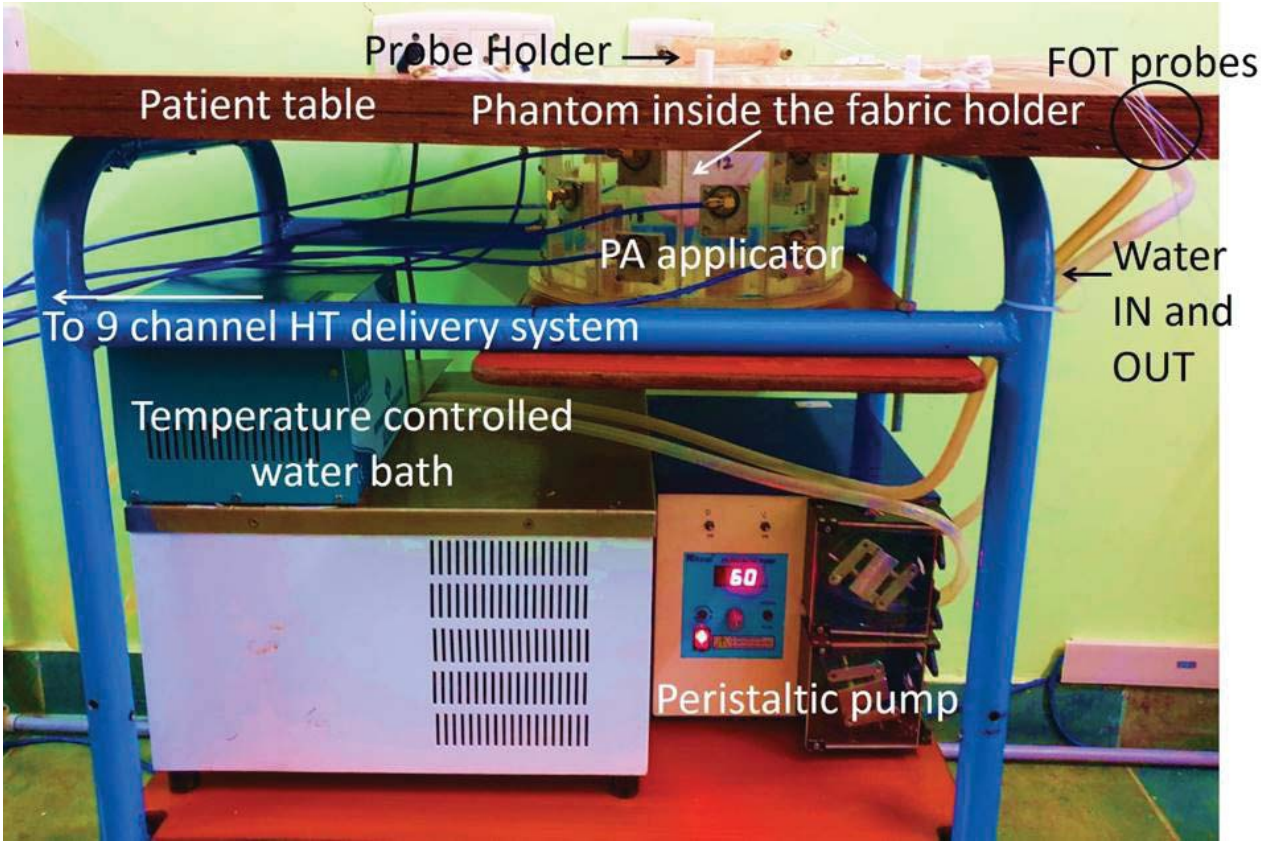
Divya Baskaran

Design and Development of Phased Array Applicator for Hyperthermia Treatment of Locally Advanced Breast Cancer

Divya Baskaran
Indian Institute of Technology, Madras

Guide:
Dr. Kavitha Arunachalam

Breast cancer accounts for 25% of all cancers in Indian women and the 5-year survival rate of advanced breast cancer is only 22%. The poor survival rate is due to the late stage at diagnosis and lack of effective treatment regimens. Hyperthermia treatment (HT) is one of the best adjuvant techniques, with no adverse side effects and late toxicities. It involves the elevation of the cancer cells to 39-44°C for 60 minutes. HT delivery system consists of an array of antennas mounted externally in a cylindrical fashion surrounding the pendant breast called phased array (PA). The important aspects in PA applicator design are i) optimal applicator configuration for electronic beam steering inside the heterogeneous breast and ii) optimization algorithm for determining the PA excitation to selectively deposit microwave power at the tumor while sparing the healthy tissues. In the proposed work, an 18-channel PA was constructed by optimally arranging 434 MHz cavity-backed antennas. Furthermore, a multi-objective optimization algorithm was proposed for HT planning to deposit > 4 times more power at the tumour than the healthy tissues. PA channel power was reduced by 50% for the proposed applicator and optimization algorithm compared to the state-of-the-art (SoA) HT planning technique, which led to the development of an affordable HT system. The performance of the PA applicator and HT planning algorithm was experimentally verified on 3D breast phantoms mimicking the thermal and dielectric properties of human breast tissues. The localized temperature rise of 5.5-6.55°C was measured at varying target locations inside the breast phantoms without overheating the healthy tissues. Targeted tissue heating demonstrated for the fabricated PA applicator using an affordable HT delivery system appears encouraging and efforts are underway for developing a clinical device.


Probe Holder
FOT probes
Patient table
Phantom inside the fabric holder
PA applicator
Water
IN and
OUT
To 9 channel HT delivery system
Temperature controlled
water bath
60
Peristaltic pump

Sujay Kumar Biswas

Nucleic Acid Testing Based Low Cost Portable Rapid Diagnostic Device for Detecting Viral Pandemic Infection at the Community Level: from Saliva to Solution

Sujay Kumar Biswas
Institute: Indian Institute of Technology, Kharagpur

Guide:
Prof. Suman Chakraborty

We develop a portable, affordable, sample-to-answer point-of-care (POC) diagnostic device for the rapid detection of pathogen-associated nucleic acids in potentially infected patients, producing test results commensurate with the widely accepted gold standard results of RT-PCR. The overall execution is simplified via piecewise isothermal steps as opposed to complex thermal cycling needed in a real-time PCR machine, followed by colorimetric detection via smartphone integration. The generic portable device disseminating the test comprises a pre-programmable thermal control unit and a colorimetric detection unit, synchronously interfaced to execute the sequence of reactions, including a specific DNA probing step post the backbone nucleic acid amplification reaction, via a single user-step sample dispensing without intermediate operative intervention. We have demonstrated the efficacy of the test in detecting SARS-CoV-2 viral infection from 200 patient samples in a double-blinded validation process conducted at the Indian Council of Medical Research (ICMR)-NICED, exhibiting high sensitivity and specificity. The test procedure has further been simplified to eliminate any formal RNA extraction step, achieving a direct sample to result in integration within 45 minutes. The generic nature of the portable device unit, as well as the detection principle, renders our innovation as a platform technology that empowers molecular diagnostics to remain efficiently functional when brought outside the ambit of specialized labs to resource-limited settings. Further, the generalization of the approach renders its potential applicability in detecting a plethora of pathogenic infections, inclusive of, but not limited to COVID 19, in an affordable paradigm, with nucleic acid as the detection target. Further, the generic nature of the detection unit renders it to offer a stand-alone platform for colorimetric detection in other types of tests, including rapid antigen and rapid antibody tests, where thermal processing may not be required.

Other Contributors:
Saptarshi Banerjee, Nandita Kedia, Subhanita Roy, Ranjini Chowdhury, and Sohom Banerjee


COVIRAP
IITKGP

Govindkumar Balagannavar

A Diagnostic Kit to Minimize Risks from the Micro-TESE Procedure While Differentiating Nonobstructive vs. Obstructive Azoospermia

Govindkumar Balagannavar
Institute of Bioinformatics and Applied Biotechnology, Bangalore

Guide:
Prof. Kshitish K Acharya

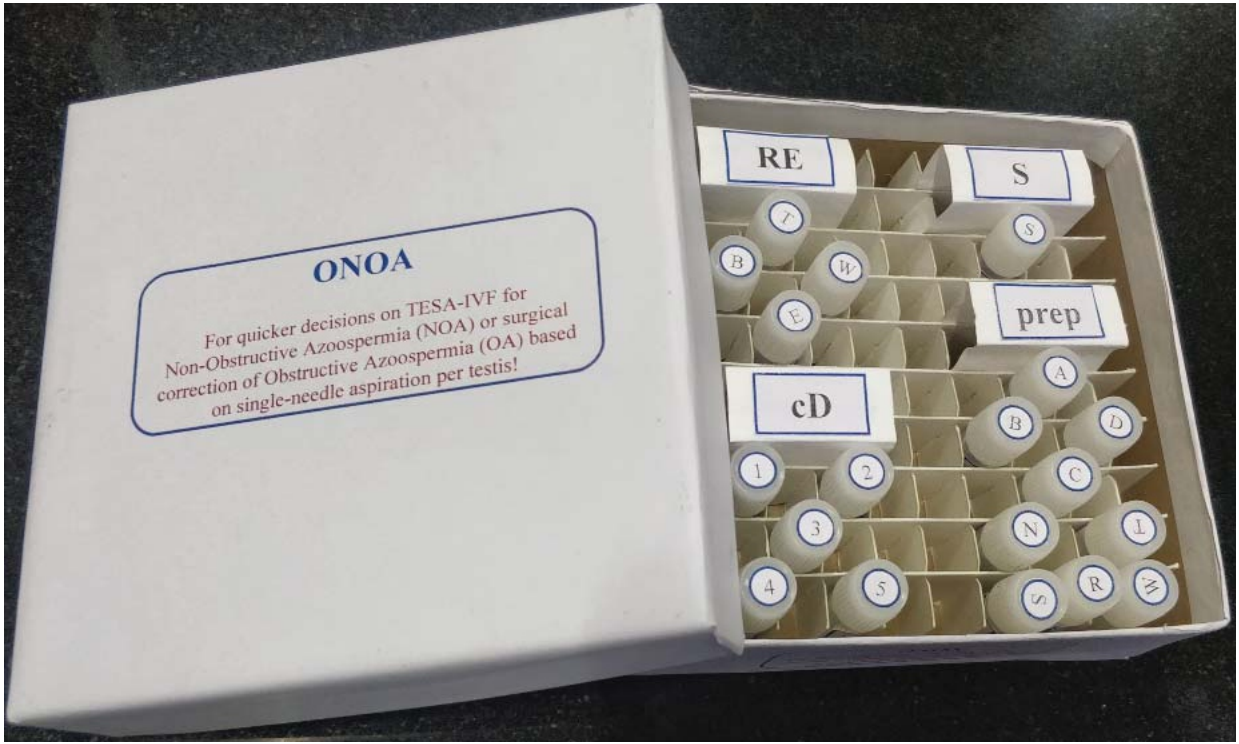
Azoospermia, a male infertility condition, is of two types: Obstructive Azoospermia (OA) and Non-obstructive Azoospermia (NOA). The latter is difficult to manage clinically. Distinguishing NOA vs. OA has not been optimal (hormone profiles are not enough). The only hope for NOA patients to be genetic fathers requires a very complicated, expensive procedure (microTESE) for sperm retrieval, which often fails.

RT-qPCR- and array-based assays hold promise, provided reliable markers are developed first. My research with a team in IBAB has helped to develop such an assay. This assay and the associated product, a diagnostic kit, can minimize the suffering of the patient and save time for health professionals. My objective is to finalize a prototype of the RT-qPCR-based diagnostic assay, obtain wider approval for a refined kit, and initiate commercialization.

Work so far: We used NGS and sequenced RNA from the NOA and control testicular samples and applied a new computational method for transcriptomic analysis to shortlist the important transcripts with significant differential expression in the NOA condition. Of the short-listed 87 potential marker transcripts, 19 showed consistent differential expression across all the samples considered. A final patent application is under consideration.

We developed an RT-qPCR-based assay and tested it with multiple clinical samples. Many urologists and reproductive clinicians have shown high interest in its application. A prototype was also developed. But the suggestions received by such physicians have prompted us to test samples from more clinical centers to develop the assay into a kit that can be used by multiple diagnostic labs across the country. Both the steps will enhance the acceptance rate of the assay developed into a prototype so far.

Other Contributor:
Kavyashree Basavaraju


ONOA
For quicker decisions on TESA-IVF for Non-Obstructive Azoospermia (NOA) or surgical correction of Obstructive Azoospermia (OA) based on single-needle aspiration per testis!
RE
S
prep
cD

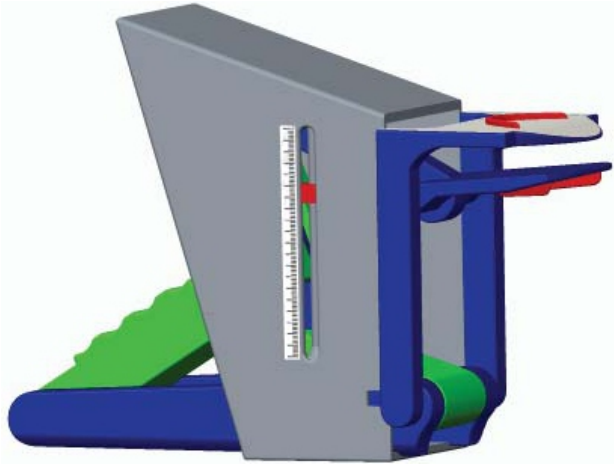
Priyanshu Raj Shrivastava

Design and Development of Post-Surgical Rehabilitation Device for Temporomandibular Joint Disorder Patients

Priyanshu Raj Shrivastava
Indian Institute of Technology, Jodhpur

Guide:
Dr. Kaushalkumar Ashokbhai Desai

TMJ-hypomobility or Trismus is the restricted jaw movement due to any infectious, traumatic, or neoplastic cause. In India, Oral submucous fibrosis (OSMF) and TMJ-Disorders, especially ankylosis, are the most familiar reasons for prolonged restricted mouth opening due to jaw overuse, patients undergoing radiation therapy, or any TMJ surgery. The jaw rehabilitation devices serve the purpose of exercising and rehabilitation of jaw for Trismus patients. Still, existing solutions have multiple functionality issues and are highly inadequate to meet the requirements of an ideal jaw rehabilitation device. The invention presents a novel device designed with unique features after rigorous research work and clinical discussions. It eliminates the demerits of the existing devices and is intended to increase muscle mastication strength (masseter-muscle, temporalis-muscle, medial and lateral pterygoid muscle), helping the rehabilitation of TMJ patient mobility. A majority of the population in India consumes tobacco, gutka, and paan-masala products; hence the number of Trismus patients is exceptionally higher. The device is designed to be used as a rehabilitation and therapeutic (preventive) device. It is compelling to post-surgery patients and individuals feeling discomfort or minor issues during mouth opening. It extends to the patient's group suffering from cervical and neck pain as the muscles associated with the jaw are interconnected to these areas. An effective jaw rehabilitation device will serve well to these groups. The device requires minimal user training, and the patient can employ the device without medical supervision. This device bridges a significant gap between an ideal rehabilitation device and existing solutions from functionality and cost-effectiveness.



Ashutosh Tiwari

Ultra-Low Cost Instrumented Foot Pressure Insole for Gait Rehabilitation in Locomotor Dysfunction Among Differently-abled and Other Clinical Populations

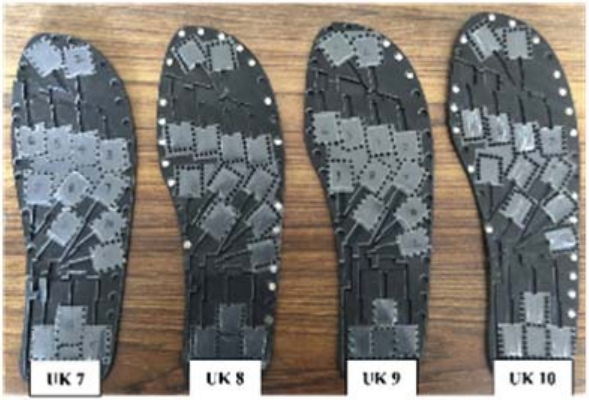
Ashutosh Tiwari
Indian Institute of Technology, Delhi

Guide:
Dr. Deepak Joshi

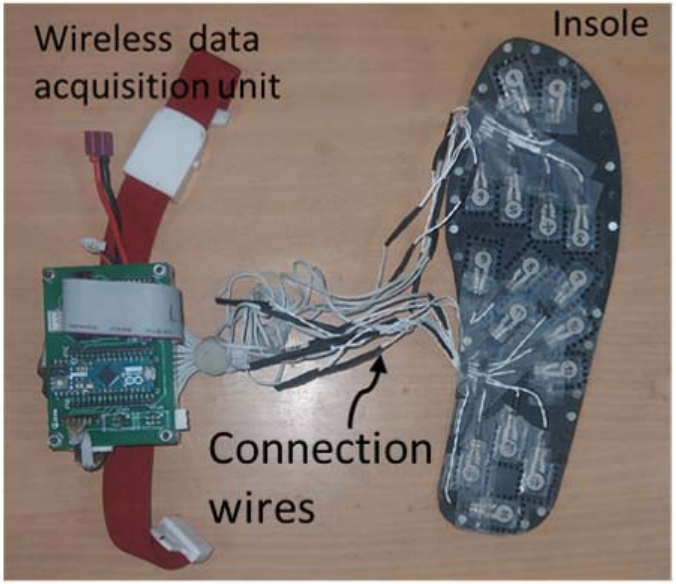
Disorders affecting human walking and balance are closely related to nervous system impairment. The common disorders include Paralysis, Parkinson's, Multiple Sclerosis, and Cerebral Palsy. Moreover, peripheral diabetic neuropathy and physical trauma are the other major causes of compromised balance and walking. Quantitative measurement of foot pressure profile during walking and balancing helps in gait rehabilitation, providing real-time biofeedback strategies to recover neuronal impairment at the brain and spinal cord level to regain walking and balance.

The current innovation relates to the design and development of ultra-low-cost multiple-foot sizes pressure insoles for plantar pressure measurement. This insole facilitates real-time data collection in the free-walking environment using Bluetooth wireless technique. Unlike commercially available insoles such as Pedar (Novel, Germany) and F-Scan (Tekscan, USA) which are manufactured by prefabricating pressure sensors on a flexible substrate, we developed an insole template for various foot sizes that consist of 16 slots mapped to critical pressure points of the foot for sensors placement. These slots facilitate the seamless replacement of a single bunch of 16 sensors among different insole templates, thus eliminating the extra cost involved in the prefabrication of the sensors for each size separately.

The insole template was developed based on three-layer architecture. Each layer was made of flexible polyvinyl chloride (PVC) sheet materials of different thicknesses, which are non-compressive but provide a flexible substrate. It ensures accurate reflection of the plantar pressure applied to the force-sensitive resistor without being absorbed within the substrate. The low cost and easy availability of these PVC sheets make them a suitable candidate in low-resource settings. This massive cost-cutting in price will benefit and attracts customers from small clinics, research organizations, hospitals, and personal home-based monitoring.



Insole template



Developed insole system

Surjendu Maity

Microfluidic Immunosensor for Point-of-care-testing of Beta-2-microglobulin in Tear

Surjendu Maity
Indian Institute of Technology, Guwahati

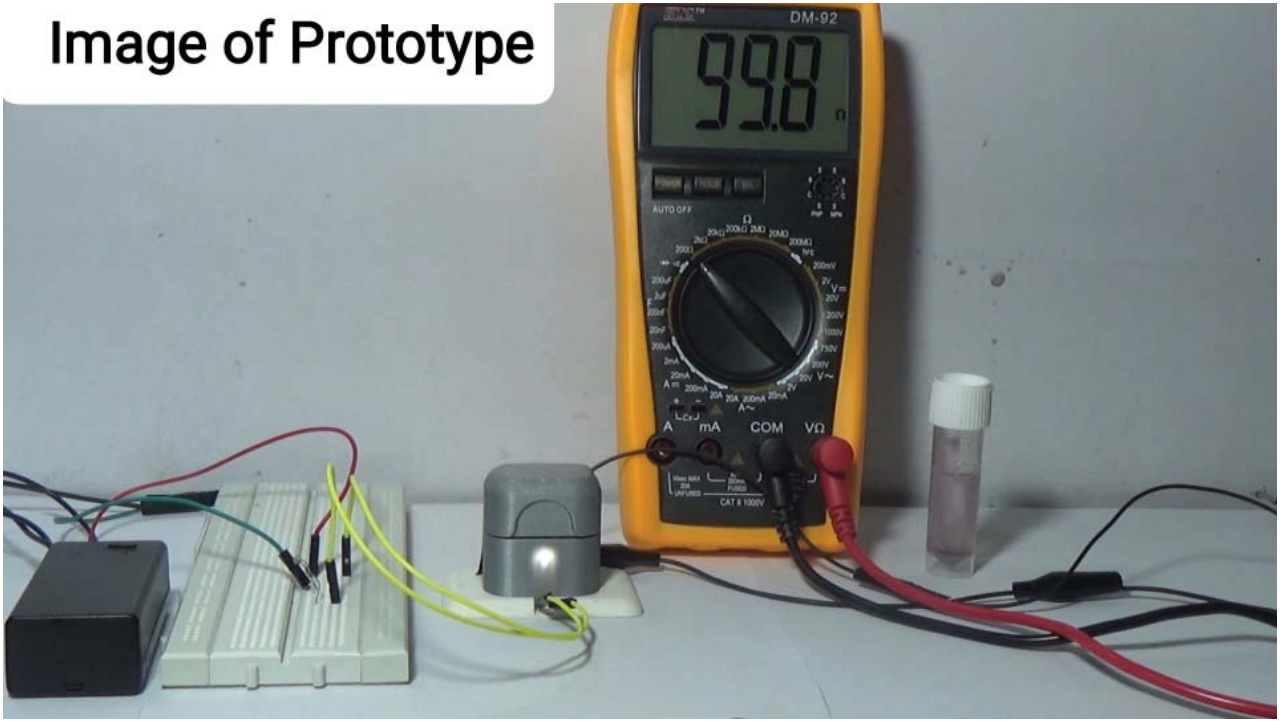
Guides:
Prof. Dipankar Bandyopadhyay
Dr. Dipankar Das

Recent studies reveal that ~25% of the diabetes mellitus affected patients can have Diabetic Retinopathy (DR). The symptoms of DR comprise blurry or fading vision with a poor night vision, ultimately leading to blindness. Presently, methods for diagnosis of DR like optical coherence tomography, fluorescein angiography, detection of exudates in the retina, image analysis using machine learning tools, etc. are not easily accessible, non-portable, and expensive. Thus, for the early and non-invasive detection of DR, we have developed an affordable, reliable, portable, and accurate microfluidic POCT device for detecting B2M in human tear, the composition of which is an aqueous suspension of gold nanoparticles (AuNPs) coated with anti-β-2-microglobulin(anti-B2M) antibody using a linker, 3,3'-dithiodipropionic acid (n-hydroxysuccinimide ester) (DTSP). The suspension shows a specific color due to the localized surface Plasmon resonance (LSPR) of the AuNP-DTSP-anti-B2M composite when placed inside a specially designed transparent glass microfluidic cuvette. The tear is collected using a micropipette before mixing the same with the aqueous suspension of AuNP-DTSP-anti-B2M composite in a microcuvette for the antigen-antibody reaction, followed by inserting the same into the device for detecting B2M. The B2M undergoes a particular epitope-paratope reaction with the anti-B2M stabilized on the AuNPs leading to the agglomeration of the AuNPs. The color of the AuNP-DTSP-anti-B2M solution is changed due to the redshift in the LSPR signal.

The measurement of this variation is done by integrating a combination of a light source and a light-dependent resistor (LDR). The data obtained by calibrating the resistance of LDR with varied known B2M loading are employed to detect the unknown B2M level in tear. This prototype has shown significant potential to translate into an affordable diagnostic device for the early and real-time detection of eye disorders.

Other Contributors:
Subhradip Ghosh and Tamanna Bhuyan

Image of Prototype



Parag Jain

Processing of Citrus Limetta Seeds as Industrial Waste into Acaricidal Agents for Controlling Cattle Tick

Parag Jain
Columbia Institute of Pharmacy, Raipur

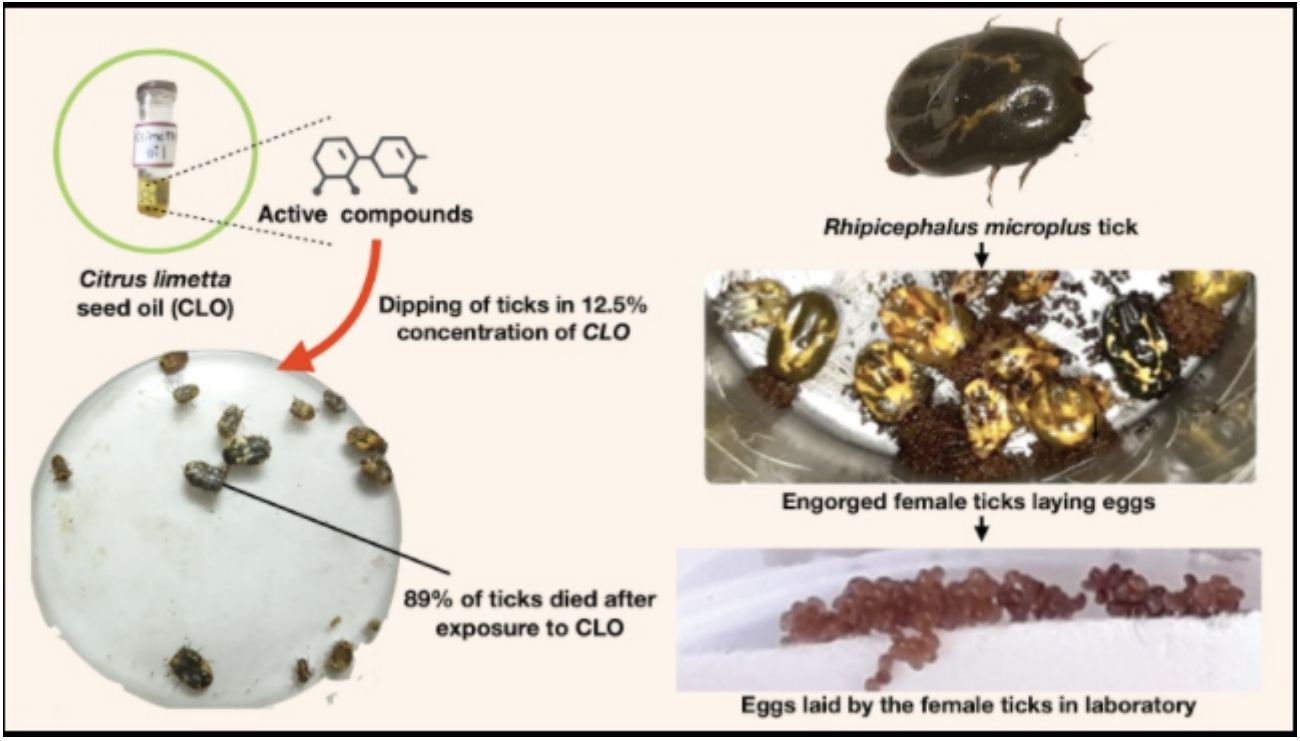
Guides:
Dr. Ravindra Kumar Pandey
Dr. Trilochan Satpathy

Livestock farming is a prime source of livelihood in the rural economy of India, and infestation of ticks causes serious problems with it. Tick and tick-borne diseases have become a major risk factor for the world's cattle population. Ticks impose a heavy health burden on animals; directly by causing damage to leather, weight loss, blood loss and decreases milk production; and indirectly by transmitting tick-borne pathogens. Due to frequent and indiscriminate use of chemical acaricides, the ticks have developed a remarkable resistance ability to almost all classes of synthetic chemicals including organophosphates, amidines, macrocyclic lactones, fipronil, pyrethroids, and carbamates. Therefore, researchers have been trying to find some effective and safe alternatives to conventional synthetic drugs.

Indian traditional system of medicines are ancient and possesses significant ethnopharmacological relevance in which medicinal plants have been used for the treatment of several diseases and disorders. *Citrus limetta* Risso commonly known as Mosambi in India belongs to the family Rutaceae. It is an extremely valued herb due to its nutritional property and medicinal use. *C. limetta* fruits are majorly used in juice processing industries; however, the seeds, pulp, and peel are thrown as waste products.

C. limetta seed oil (CLO) was found effective in controlling cattle tick *Rhipicephalus microplus*. CLO showed significant acaricidal activity by causing the mortality of larvae and adult ticks. It reduced the hatching ability of eggs, reproductive index, and oviposition rate of female ticks. CLO was effective on topical application and did not cause any irritation of the skin. Thus, since the daily application of CLO may not be a practical approach, its nanoformulation is an understudy looking for the development of a suitable acaricidal formulation with a longer residual period to control R. microplus.

Other Contributor:
Dr. Akanksha Jain


Active compounds
Citrus limetta
seed oil (CLO)
Dipping of ticks in 12.5%
concentration of CLO
89% of ticks died after
exposure to CLO
Rhipicephalus microplus tick
Engorged female ticks laying eggs
Eggs laid by the female ticks in laboratory

Falguni Pattnaik

Technological Transformation of the Integrated Biomass Conversion Process in the Rural Context for the Production of Handmade Paper from the Locally Available Common Reed *Phragmites karka* in Chilika Lake of Odisha

Falguni Pattnaik
Indian Institute of Technology, Delhi

Guides:
Dr. Satyanarayan Naik
Dr. Vivek Kumar

Phragmites karka comes under the class of invasive species that grows in wetlands of Chilika Lake covering 400-450 sq. km area of the Chilika Lake and creating various socio-ecological problems. In the eradication of this species, various chemical and mechanical processes could not hinder the rapid invasion of Phragmites. Therefore, the best way is to utilize this lignocellulosic biomass to produce platform chemical and cellulose fibre; and wastewater remediation. In this project, our purpose was to develop a three-stage integrated process to utilize the biomass in an environmentally and economically sustainable way, which comprises of a three-stage process, wherein first stage, the hemicellulose moiety of the biomass was hydrolyzed by the subcritical water into soluble sugars. These soluble sugars can be converted into various platform chemicals (e.g. furanics) by using solid acid catalysts. In the third stage, isolation of cellulose fibre from the solid residue obtained from the subcritical hydrolysis was performed using a minimal amount of sodium hydroxide (0.5M) and hydrogen peroxide (0.5-3%). In this process, cellulose yield was found to be 35% with almost removal of other non-cellulosic components (hemicellulose, lignin, and extractives). The inclusion of subcritical water has increased the greener perspective of the process by minimizing the harmful chemicals. Furthermore, in the second phase of the project, the lab-scale methodologies can be simplified in a rural context, so that the developed technologies can be adopted by the rural people for the production of cellulose fibre and related products like handmade paper. In this phase, some Self Help Groups can be constituted by the housewives and unemployed men from the local areas of the northern and north-western coast of Chilika Lake to execute the project.

Phragmites karka

Untreated Biomass

Subcritical Water (SbCW) Hydrolysis

- Temperature = 170°C
- Pressure = 35 Bar
- Time = 30 min
- Feed to Water Ratio = 1:50

SbCW Hydrolyzed Biomass

Pulping and Bleaching Processes

- Pulping @ 0.5 M NaOH
- Bleaching @ Alkaline H_2O_2 Solution (0.5-3%)

Cellulose

Starch as binder

Handmade paper

Swetha Menon

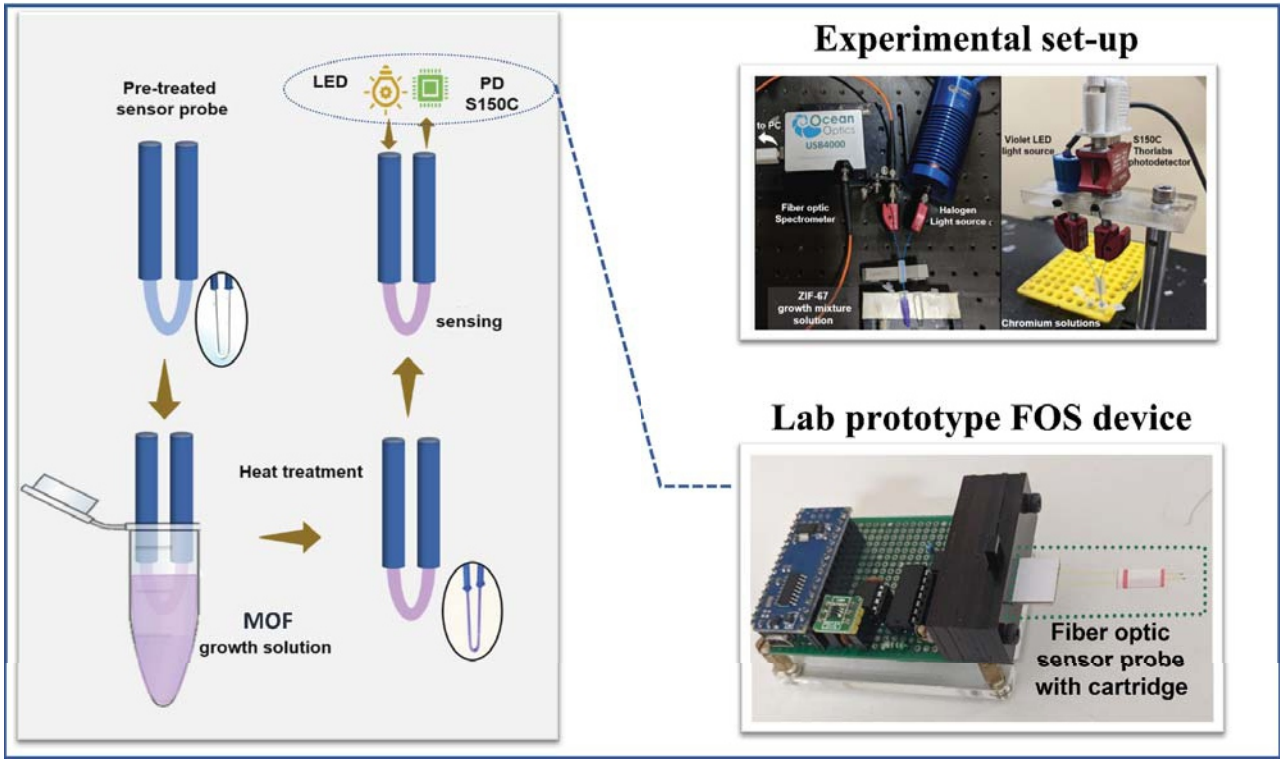
A Point-of-Care Device for Heavy Metal Ion Detection in Body Fluids

Swetha Menon
Indian Institute of Technology, Madras

Guide:
Dr. V. V. Raghavendra Sai

Heavy metals are known to cause toxic effects in humans, even at very low concentrations. The detection of heavy metals at an ultra-dilute concentration in drinking water as well as bodily fluids such as blood and urine are vital. To detect parts-per-billion levels of these heavy metals, the current technologies available are ICP-MS, ICP-AES techniques which offer highly sensitive detection limits of concentration as low as parts per trillion. However, these techniques involve the use of expensive sophisticated instruments and must be operated with trained personals, and it also requires time-consuming, tedious sample preparation procedures, and even a single test costs more than 100$. There comes the need to develop a chemical or biosensor, which embarks the necessity to make it a hand-held field-deployable device. Here, we established a fiber optic absorbance-based chemical sensor coated with specific metal-organic frameworks (MOFs) as a potential probe which is highly selective for heavy metal ions (Cr^{6+}, Cu^{2+}, Pb^{2+}) detection in water. The sensor probe was able to detect Cr^{6+} ions down to 1 ppb, where the WHO guideline detection limit in drinking water and blood serum level is 50 ppb and 1.4 ppb, respectively. The selectivity of the chromium ions over other metal ions shows that even fifty times interference from other ions will not affect the sensor performance. Further, the development of this sensor into a field-deployable device using a simple LED-PD home built set-up. This work can further be extended into subsequent phases, which consist of the body fluid tests for chromium, and other heavy metals such as lead and copper. Thus, the U-bent optical fiber platform assures the sensitive and cost-effective sensor units to be fabricated for field analysis.

Other Contributor:
Ratan Kumar


Pre-treated
sensor probe
LED
PD
S150C
sensing
Heat treatment
MOF
growth solution
Experimental set-up
to PC
Ocean Optics
USB4000
Fiber optic
Spectrometer
Halogen
Light source
ZIF-67
growth mixture
solution
Violet LED
light source
S150C
Thorlabs
photodetector
Chromium solutions
Lab prototype FOS device
Fiber optic
sensor probe
with cartridge

Rathin Joshi

Neonatal Hearing Screening Headband for Brainstem and Cortical Response Extraction

Rathin Joshi
Indian Institute of Science, Bangalore

Guide:
Dr. Hardik J Pandya

Hearing Deficit is the most prevalent neonatal, chronic sensory deficit. The prevalence of congenital bilateral permanent hearing loss is 1 to 5 per 1000 live births in well-baby nurseries and 2 to 4 per 100 infants in neonatal intensive care units' babies. More than 80% of hearing losses are congenital or acquired during the neonatal period. Therefore, early identification and subsequent intervention are crucial in saving a child from a permanent disability. Auditory Brainstem Response (ABR) and Otoacoustic Emissions (OAE) are the current approaches to detect deafness in neonates. Both methodologies test a specific early part of the auditory pathway, but not its entirety until the perception of sound in the brain. Moreover, the paucity of clinicians or audiometric professionals, expensive equipment, and patient follow-up are the challenges for the success of current neonatal hearing screening programs, especially in a resource-constrained country like India. We aim to develop non-invasive, low-cost, objective screening tools to assess the complete auditory pathway combining brainstem and cortical responses. The cortical auditory evoked response provides essential information about subsequent auditory pathway elements' functionality, making it a comprehensive signature to evaluate the entire auditory pathway.

So far, no system scans the entire auditory pathway at the time of birth.

This project aims to use brainstem and cortical response for hearing screening and test the auditory system with two indices: ABR and Cortical responses (Mismatch Negativity). Implementation of the proposed approach requires integration of multidisciplinary submodules including Auditory Stimuli Generation, Biopotential Acquisition, Signal Processing, PCB Fabrication, Embodiment Design, and Output display. We have developed an initial prototype of the headband to conduct a proof of principle study and obtained preliminary results.

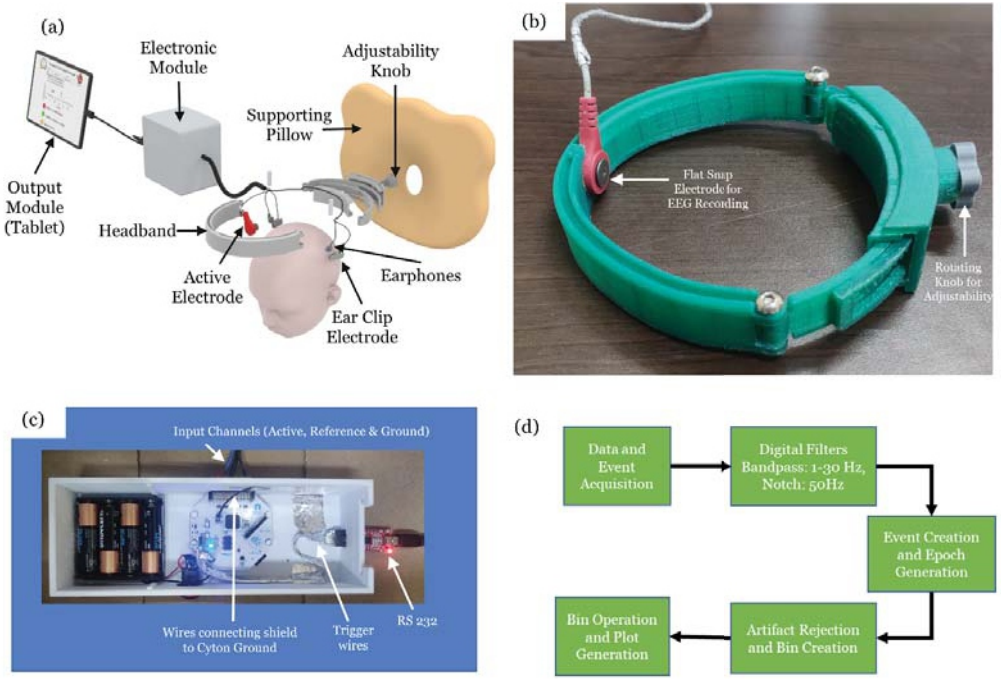


Figure 1 Developed Prototype: (a) Exploded view of the prototype, (b) Neonatal headband with electrode, (c) Electronic module for the EEG recording, and (d) Flow of ERP extraction algorithm.

Yogesh Singh

Wearable Interactive Parkinson's Disease Assistive Device (WIPAD)

Yogesh Singh
Indian Institute of Technology, Gandhinagar

Guide:
Dr. Vineet Vashista

Freezing of Gait (FoG) is a sudden uncontrollable motor phenomenon observed in the advanced stage of parkinsonian's syndrome. It occurs as an episodic inability to generate push to lift off the foot. Parkinson's Disease (PD) patients describe it as a feeling of their feet being glued to the floor. It frequently triggers while turning, initiating stride, stress, or distraction of any kind from walking. Moreover, FoG is closely associated with falls due to trembling of legs, complete immobility, and postural instability.

We propose to develop a wearable and portable device that can prevent the onset of freezing episodes of gait in PD patients using patient-specific and gait adaptive algorithms. The FoG suppression is proposed in two steps - (i) FoG detection by identification of high-frequency components of lower leg tremors during walking, turning, or sit-to-stand activities using an onboard inertial sensor on the device; and (ii) providing real-time feedback using auditory, visual or vibrotactile cues to the patients during freezing episodes to bring patient's attention back to walking. These biofeedback modalities act to mitigate the FoG events and reduce fall risk in PD patients by unfreezing gait blocks and changing patients' stepping patterns resulting in minimal gait variability. The device also aims to train PD patients in locomotion activities of daily living to reduce gait variability and freezing episodes when walking without the aid of the device. The training modality is proposed as a goal-oriented gait activity paradigm to improve the higher variability gait characteristic as diagnosed by the device.

Wearable Interactive Parkinson's disease Assistive Device (WIPAD)

Isha Rana

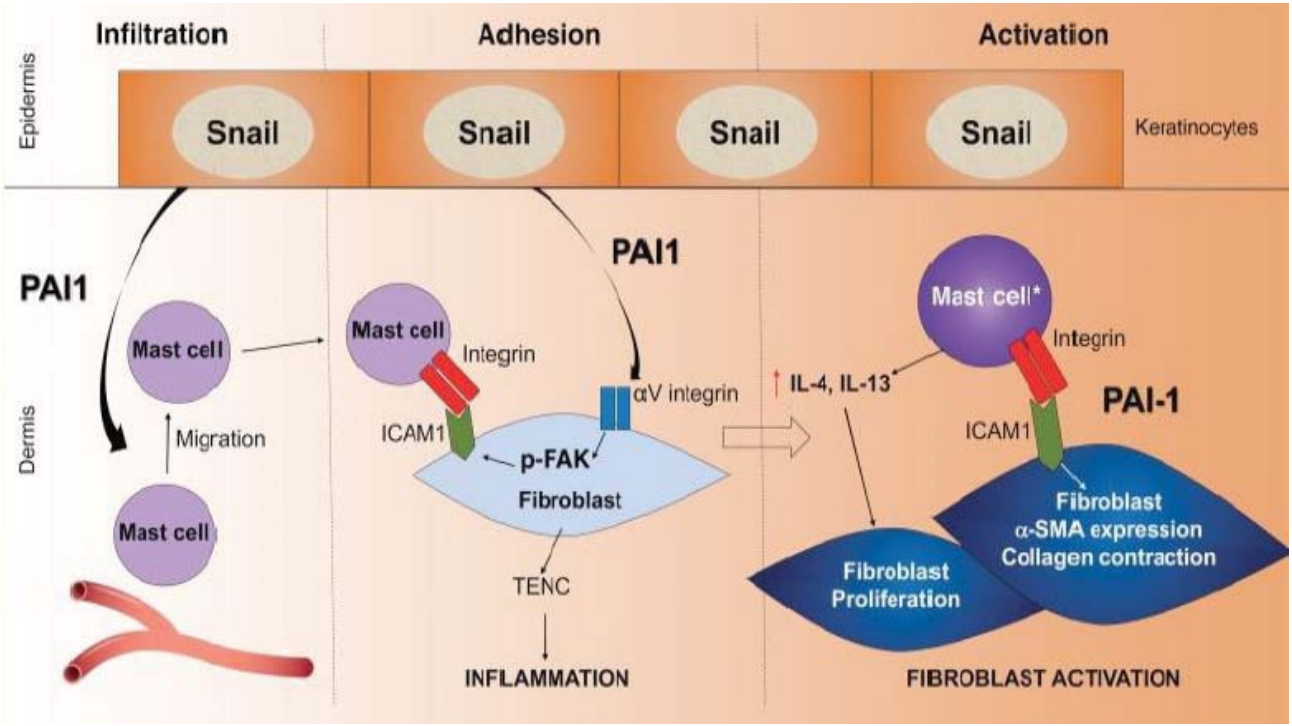
Targeting Plasminogen Activator Inhibitor-1 to Treat Skin Fibrosis

Isha Rana
Institute for Stem Cell Science and Regenerative Medicine, Bangalore

Guide:
Prof. Colin Jamora

The skin is vital in protecting the body from the outside environment. The body's healing response involves extensive intercellular communication via secreted signaling molecules. The deregulation of this crosstalk can lead to abnormal healing processes, such as pathological over scarring in fibrosis. Fibrosis is the progressive scarring of the body caused by many diseases. Overall, fibrosis contributes to 33% of deaths worldwide and the number increases to 45% in the developed world. Given the scale of the socioeconomic burden, it is critical to identify mechanisms for developing anti-fibrosis therapeutics. Despite of global mortality, there is no effective treatment for fibrosis, emphasising the importance of identifying how these fibroblasts are regulated in order to develop new therapeutic interventions. We used a transgenic mouse model of fibrosis in which the transcription factor Snail is overexpressed in epidermal keratinocytes to investigate this. Instead, we discovered that Snail-expressing keratinocytes secrete proteins that can activate fibroblasts, one of which is the Plasminogen activator inhibitor-1 (PAI-1).

Our recent findings suggest that snail transgenic keratinocytes secrete PAI-1, which influences fibrosis development during the inflammatory stage of disease development. As PAI-1 increases fibrin deposits, it indirectly aids in the development of fibrogenesis in a pro-inflammatory environment. We discovered that PAI-1 acts as a chemotactic factor, stimulating mast cell migration into the skin. It also promotes mast cell adhesion to fibroblasts, resulting in the reciprocal activation of both cell types. The resulting fibroblast activation, manifested in increased contractility and cell proliferation, contributes to the development of skin fibrosis in the Snail transgenic mouse. As a result, we have discovered previously unknown mechanisms by which PAI-1 plays a role in the development of fibrosis. This study essentially suggests that if we target PAI-1, we can either inhibit or reverse the development of fibrosis, which will be extremely beneficial in socioeconomic burden associated with these diseases.


Infiltration
Adhesion
Activation
Epidermis
Snail
Snail
Snail
Snail
Keratinocytes
PAI1
PAI1
Dermis
Mast cell
Migration
Mast cell
Mast cell
Integrin
αV integrin
ICAM1
p-FAK
Fibroblast
TENC
INFLAMMATION
Mast cell*
Integrin
IL-4, IL-13
PAI-1
ICAM1
Fibroblast
α-SMA expression
Collagen contraction
Fibroblast
Proliferation
FIBROBLAST ACTIVATION

Akshay Hegde

A Novel Approach to Cure the Chronic Diabetic Wounds

Akshay Hegde
Institute for Stem Cell Science and Regenerative Medicine, Bangalore

Guide:
Prof. Colin Jamora

India has a large number of diabetic patients and accounts for approximately 100000-foot amputations per year. Also, the financial burden is huge on the patients. Unfortunately, 50% of the foot amputations require re-amputations in the next two years. Chronic diabetic foot ulcers have a very poor prognosis. The present wound-care involves regular wound dressing, debridement, skin substitutes, negative pressure therapy, and hyperbaric oxygen therapy. But they are less effective and reduce the quality of life. Since wound healing is a multistep and overlapping process and extremely complicated, at the molecular level, the no-silver bullet which controls every step of the wound healing was known. Our lab has deciphered a signaling pathway regulated by Caspase-8 which initiates and controls all the phases of the wound healing response. My work has shown that this pathway is impaired in the skin of the diabetic mouse model which mimics the chronic wounds of diabetic patients. Using genetic manipulation in mice, our lab has generated robust preliminary results showing that it is possible to intervene to cure the chronic wound of type II diabetes by targeting Caspase-8. We have also developed shRNA probes to target Caspase -8 in human cells. To overcome the problems posed by conventional diabetic wound care methods, it is important to develop less complicated, cheap, and more practical medication. The topical application of gels and ointments is the easiest. We propose to develop siRNA and ProTac probes to develop ointments and hydrogels for topical applications to cure diabetic chronic wounds by targeting Caspase-8.

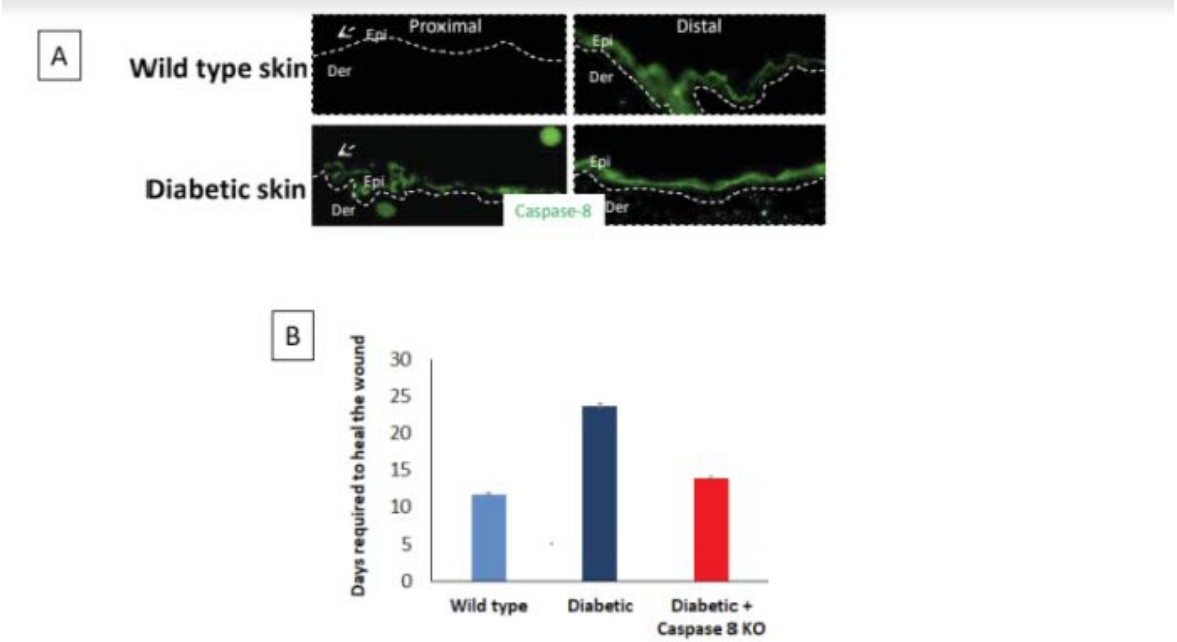


Fig1: Immunofluorescence staining shows that, in the wild type mouse skin, Caspase-8 protein is downregulated proximal to the wound, where as the diabetic mouse skin fails to downregulate it (A). In the wild type mouse skin, the 5mm excisional wound heals in 12 days where as in the diabetic skin, the same sized wound heals only after 24 days. If caspase-8 is genetically knocked out in the diabetic background, the wound healing is faster (B).
--→ indicates the wound edge, 'proximal' indicates the wound proximal, 'distal' indicates the wound distal. Epi – epidermis, der – dermis. KO –knockout.

Pushing the frontiers of technology: GYTI on the edge

SRISTI - GYTI 2021
APPRECIATION

B. Sri Sai Ramya

Osteoinductive Personalized Bone Grafts by 3D Printing of Novel Natural Fiber-reinforced Composite for Maxillofacial Reconstruction

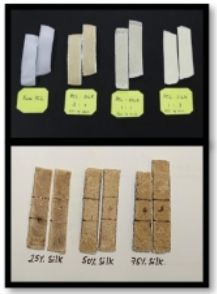
B. Sri Sai Ramya
Indian Institute of Technology, Hyderabad

Guide:
Dr. Falguni Pati

The maxillofacial anatomy is highly personalized with its cosmetic and functional aspects but is prone to genetic and environmental insults. The central target regions affected by trauma and cancer are the head and face, accounting for about one-third of major or minor anomalies. The most common surgical approach is to replace missing or damaged tissue with autologous bone grafts. However, its harvesting necessitates further surgical procedure, quantity restrictions, substantial costs, and risk of infection. During the reconstructive process, a maxillofacial surgeon must balance both aesthetics and function for the psychological and social well-being of the patient. The main concern in developing adequate bone graft substitutes or a scaffold is the substantial variation in each patient's bone anatomy. Additionally, the anatomical shape and size will be varied based on the type of defect. In addition to answering the customization aspect of the fabrication strategy via 3D printing technology via patients CT or MRI data, this project addresses the requirements of adequate healthy bone healing by concentrating on the cellular responses of human GMSCs as well as mechanical behavior of the natural fiber-reinforced composite in comparison to that of maxillofacial bone. PCL is mixed with silk fibroin microfibers (*Bombyx mori* and *Anthera myllita*) to form the composite. A perfect silk-PCL ratio is optimized, which balances the cellular (metabolic activity, alkaline phosphatase activity, and calcium deposition assay) and mechanical behavior of the scaffold. By understanding the cellular responses of the autologous GMSCs of patients, this project integrated them onto the hybrid scaffold, making them unique and osteoinductive during the implant placement at the defect site.

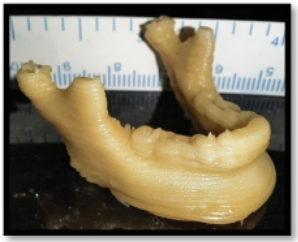
***Bombyx mori* and *Antheraea mylitta* silk fibroin microfibers obtained via degumming and alkali hydrolysis**

Polycaprolactone



Silk-PCL composite

***Bombyx mori* and *Antheraea mylitta* silk-PCL scaffolds**



3D printed patient defect specific model

Integration of human autologous mesenchymal stem cells to the 3D printed scaffolds

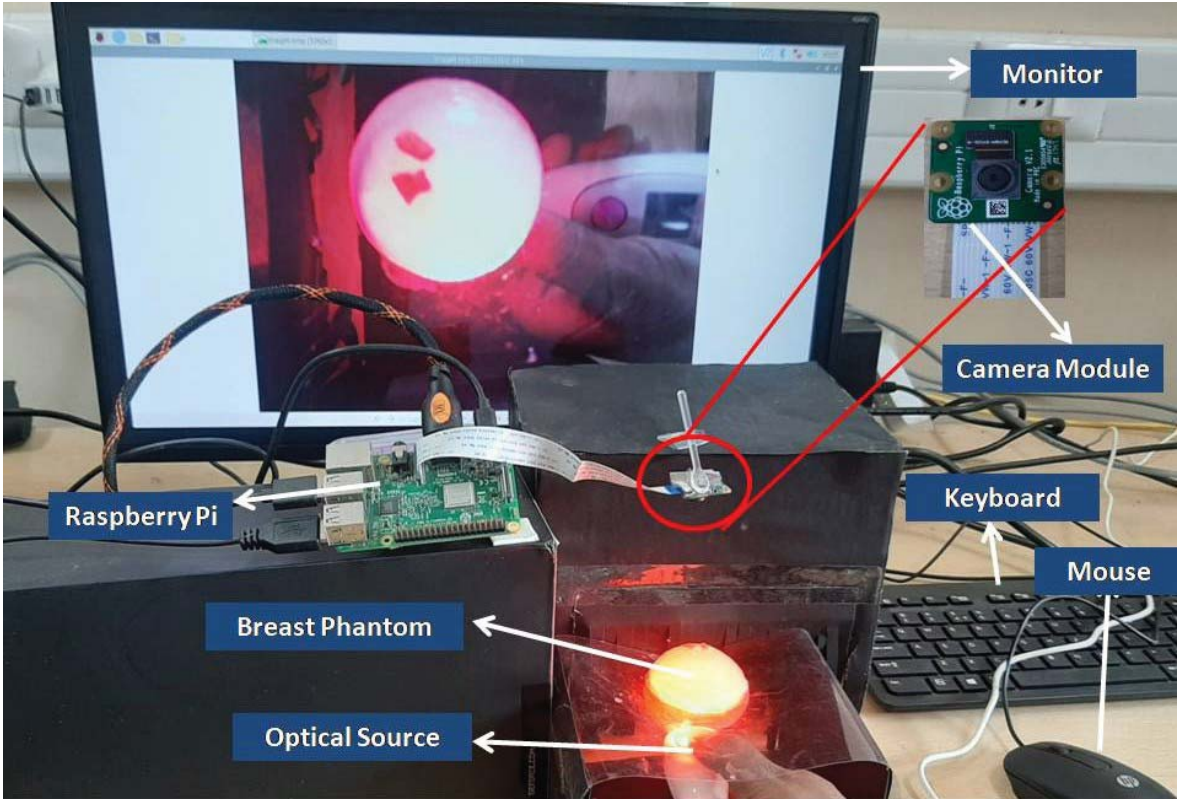
Chiranjib Bhowmick

Design and Development of a Trans Illumination Imaging to Detect Breast Malignancies and Correlation of Results with Mammograms

Chiranjib Bhowmick
Indian Institute of Technology, Kharagpur

Guides:
Prof. Manjunatha Mahadevappa
Prof. Pranab Kumar Dutta

Breast Cancer is a leading health concern as it has affected the human clan to a large extent by decreasing the mortality rate in developed and developing countries. According to recent WHO reports (2020), Breast Cancer stands as the most encountered cancer case worldwide. The primary organ of interest is the breast, and by the process of metastasis, the cancerous cells swim over to other vital organs and organ systems, forming secondary or tertiary tumours. Recent studies and research show that the survival rate for late-stage breast cancer is extremely low. Thus the role of early diagnosis is of supreme importance. Here a Transillumination imaging setup has been proposed to detect breast tumours that are radiation-free, safe, economical, and user friendly. Transillumination is a technique of illumination of a sample by passing light through it. The potential of this technique is immense as it has been successful in solving a wide range of medical problems, right from dentistry to detecting tumours. The trans-illuminated imaging setup consists of an optical source, a microcomputer, and interfacing with an AI-based model. The optical source will be developed using Light Emitting Diodes, which will be of high power and wavelength matched to hemoglobin. The microcomputer will be a Raspberry Pi interfaced with a camera module and monitor to capture real-time images of the transilluminated breast. Image processing or AI-based algorithms will be interfaced with the set up which would be able to identify the region of abnormalities in the image. The results obtained can be correlated with mammograms for further comparison between them.


Monitor
Camera Module
Keyboard
Mouse
Raspberry Pi
Breast Phantom
Optical Source

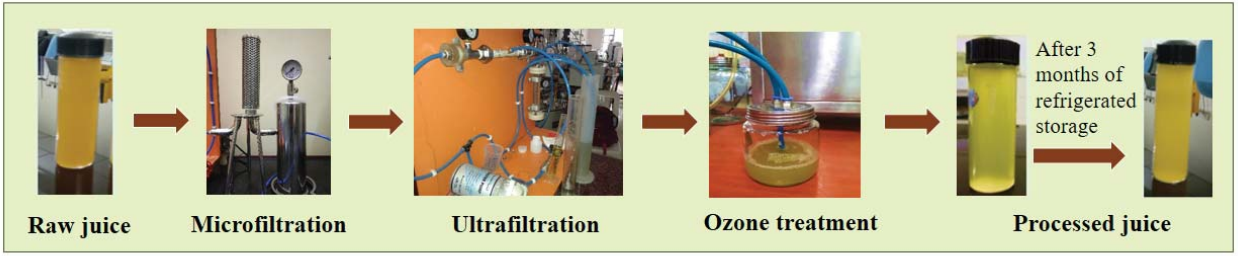
Chirasmita Panigrahi

Development of a Novel Low Cost Non-thermal Process Technology for Preparation of Shelf Stable Sugarcane Juice

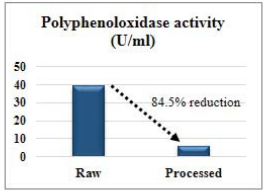
Chirasmita Panigrahi
Indian Institute of Technology, Kharagpur

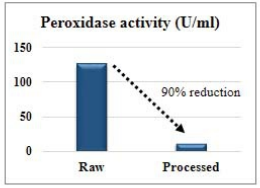
Guide:
Dr. Hari Niwas Mishra
Dr. Sirshendu De

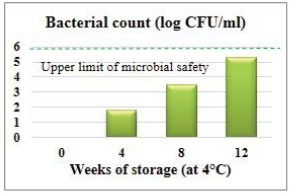
Sugarcane juice is extremely perishable in nature owing to enzymatic action and microbial fermentation. Its short shelf life limits the long-term storage and processing. Additionally, due to its seasonal availability and hygienic issues, the demand for processed sugarcane juice has intensified. Thermal means though have been used extensively for this purpose, but heat poses deleterious effects on color, flavor, and bioactive. Our target was to extend its shelf life without compromising the inherent quality aspects. The ultrafiltration technique coupled with ozone treatment is adopted as a hybrid non-thermal process with microfiltration as the pre-filtration step. It offers a 7 log reduction in bacterial count, 5 log decline in yeast mould count, and 85% inactivation of polyphenoloxidase enzyme. It yields a clarified and decontaminated juice rich in natural flavor and sweetness, polyphenols (80% retention), and other nutritional parameters. The microbial and sensory stability evaluation suggests that the processed juice can be stored for up to 3 months under refrigeration. The development of this cold sterilization technology is a first-time attempt towards the stabilization of sugarcane juice without heat or chemicals that adjoins a dimension of novelty. The developed technology is less energy-intensive, highly scalable, and economically viable. This natural health drink (Rs.75/L) can be availed by masses. It possesses the immense potential to sustain future profitability in crop trade through entrepreneurship development. The prototype unit encompassing continuous scale processing can facilitate the proliferation of small-scale agro-based industries augmenting the rural economy and national status. The patent for the process technology has been filed and research papers pertaining to the study are published in international peer-review journals.

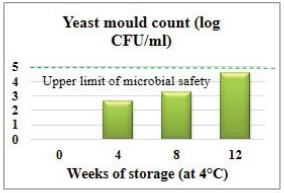


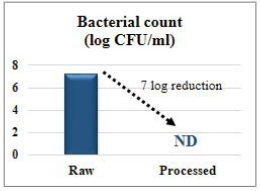
Processing and preservation of sugarcane juice using hybrid non-thermal technology

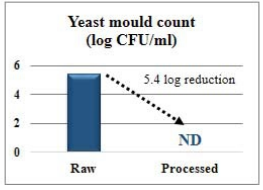


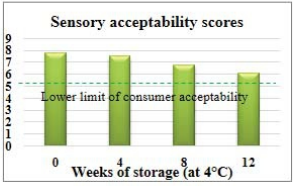












Sumit Kumar

Ebinesh Abraham

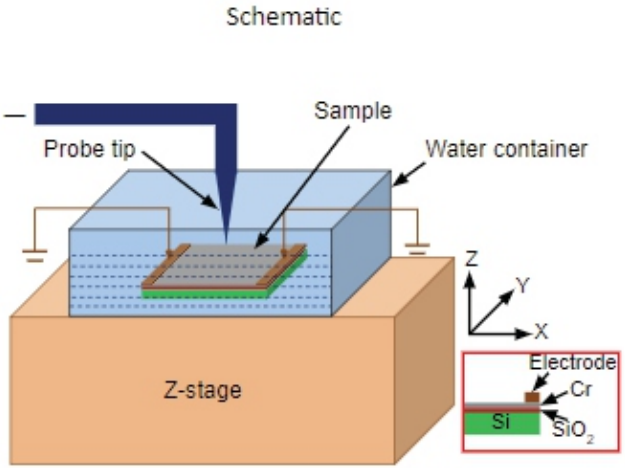
An Electrolithography Tool for High Throughput Pattern Generation

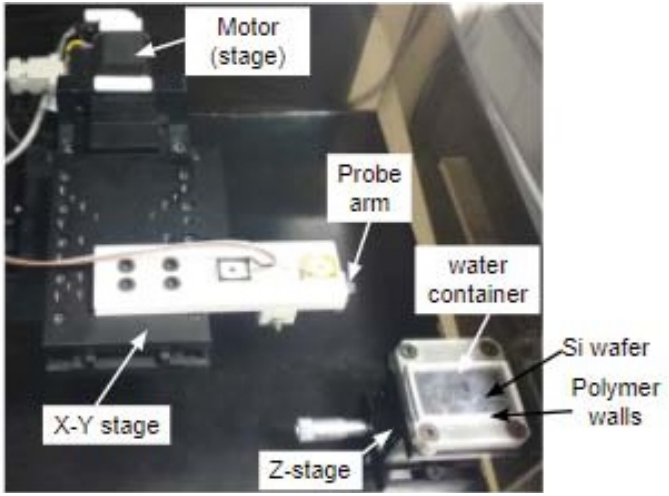
Sumit Kumar and Ebinesh Abraham
Indian Institute of Science, Bangalore

Guides:
Dr. Praveen Kumar
Prof. Rudra Pratap

Patterning at small scales (micro-nano) has become ever-growing demand in today's digital-trending world. Existing technologies in the field of pattern generation include optical lithography and scanning probe lithography (SPL), which require expensive and complicated machinery and special training for their careful handling. Moreover, these existing SPL techniques face inherent impediments, e.g., frequent tip damage, substrate-film deterioration, low throughput, and debris amassing in the patterned region. Therefore, conventional SPL methods have not attained the parameters of industrial-level fabrication.

We present a novel SPL technique, named water electro-lithography (W-ELG), for patterning at the microscale and potentially at the nanoscale. W-ELG is a direct writing technique performed in a non-contact mode in a water medium and is based on the electric field-induced selective chemical etching of a metallic film by a scanning probe tip. Wide-scale patterning is possible by selection of the proper tip diameter and the controlled reactant-flux generation. W-ELG achieved a throughput of 1.5×107 μm2/h, which is the highest amongst the existing scanning probe lithography (SPL) techniques while drawing 4 μm wide lines. The patterning in non-contact mode resolves the issue of tip and sample damage and increases the lifetime of the probe tip. One of the basic components of our invention is water, which is non-corrosive and available in plenty. The water medium does not only remove the debris produced due to the chemical reaction from the patterns but also keeps the "writing" tip clean. The experimental setup to perform W-ELG is significantly inexpensive (less than 10 Lakh). The potential of low cost, green and sustainable lithography tool development and their easy handling beats all the existing tools in the field of small-scale pattern generation.


Schematic
Sample
Probe tip
Water container
Z
Y
X
Electrode
Cr
Si
SiO_2
Z-stage


Motor
(stage)
Probe
arm
water
container
Si wafer
Polymer
walls
X-Y stage
Z-stage

Rishabh Shukla

Modified Trickling Filter- A Solution to Water Crisis in India

Rishabh Shukla
Indian Institute of Technology, Delhi

Guide:
Prof. Shaikh Ziauddin Ahammad

Water is one of the most vital substances required by all living organisms to survive. About 71% of Earth's surface is covered by water, but only 2.5% of the water present on Earth is freshwater. More than one-third of the planet's accessible freshwater is used for agricultural, industrial, and municipal purposes. But most of the activities eventually lead to the contamination of freshwater systems with releasing thousands of industrial and natural chemical compounds. According to the World Health Organization (WHO), globally, around 1.1 billion people don't have access to safe drinking water and at least 2 billion use drinking waters contaminated with faecal matter. Moreover, according to United Nations data, 80% of the wastewater generated in the world is discharged into water resources without treatment which eventually contaminates our natural water resources. Therefore, it is necessary to develop a low-cost decentralized wastewater treatment system that can restrict the discharge of untreated urban sewage into the water bodies. We developed a low-cost biological Modified Trickling Filter (MTF) that can remove conventional and emerging pollutants from urban sewage. The MTF reactor has a separate aerobic and anoxic zone which allows the growth of diverse microbial communities inside the reactor that ultimately helps in removing various pollutants from the wastewater. Advantages of MTF over conventional wastewater treatment systems:

Efficiently removes conventional as well as emerging pollutants, Low energy requirement, Require less footprint for installation, Negligible sludge generation, Can be operated at lower HRTs.


TITUS
TITUS

Anusha Vupputuri

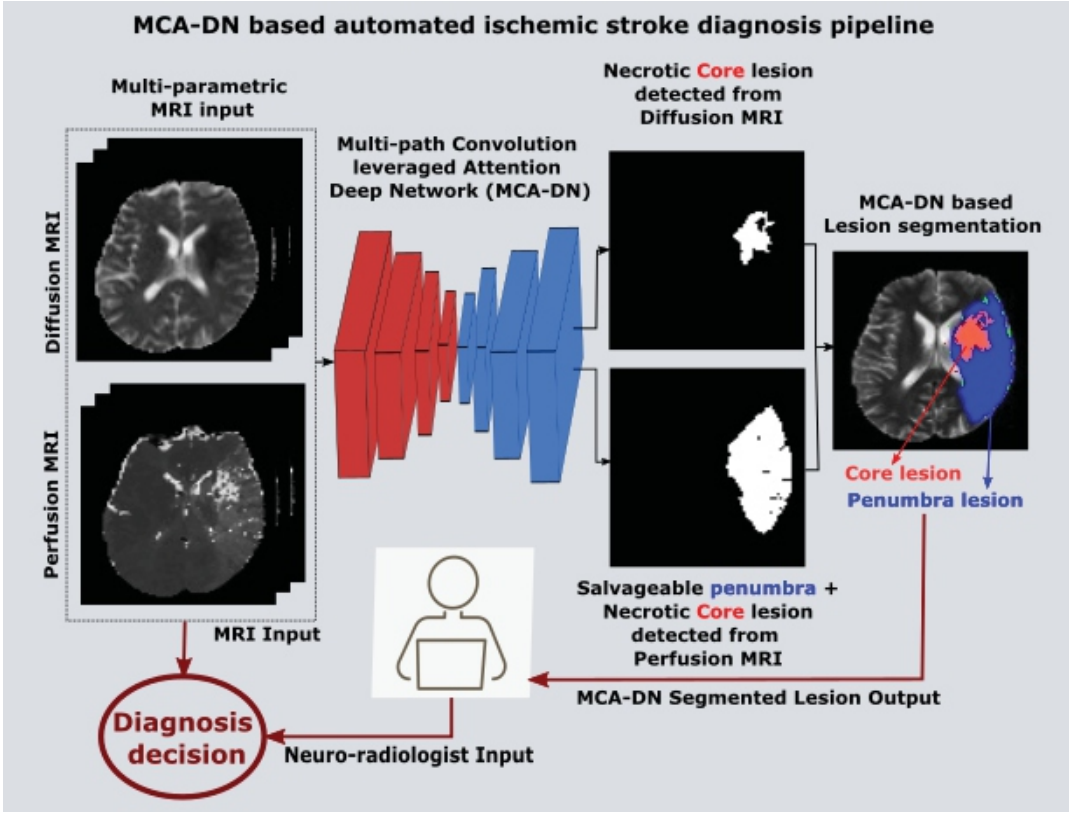
Akshat Gupta

Efficient Deep Learning Technique for Automated Ischemic Stroke Detection Assisting Radio-diagnosis for Reperfusion Therapy

Anusha Vupputuri, Akshat Gupta
Indian Institute of Technology, Kharagpur

Guide:
Dr. Nirmalya Ghosh

India is a developing nation and providing efficient and timely healthcare to the majority of the population is a critical challenge. Stroke has been a predominant cause of death and disability and imaging diagnostics like MRI and CT have proved to be efficient in stroke diagnosis and treatment. “Time is brain” is a major guideline followed in stroke therapy with a limited time-to-treatment window of 2-4 hours to provide the patient with timely intensive care. Though identifying and delineating the entire ischemic stroke injury is important, differentiating the core (dead) and penumbra (salvageable tissue) of the injury is of utmost importance for clinicians as it aids reperfusion therapy. Our research proposes a multi-path attention-assisted convolutional deep network that enables the computer to gain knowledge of stroke injury. Attention-based learning is imparted to the machine through convolution operations and weight learning via the backpropagation of error. The multiple convolution paths help the network to learn distinct regions from different areas in the diffusion and perfusion MRI volumes and finally aggregate this knowledge to identify injury and delineate the core-penumbra. Segmenting lesions from the multi-volume scan data manually from each slice is painstaking. This automated, robust and accurate segmentation method can aid the experts to identify lesions from multiple imaging volumes within a few seconds by contributing to saving the ‘Golden Hour’ in stroke. With further processing, this algorithm can be directly embedded into an MRI/CT scanner software enabling a real-time diagnosis and decision making by the neuro-radiologist. This would in turn facilitate more time for prudent diagnostic decisions and treatment planning like reperfusion and stem cell therapy to the salvageable penumbra tissue preventing further impairment.


MCA-DN based automated ischemic stroke diagnosis pipeline
Multi-parametric MRI input
Diffusion MRI
Perfusion MRI
MRI Input
Multi-path Convolution leveraged Attention Deep Network (MCA-DN)
Necrotic Core lesion detected from Diffusion MRI
Salvageable penumbra + Necrotic Core lesion detected from Perfusion MRI
MCA-DN based Lesion segmentation
Core lesion
Penumbra lesion
MCA-DN Segmented Lesion Output
Diagnosis decision
Neuro-radiologist Input

Ankit Nagar

Md Rabiul Islam

Greywater Sink for Potable and Non-potable Uses

Ankit Nagar and Md Rabiul Islam
Indian Institute of Technology, Madras

Guide:
Prof. Thalappil Pradeep

The rise in water demand due to the COVID-19 pandemic is stressing the existing sources of freshwater. This is possible only if water consumed by people is recycled and reused, so that their routine water wastage is minimal, and so is their daily freshwater requirement.

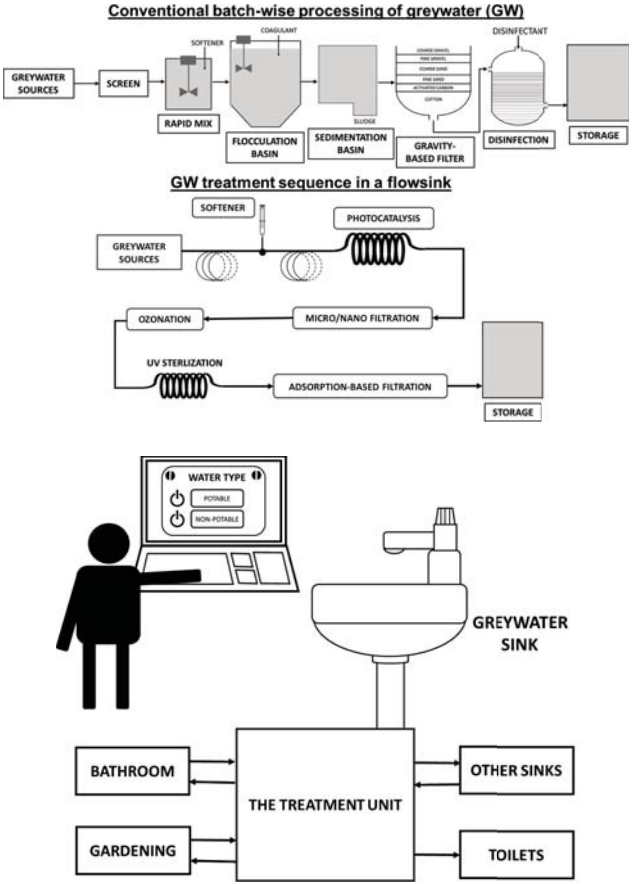
The pandemic has increased daily per capita water consumption, primarily for continuous disinfection. Hand washing has become a sort of norm, and is gradually becoming a part of routine. Water consumption will rise, averaging 3-10 lit/ person/day, putting additional strain on existing water networks. Along with it, more detergents and disinfectants are being introduced into our ecosystem, all of which will have a long-term impact. These anticipated challenges must be addressed by developing advanced and compact point-of-use treatment systems dealing with disinfectants and enable sustainable hygiene practices during water crises.

Domestic wastewater consists of black water from toilets and greywater from other sources like bathrooms, washbasins, and kitchen sinks etc. Greywater typically accounts for 55-75% of total domestic wastewater, with variations depending on overall water consumption. As per IS: 1172-1957, total water consumption in India should be 135 litres/capita/day or less, with 70-90 litres generated as greywater. The wastewater from kitchen sinks, and laundry is more contaminated and is referred to as dark greywater, whereas less contaminated bathroom wastewater is referred to as light greywater.

Bathing & washing together contribute to nearly 80 lit/ capita/ day, which is the target water for the proposed 'flowsink'. If this greywater is recycled and reused, each four-membered family can save nearly 116,800 litres of freshwater annually.

Due to the need for significant space in a household, the high initial cost, and variation in wastewater quality, greywater recycling technologies have not been widely adopted. To overcome these, we propose developing a 'greywater sink,' which consists of a compact treatment system that can fit under a sink and is capable of treating light greywater bath wastes.


KEEP THE SINK CLEAN
Greywater


Conventional batch-wise processing of greywater (GW)
GREYWATER SOURCES
SCREEN
SOFTENER
RAPID MIX
COAGULANT
FLOCCULATION BASIN
SLUDGE
SEDIMENTATION BASIN
GRAVITY-BASED FILTER
DISINFECTANT
DISINFECTION
STORAGE
GW treatment sequence in a flowsink
SOFTENER
PHOTOCATALYSIS
GREYWATER SOURCES
OZONATION
MICRO/NANO FILTRATION
UV STERLIZATION
ADSORPTION-BASED FILTRATION
STORAGE
WATER TYPE
POTABLE
NON-POTABLE
GREYWATER SINK
BATHROOM
GARDENING
THE TREATMENT UNIT
OTHER SINKS
TOILETS

Abhranila Das

An Indigenous Low-cost Smartphone Interfaced Handheld Potentiostat

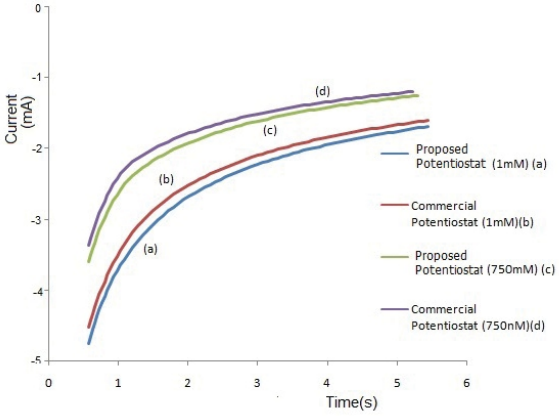
Abhranila Das
Indian Institute of Engineering Science & Technology, Shibpur

Guide:
Dr. Chirasree Roy Chaudhuri

Electrochemistry is a multi-disciplinary science involving applications in clinical diagnostics, wearables, environment, energy, and food monitoring. The electrochemical detection of ions, proteins, and other molecules has been performed by activating redox reactions which require potentiostats for precise control and measurement. In the past few years, a number of handheld potentiostats have been developed, which have a limited current measurement range, are expensive, and do not have to facilitate online laboratory sessions.

This innovation has attempted to fill these gaps. The upper limit of current measurement has been extended by 50 times compared to the existing reports to widen the scope of experimentation. The developed potentiostat can be used for common electrochemistry measurements of cyclic voltammetry and chronoamperometry and the device can be modified to include other electrochemical experiment protocols like impedance spectroscopy. The potentiostat has a uniquely designed PC interface and Android smartphone application. The voltage adjustments and experiment protocol selection of the device can be controlled remotely and corresponding data and graphs can be viewed and saved in the smartphones of the students which are located miles away from the site of operation while the potentiostat is actually located in the institution laboratory. In case of the absence of any internet connection, the raw data are stored in the mobile app for subsequent transmission when the connection is available. In addition to these features, the device is rechargeable battery-operated and can be easily charged using a USB port. Since the innovation is a robust, comprehensive, low-cost, user-friendly instrument, it has a huge potential for commercialization.

The chronoamperometry of 1 mM and 750µM ferricyanide on a screen printed electrode by potentiostat and a commercial potentiostat



Bhaswati Chakraborty

An Affordable, Sensitive and Portable Electric Field Mediated Device Towards Label-free, Point of Care Disease Diagnostics

Bhaswati Chakraborty
Indian Institute of Engineering Science & Technology, Shibpur

Guide:
Dr. Chirasree Roy Chaudhuri

Decentralized laboratory testing, especially point-of-care testing (POCT) is of extreme importance in critical care settings where rapid therapeutic turnaround time is in demand. Existing detection techniques have the issues of poor sensitivity, complex fabrication steps and require costly instruments which provide a hindrance to their translation into commercial point of care (POC) devices. To address the existing challenges, we have developed for the first time a FET biosensor using simple wet chemical processing and cost-effective screen-printing technology which has demonstrated a detection limit lower by more than three orders of magnitude for viral antigen and protein biomarkers compared to both commercially existing POC devices and recent research reports. The proposed innovation has utilized 3D matrix of ZnO nanorods as the sensing material on both glass and flexible PET substrate. Problems of defects, lack of comprehensive design methodology, and requirement of lithographically patterned electrodes for high sensitivity are the major concerns that have introduced difficulties in ZnO-based FET biosensor commercialization. We have attempted to address these challenges. To meet our objectives, firstly vertical electrode configuration has been developed which allows enhanced penetration of the electric field lines through the nanorods. Secondly, a unified design approach has been devised by considering nanorod spacing-dependent liquid penetration depth and different temporal fluctuations of the sensor for developing the optimized nanorod geometry. Thirdly, the control of defect states by tuning the surface roughness has not only improved the receptor binding density and sensor response by 15 times but also imparted reliability to the device performance. All the above investigations have made it possible to realize a label-free ZnO nanorod FET-based POC device using screen-printed electrodes.

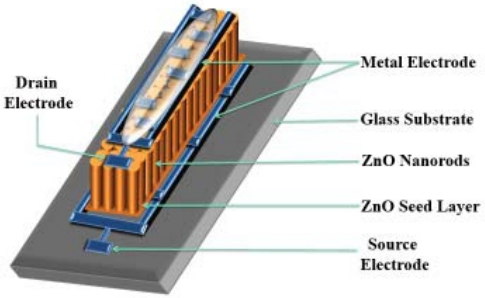


Fig.1 Schematic illustration of the FET Sensor with vertical electrode configuration

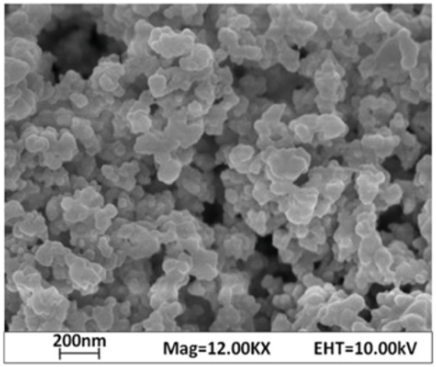


Fig.4 FESEM image of sensor surface after antibody attachment

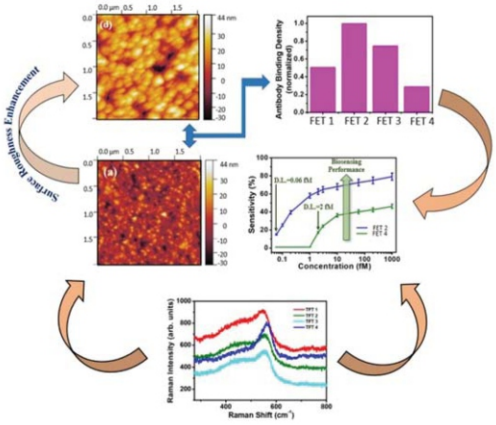


Fig.5 Impact of defect state optimization on bioFET performance

Fig.6 Interface of the sensor with the packaged circuit

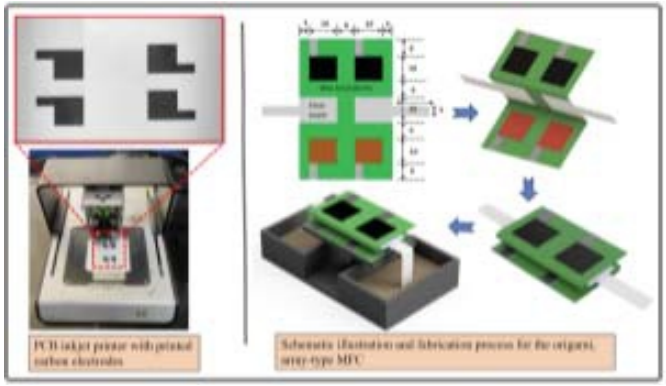
Prakash Rewatkar

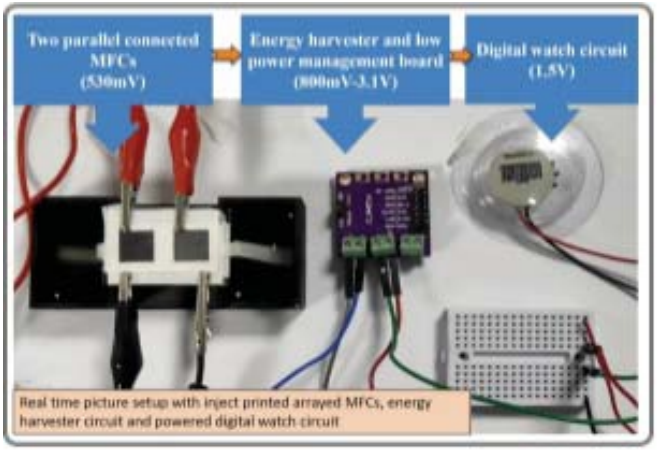
Origami Microfluidic Microbial Fuel Cell (MFC) for Powering IoT Node with Cloud IoT Platform

Prakash Rewatkar
Birla Institute of Technology and Science Pilani, (Hyderabad Campus)

Guide:
Prof. Sanket Goel

Microbial fuel cells (MFCs) are bio-electrochemical devices that produce electrical current from electrochemically active bacteria (EABs). These bacteria generate the electrons from the degraded organic matter and harness renewable and pollution-free energy in a self-sustaining manner. However, in order to be commercially viable, the device architecture, size of the MFCs, and electrode material become the essential parameter for power generation, which decides the potential application. As a result, paper as a substrate with microfluidic physics has received considerable attention because of its compact, flexible, and low-cost fluid manipulation paradigm. By this encouragement, a portable MFC in the form of an origami array has been demonstrated using custom carbon electrodes and a modified transition metal oxide MnO2 nanomaterial. The electrode was manufactured using a tabletop PCB inkjet printer, and the anode was further modified with synthesized MnO2. The MFC was built by folding the paper along preset edges, through which the fuel, *Shewanella putrefaciens,* was continuously fed via inherent capillary action. Several morphological, surface catalyst coating, amount and volumetric culture optimization and electrochemical studies have also been accomplished to find the most appropriate optimum parameter to enhance power conversion efficiency. The developed origami arrayed microbial fuel generated an open-circuit potential (OCP) for two parallel-connected MFCs of 0.534 V and with a maximum power density of 15.9 μW/cm2. In the end, the harvested power was used by powering the digital watch circuit through the ultra-low DC-DC booster board. Such an MFC origami array, with simple electrode manufacturing and modification process, has great potential and a bright future in Internet of Things (IoT) applications via wireless data transmission with cloud technology by making multiple stacks where the data can be monitored.




Two parallel connected MFCs (530mV)
Energy harvester and low power management board (800mV-3.1V)
Digital watch circuit (1.5V)
Real time picture setup with inject printed arrayed MFCs, energy harvester circuit and powered digital watch circuit

Gautam Rituraj

A Unipolar Coil Arrangement Method for Improving the Coupling Coefficient without Ferrite Material in Wireless Power Transfer Systems

Gautam Rituraj
Indian Institute of Technology, Guwahati

Guide:
Prof. Praveen Kumar

Wireless power transfer (WPT) has been extensively researched in recent years because it is a reliable and safest way of electric vehicle charging. Generally, rectangular-, square-, and circular-shaped unipolar coils are used in static and dynamic WPT systems. However, these unipolar coils suffer from reduced coupling coefficient (k) due to large leakage flux, decreasing power transfer, and transmission efficiency. In this context, this invention relates to a method for the arrangement of unipolar transmitter or receiver coils for improving k compared with a conventional coil system of the same self-inductances and outer dimensions in the WPT system. In the invented unipolar coil arrangement method (UCAM), a coil structure is arranged in two coil sets-outer coil and an inner coil, connected in series, both electrically and magnetically, and are coaxial and coplanar. The coil parameters (Tg-out, Tg-in, Nout, Nin, Cgx, and Cgy) of this coil structure are calculated using the steps in UCAM to achieve the maximum coupling value without changing the initially selected self-inductance for the different coil shapes. These calculations are done through computer simulation software (or from the developed analytical model). For the rectangular geometry of 400mm×300mm, 6.78%–27.04% improvements in k are achieved at the 150-mm air gap for the case 3 coil system compared with the different conventional coil systems. Prototypes of various coil systems are built in the laboratory. Experimental results confirm improvement in k, even for different misalignments between the transmitter and the receiver coils. Moreover, the invented UCAM improves k of the square- and circular-shaped coils up to 26.02% and 26.41% for the outer dimensions of 350mm×350mm and 400mm×400mm, respectively. In addition, the invented UCAM also improves k of nonidentical unipolar coils.

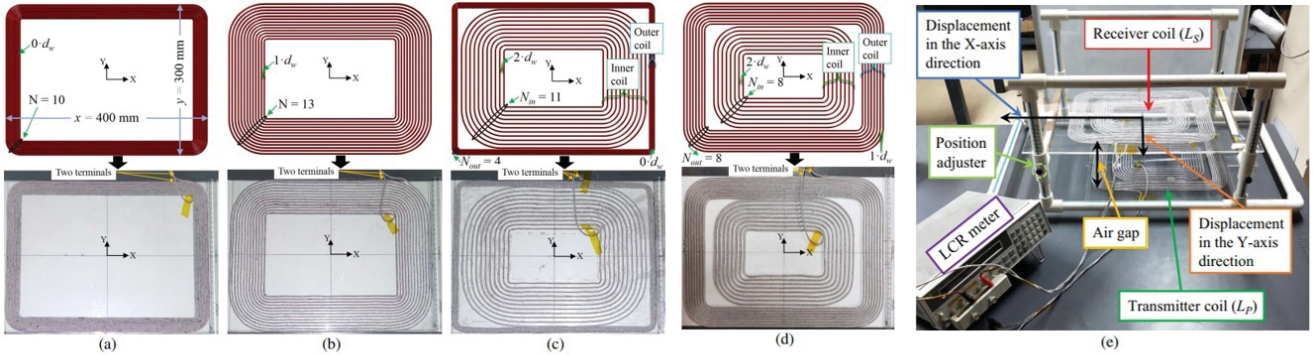


Figure: Prototypes of the constructed (a) type-I conventional coil, (b) type-II conventional coil, (c) and (d) proposed coils (case 3 and case 6) (e) Experimental setup.

Abhinav Gautam

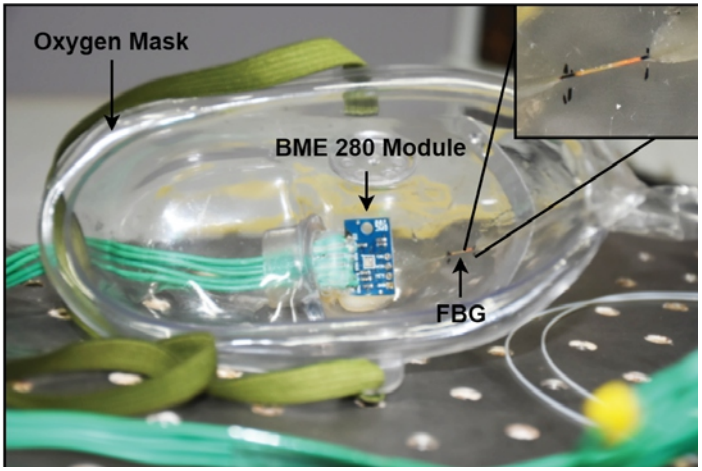
Psychophysiological Monitoring of a Subject using Optical Respiration Rate Measurement System

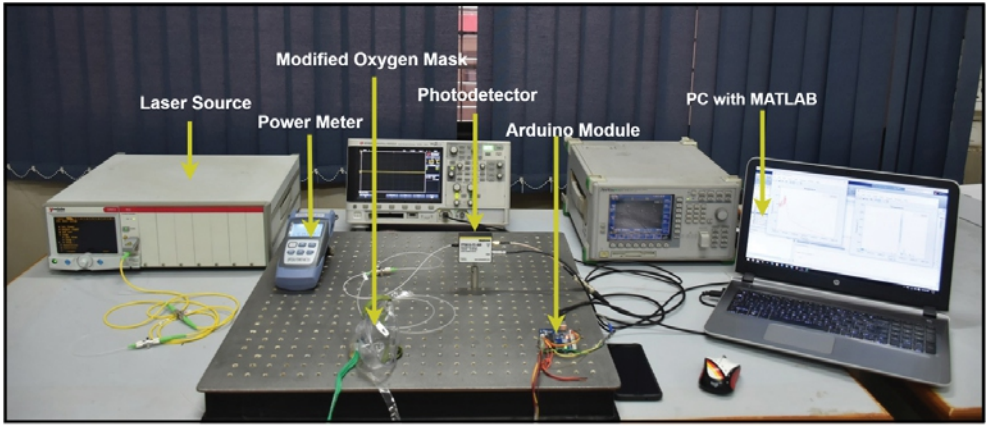
Abhinav Gautam
Indian Institute of Technology(ISM), Dhanbad

Guide:
Dr. Amitesh Kumar

Psychophysiological monitoring can be very crucial in critical conditions faced in aviation, military, hospitals, etc. Respiration rate (RR) is one of the primary parameters to determine a person's psychophysiological condition. Although electronic sensors used for RR monitoring are sufficient in daily routine, it can be quite uncomfortable for pilots in cockpits, space shuttles, underwater excavations, etc. MRI is another situation where psychophysiological monitoring can be crucial. During this examination, claustrophobic episodes may occur due to a confined environment inside the MRI scanner. Also, the use of electronic sensors is prohibited as they could interfere with electromagnetic fields, which can be dangerous for both patients and equipment. In this case, it is impossible to observe the psychophysiological condition of a patient who is unconscious or in coma.

Fiber optic sensors have proved their capability to replace electronic sensors due to their inherent advantages over electronic sensors such as being a lightweight, better response, higher sensitivity, longer life, and immunity to electromagnetic interference. In our work, an optical RR measurement system is developed using Fiber Bragg Gratings (FBG) as an optical sensor for temperature sensors. The temperature variation occurred due to the respiration process being sensed by both optical and electronic sensors. The experiment is carried out on five subjects, where it is observed that optical sensors are much more reliable and responsive. In the event of coughing, the response of the optical sensor is much more prominent as compared to the electronic sensor. However, respiration rate calculation remains unaffected and reliable.


Oxygen Mask
BME 280 Module
FBG


Modified Oxygen Mask
Laser Source
Power Meter
Photodetector
Arduino Module
PC with MATLAB

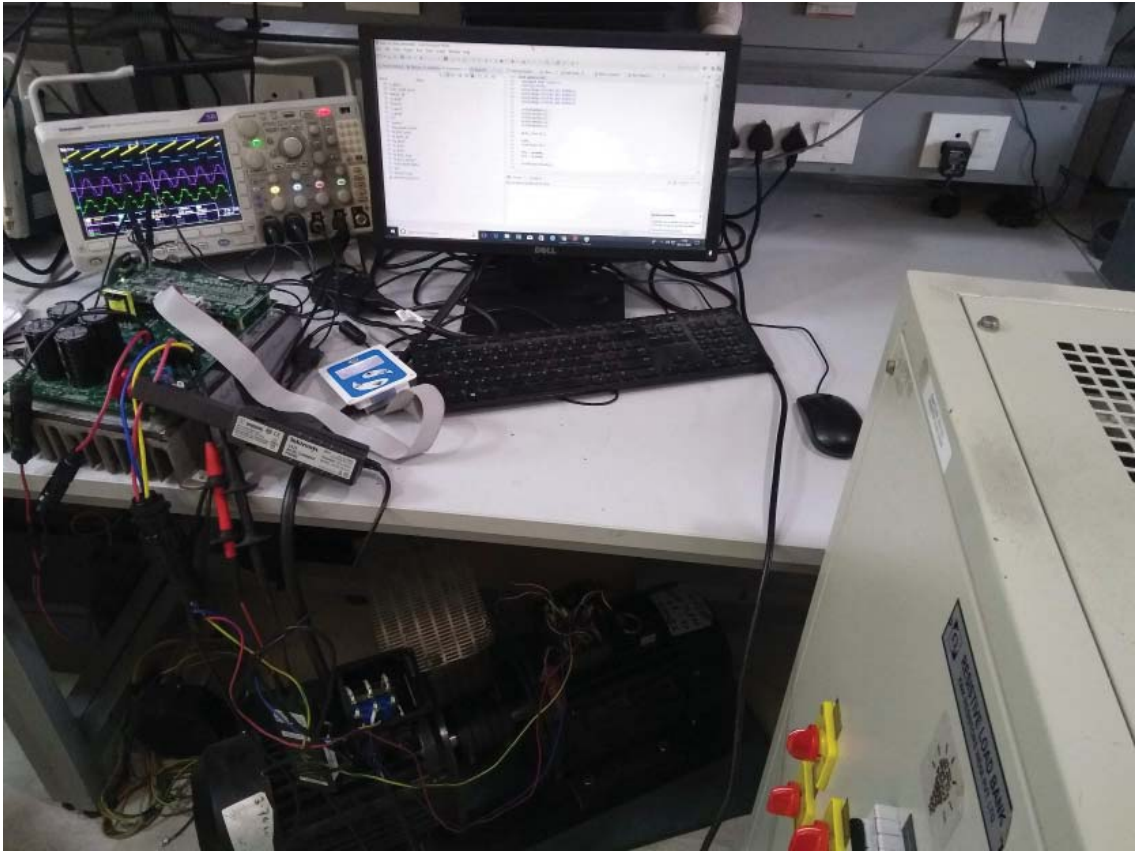
Aryadip Sen

Position Sensorless Permanent Magnet Brushless DC Motor Drive for Grid Interactive and Solar Powered Irrigation Pump

Aryadip Sen
Indian Institute of Technology, Delhi

Guide:
Dr. Bhim Singh

Due to unavailability of proper voltage, grid outage, solar photovoltaic (PV) array fed brushless DC (BLDC) motor coupled irrigation pump system is replacing the conventional induction motor based water pumping especially in rural areas due to high efficiency and zero running cost in recent days. The groundwater level is typically 20m in rural areas so a submersible pump motor set is essential for water extraction. As being a submersible pump, further, the use of Hall Effect position sensors for BLDC motor is not reliable due to the high chance of sensor failure at adverse atmospheric conditions. So position sensorless PMBLDC motor drive is the feasible solution for this problem. But smooth position sensorless control at different speeds is challenging for PMBLDC motors, particularly in low-speed zones. Along with this energy-efficient low-cost solution is also required for any commercial development where agriculture is the prime application. Addressing all the problems a cost-effective, highly reliable PMBLDC motor drive with robust position sensorless control for solar-powered irrigation pump application integrated with solar maximum power point tracking is developed. Precise position estimation at all speeds is achieved in the developed sensorless algorithm along with the reliable sensorless starting of the PMBLDC motor. The developed position sensorless PMBLDC motor drive starts the PMBLDC motor with high reliability even with a high load like a high-pressure water column in submerged conditions. Current and position sensor reduction make the PMBLDC drive circuit simple, compact, and cost-effective. The use of solar power and PMBLDC motor make the whole system highly energy efficient with zero running cost at the availability of solar insolation. The feasibility and reliability of the developed PMBLDC motor drive are tested at industrial product prototypes at different testing conditions.



Vijay Shankar Dwivedi

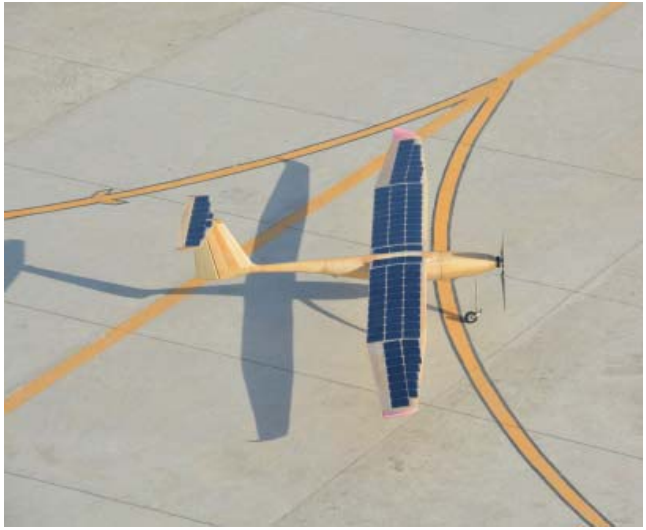
A New Control Surface Auxiron for Aircraft and a Solar UAV Equipped with it

Vijay Shankar Dwivedi
Indian Institute of Technology, Kanpur

Guides:
Prof. A. K. Ghosh and Prof. G. M. Kamath

Due to rising climate change concerns, solar energy is a natural alternative for all fossil fuel applications including aviation. In the past four decades, the aviation sector has witnessed a lot of progress in solar-powered flights. Many solar-powered aircraft has been developed and flown successfully. Solar aircraft that have good payload carrying capacity and endurance need a large wingspan which limits their practicability. Those which have relatively a smaller wingspan and good endurance have very small payload carrying capacity. Lastly, solar aircraft that have smaller wingspan and good payload carrying capacity have limited endurance. Hence there is scope for research, development, and improvement in the domain of solar-powered aviation. This work has an objective to address several aspects of a solar-powered aircraft that can improve its performance and make it more viable for long endurance applications like remote sensing, aerial surveillance, communication node, pseudo-satellites, law enforcement, search and rescue, pollution monitoring, petroleum and mineral exploration, disaster relief, etc. A novel control surface named "Auxiron" is developed for the augmentation of solar power collection by a solar-powered aircraft. Auxiron eliminates the sideslip for a nonzero bank angle flight which reduces the drag from a banked flight resulting in a lower power requirement for sun-tracking. Apart from solar power augmentation, the axiron enables an aircraft to trim with wing level in the presence of sideslip angle which allows an aircraft to land without "crab maneuver" in the presence of crosswind. This additional advantage of auxin helps an aircraft to land in the presence of wind gusts which increases flight safety. This work is also dedicated to the development and prototyping of a solar-powered aircraft named "Maraal" which served as a testbed for different experiments.


FLIGHT LABORATORY
INDIAN INSTITUTE OF TECHNOLOGY, KANPUR



Ankit Kumar Singh

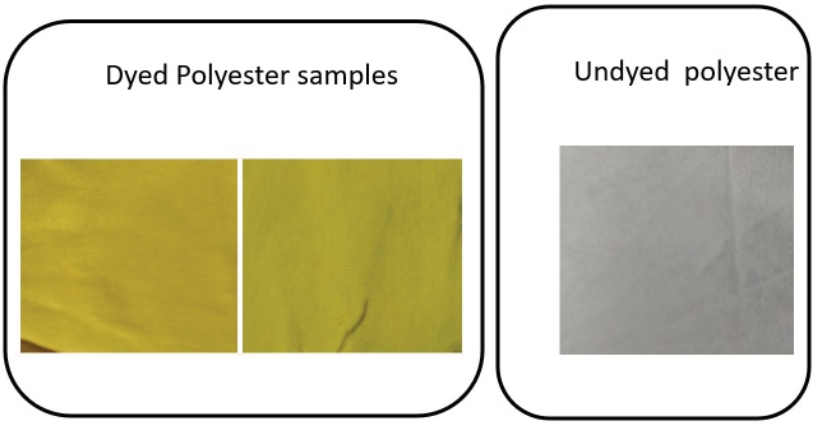
Multifunctional Disperse Dyes

Ankit Kumar Singh
Indian Institute of Technology, Delhi

Guide:
Dr. Javed Nabibaksha Sheikh

Mosquito bite to humans is a great cause of concern all over the world as it serves as a vector to spread deadly diseases. The deaths of over a million people per year because of mosquito-borne diseases necessitate effective inventions to protect human beings from mosquitoes. Some products like lotions, creams, and electric devices that can protect us against mosquitoes are available in the market. Direct application of the cream is not as safe as most of the ingredients used may cause skin allergies. Durability and effectiveness are other issues as these repellents lose their effectiveness after a few hours. Textiles, being the basic need of human beings, are among the widest used materials by human beings. With the increase in deadly mosquito-borne diseases, the demand for mosquito repellent fabric is continuously increasing. Health problems due to bacterial infections and harmful UV exposure also remain a worldwide concern.

In the quest to develop an efficient protective textile against mosquitoes, bacteria, and UV exposure, the present work explores the synthesis of novel multifunctional mosquito repellent disperse dyes. A range of colours having multifunctional properties has been prepared through diazotization and coupling reactions. The synthesized disperse dyes were utilized for the colouration of polyester fabric, and the dyed polyester was studied for mosquito repellency, UV protection, and antibacterial activity. The dyed polyester showed efficient mosquito repellency (100%), antibacterial activity (more than 97%), UV protection (UPF in excellent range). The functional properties of dyed polyester were found durable against repeated laundering treatments. Hence, the development of novel multifunctional and non-toxic dispersed dyes was reported.



Two samples of synthesized disperse dyes

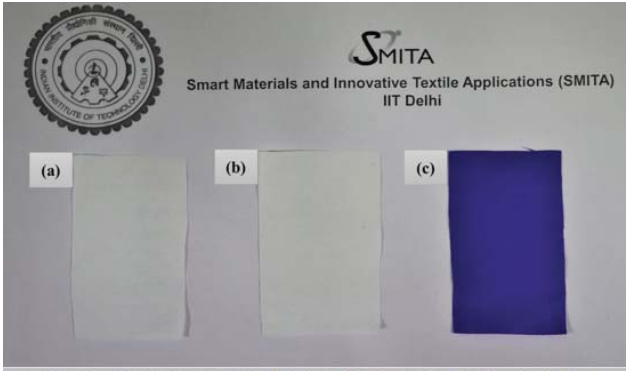
Hardeep Singh

Metal-Organic Frameworks Functionalized Smart Textiles for Environmental Air Purification, Anti-odour, and Antimicrobial Applications

Hardeep Singh
Indian Institute of Technology, Delhi

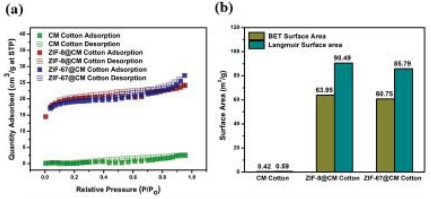
Guides:
Prof. Ashwini K. Agrawal
Prof. Manjeet Jassal

The present invention illustrates the MOF functional textiles for environmental air purification, harmful toxins adsorption, anti-odour, and antimicrobial applications. In this invention, we develop the MOF functional textiles and a technique for the fabrication of MOF Functional Textiles. The ZIF MOF Functional Textiles were made by simple in-situ growth of MOFs on anionic functionalized cotton fabrics by facile textile finished methods, which were padding and curing. The MOF nanocrystals were uniformly grown on the fabrics with approximately 100% surface coverage. The add-on of MOFs was in the range of 12 to 14% of the wt. of the fabrics. The MOF functional fabrics showed very high wash durability up to 15 harsh laundry cycles. The MOF functional fabrics had almost 150 times the higher surface area as compared to the control fabrics. The reported fabrics successfully capture the different kinds of odours or VOCs like acids, amines, aldehydes, and thiols from the surrounding air. The results for anti-odour studies were in agreement with the industrial standards. It was also found that ZIF MOF functional fabrics also absorbed the toxic aromatic pollutants like aniline, benzene, and styrene, etc., from ambient air very efficiently as compared to the control fabrics at ambient conditions. Additionally, the reported fabrics also possess antimicrobial properties. The special abilities of MOF functional fabrics were due to the MOF crystals, which possess some unique features such as high surface, pores, acidic and basic functionalities, etc. The reported technique for the fabrication of MOF functional textiles is commercially viable and eco-friendly.



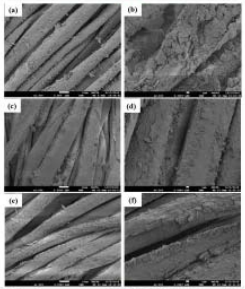
(a) Optical Image of CM Cotton Fabric. (b) Optical Image of ZIF-8@CM Cotton Fabric. (c) Optical Image of ZIF-67@CM Cotton Fabric

BET Surface Area analysis



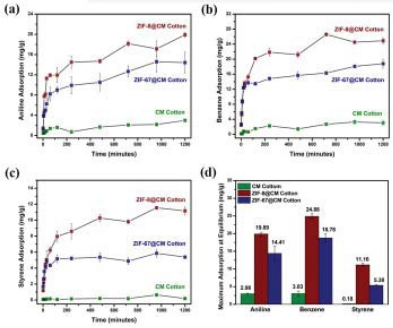
(a) N_2 adsorption and desorption isotherms, and
(b) Bar graphs of calculated BET and Langmuir surface areas of MOF functionalized Fabrics.

FESEM analysis after laundry cycles



FESEM micrographs of ZIF-8@CM Cotton fabric in two magnifications (a to b) as prepared, (c to d) after 5 laundry cycles, and (e-f) after 10 laundry cycles

Toxic Aromatic Pollutant Adsorption studies from ambient air



Time-dependent high concentration adsorption plots of MOF functionalized fabrics against three model pollutants named:
(a) Aniline
(b) Benzene
(c) Styrene
(d) Bar graphs depicting the observed maximum capture of aromatic pollutants by MOF functionalized fabrics
(e) Bar graphs depicting the % reduction of aniline, benzene, and styrene by MOF functionalized fabrics after 2 h at harmful environmental concentrations (500 ppm of each).

Shounak Roy

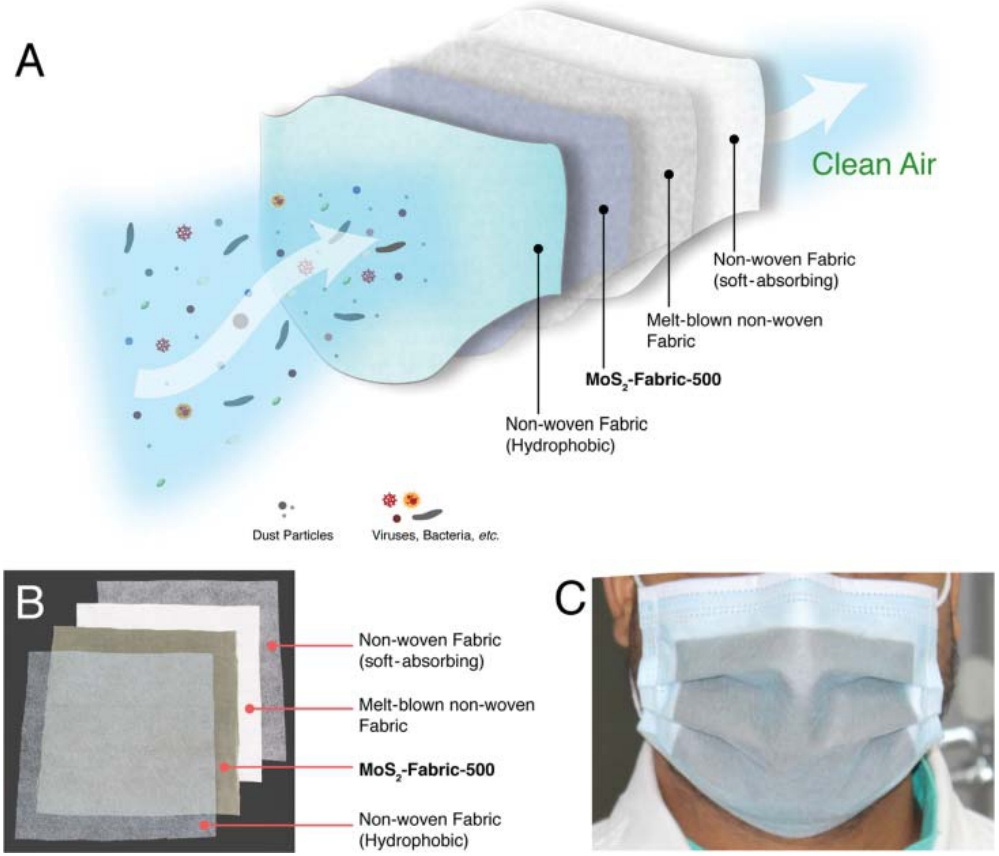
Praveen Kumar

Reusable MoS2 Nanosheet Modified Antibacterial Cotton Fabric with Solar Light Driven Self-Disinfection Property for Repurposing of Personal Protective Masks

Shounak Roy and Praveen Kumar
Indian Institute of Technology, Mandi

Guide:
Dr. Amit Jaiswal

The current pandemic of COVID-19 has swept across the globe at an alarming pace, disrupting both lives and businesses. Our biggest challenge right now is to prevent person-to-person transmission of deadly pathogens (bacteria/virus). The currently in-use PPEs only act as a physical barrier between the wearer and the outside world but lack antimicrobial properties. We have designed a technology to repurpose the existing PPEs (especially face masks), such that the face masks would perform the dual function of providing barrier protection to the wearer as well as killing the pathogen. Molybdenum disulfide (MoS2) nanosheets, having excellent antibacterial activity and photothermal properties were used to prepare a nano-based antimicrobial coating on polycotton fabrics. The combined action of surface contact-mediated membrane destruction and oxidative stress generation by the MoS2 nanosheets resulted in high antibacterial activity of the fabrics. Upon sunlight irradiation, complete self-disinfection of the nanosheet-modified fabric was achieved within 3 min of irradiation, making the fabrics favourably reusable upon self-disinfection. The nanosheet-modified fabrics maintained antibacterial efficiency even after 60 washing cycles. Finally, a prototype of a repurposed 4-layer face mask was developed using the MoS2 modified fabric as an additional layer of protective clothing without compromising the breathability of the masks. The MoS2 nanosheet repurposed mask is capable of filtering out around 97% of 200 nm particles and 96% of 100 nm particles, thereby emerging as a potential tool for preventing the spread of coronavirus (120 nm) by trapping them along with antibacterial protection against other airborne pathogens. The low-cost and easy disinfection method in a tropical country like India is expected to make this PPE a success.


A
Clean Air
Non-woven Fabric
(soft-absorbing)
Melt-blown non-woven
Fabric
MoS2-Fabric-500
Non-woven Fabric
(Hydrophobic)
Dust Particles
Viruses, Bacteria, etc.
B
Non-woven Fabric
(soft-absorbing)
Melt-blown non-woven
Fabric
MoS2-Fabric-500
Non-woven Fabric
(Hydrophobic)
C

Hema Garg

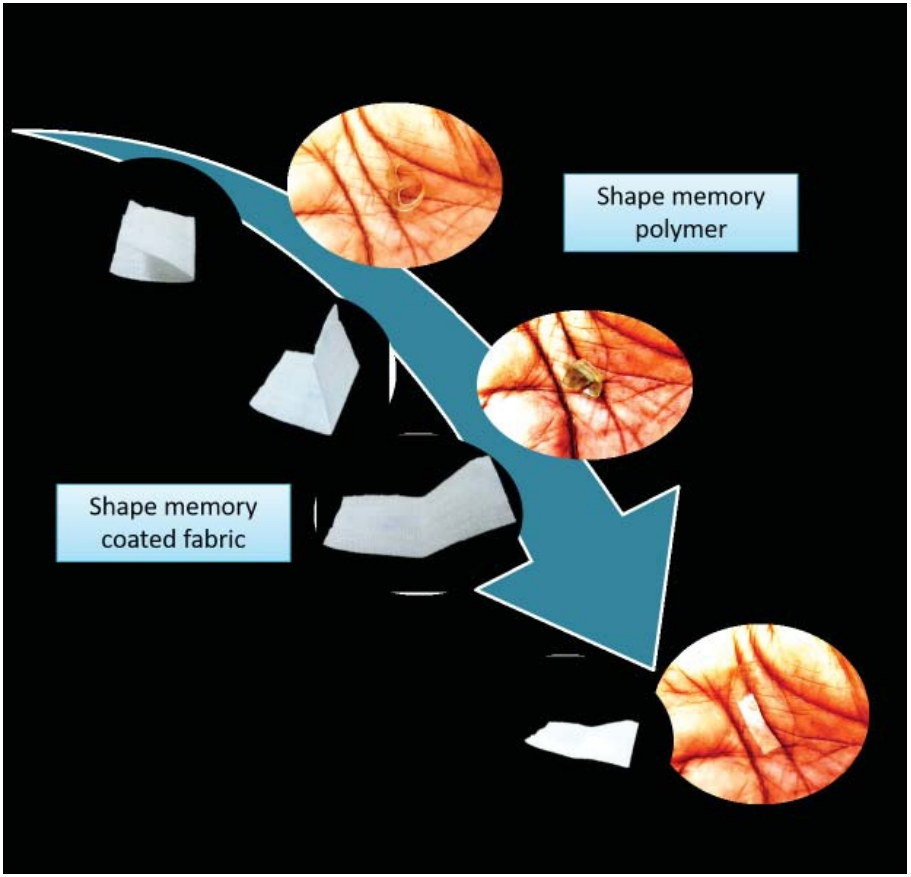
Smart Polymer with Human Body Temperature Activation

Hema Garg
Indian Institute of Technology, Delhi

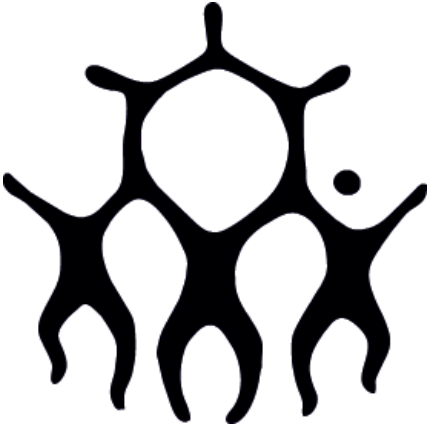
Guides:
Dr. Bipin Kumar, Dr. Bijay P. Tripathi and
Dr. Apurba Das

Climate change is one of the greatest challenges across the globe, which is severely impacting the agriculture and animal husbandry sectors. Global warming is inevitably a major concern that has led to an elevated temperature of the earth with many parts of the world experiencing drastic climate change. Mortality rates have risen in India due to the heatwaves, especially in the last few years. This demands smart wearables which can automatically regulate the body's temperature. The farmers in India experience body temperature fluctuations that adversely affect their health causing health and economic impact resulting in sunstroke, reduced work capacity, heat exhaustion, and untimely death. Clothing act as an integral part of protecting from harsh weather conditions. The temperature fluctuations in India and across the world demand smart clothing which can thermoregulate the human body temperature.

Thermally sensitive shape memory polymers (SMP) with phase-changing abilities have the potential to tackle this problem. However, the conventional materials exhibit a high transition temperature which requires a supply of thermal energy. The SMPs developed till now possess good tensile strength, however at the cost of high modulus and low elongation at break, which imparts stiffness to the end product and also limits the strain range to achieve the deformed shape. In the currently available technologies, the transition temperature of thermally sensitive shape memory polymers (SMP) is too high and the shape memory activation temperature has to be at least 10℃ above the transition temperature to attain a reasonable memory effect.


Shape memory
polymer
Shape memory
coated fabric

Honey Bee Network



Honey Bee Network

The Honey Bee Network (HBN) is a social movement supported by a large number of volunteers. The network which had pioneered the open innovation culture much before the term became popular. For the past 34 years, it has been the vanguard of protecting knowledge, resources and rights of the knowledge rich, economically poor people. It aims at i) cross-pollination of ideas, promoting lateral learning among creative individuals and communities, ii) overcoming anonymity of the grassroots innovators and other knowledge holders iii) ensuring that whatever is done with their knowledge is shared with them in local language, and iv) if any profit or income is generated using their knowledge, a fair and just share should go back to the people. It has been promoting creativity and green grassroots genius in several countries. It has facilitated documentation of over 45000 ideas, innovations and traditional practices besides student projects through volunteers. Honey Bee Network has incubated a series of institutions to support green grassroots innovators and others. It has given birth to Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), Grassroots Innovation Augmentation Network (GIAN), National Innovation Foundation (NIF) and inspired many national and international innovation policies. It is a global platform where like-minded individuals, innovators, farmers, academicians, policymakers, entrepreneurs and non-governmental organizations (NGOs) come together to respect, recognize and reward grassroots innovations. Various volunteers associated with the network help in scouting innovators, supporting them, mentoring them and provide help in disseminating the innovations as well.

The key areas of engagement:

- Scouting, spawning, and supporting innovations and outstanding traditional knowledge at grassroots. It links formal and informal science, tries to validate and add value

in sustainable innovative technologies, promotes creativity among children and also pursues learning from grandparents, particularly centenarians, about viable and green traditional knowledge.

- Promoting innovations and creativity among grassroots farm and non-farm workers, communities and women's groups engaged with culture, folk art, school and college technical education, institutions (particularly common properties or community managed) for conservation of biodiversity and natural resources.

- Mentoring individual innovators in various sectors and linking them with each other and informal sector innovators. Lobbying for policy and institutional changes in support of grassroots creativity and innovations at regional, national and international levels.

- Supporting knowledge and intellectual property rights (IPR) of economically poor people, young inventors and encouraging them to share their knowledge with other self-employed people, as a part of Technology Commons. The transfer of people's knowledge to firms is facilitated on fair and just licensing terms with benefit-sharing.

- Linking innovators with formal research and development (R&D) institutions, market and communication institutions & networks, media etc., so that more and more people are inspired to find solutions to problems of our society. SRISTI (www.sristi.org) and GIAN (www.gian.org)provide institutional support to the Network, along with other volunteers.

Linking technology students with small industry, entrepreneurs and informal sector through techpedia.in and facilitating Gandhian Young Technological Innovation [GYTI] Awards by SRISTI. Creating world's largest open-source pool of sustainable solutions developed by people without outside help, accessible to communities worldwide. Bringing out Honey Bee quarterly newsletter, a unique voice of creative and innovative people at grassroots in different languages. Motivating commercial organizations and public systems to become more empathetic in providing extremely affordable services and products to common people.

SRISTI (www.sristi.org)

INTRODUCTION:

sristi.org

SRISTI, which means creation in Sanskrit, was born in 1993, to support the activities of the Honey Bee Network (1987-88) to recognize, respect and reward creativity at the grass-roots level.

SRISTI, as a developmental voluntary organization strengthens the spirit of creativity and innovations by knowledge-rich, economically poor individuals and communities. It builds bridges between informal and formal science, protects intellectual property rights of grassroots innovators and helps in conserving and augmenting biodiversity and associated knowledge systems.

It supports eco-friendly solutions to local problems being scouted, spawned and spread by the Honey Bee Network volunteers for the last 27 years. It also nurtures ecopreneurs engaged in conserving biodiversity, common property resources, cultural diversity and educational innovations. There are five pillars of Honey Bee Network which SRISTI is committed to backstop:

[1] Educational innovations by school and college students, teachers, and other stakeholders;

[2] Institutional innovations at community and other levels in managing natural and other resources,

[3] Cultural creativity so that curiosity, collaboration, and com passion grow through art, literature and crafts;

[4] Technological innovations and traditional knowledge dealing with human, animal, plant and ecosystem health, and

[5] Policy reforms to generate frugal innovations for sustainable development at all levels, with specific reference to youth, children, women and elderly.

Essentially, it aims at improving access of knowledge-rich, economically poor people to various informal and formal institutional resources to trigger self-reliant development process as per the Gandhian ethics and principles.

OBJECTIVES:

Systematic documentation and dissemination of and value addition in green grassroots innovations and supporting biotechnological innovations by communities, technology students and others for a sustainable future.

BIODIVERSITY

- Providing intellectual property rights protection and risk capital support.
- Extending necessary support for in-situ and ex-situ conservation of local biodiversity and associated knowledge system.
- Empowering the knowledge-rich, economically poor people by adding value to their innovations, traditional knowledge and associated biological diversity including microbial diversity.

- Linking formal and informal science to enrich both the knowledge systems, build databases of innovations by farmers, artisans, mechanics, technology students, teachers and other social innovators.
- Providing early stage risk capital and mentoring support to grassroots innovators, students and other mavericks to scale up their products and services which are based on grassroots innovations through commercial or non-commercial channels. Embedding the insights learnt from grassroots innovations in the formal educational, policy and institutional systems in order to expand the conceptual, cognitive, institutional and policy space available to these innovations.

INITIATIVES:

BIRAC's BioNEST

Sanctuary of Innovation, Incubation and Entrepreneurship

(SIIE), SRISTI-BioNEST is an innovation and grassroots distinctive traditional knowledge based business incubator, an entity funded by BIRAC (Biotechnology Industry Research Assistance Council, Department of Biotechnology, Govt. of India). Innovations based on 'out-of-the-box' thinking, traditional knowledge, grassroots level knowledge systems, ideas of university students and even children are supported for successful product development and commercialization. Innovations from both formal and informal sectors are supported. The incubator caters to sectors like biotechnology, biological sciences, environmental sciences, food technology, medical science and technology, nanotechnology, pharmacy, rural development and other allied areas. Currently there are 28 incubatees incubated at SIIE-SRISTI BioNEST.

CHILDREN'S CREATIVITY:

The Children's Creativity and Co-creation Workshops aims to empower children to not only identify and articulate their own problems but also identify and try to solve problems of socially disadvantaged segments, individually and/or collectively. This workshop aims to involve children in solving the social challenges faced by community and thus help us mobilize the creative potential of children around the world. The aim is to overcome persistent social inertia in emerging and sometimes even in advanced geographical regions. It is hoped that many of these children will grow into empathetic, creative, and compassionate leaders in future and will try to work towards making an inclusive and sustainable society.

INSHODH - “TEACHERS AS TRANSFORMERS”

Teachers as Transformers is the initiative of Educational Innovations Bank (EI Bank), which is partnered with SRISTI and Honey Bee Network and based at the Ravi J. Matthai Centre for Educational Innovation, Indian Institute of Management Ahmedabad (RJMCEI-IIMA). EI Bank is a clearing house for effective educational innovations developed and implemented by elementary school teachers working in the public system. Teachers in the public system continue to play an important role in ensuring education for the marginalized sections of our society. In spite of the increase in the share of private sector enrolment, the precariously placed socio-economic strata will continue to depend on this system in the foreseeable future. However, the quality and other educational outcomes of the public system have often been criticized for their less than desirable levels. The EI

Bank assumes that top-down reform is necessary but not sufficient: learning from those who have performed in spite of constraints that are common to many teachers, valorizing and supplementing their work and converting this work into a resource, will expose teachers to a solution-augmenting approach to local educational reform, and motivate them.

SHODH SANKAL

The concept of Shodh Sankal (a chain of experimenting farmers) to generate a lateral learning environment among grassroots innovators was started by SRISTI in 1996. The idea was to bring together experimenting farmers and discuss the results of trials that farmers have taken up on their own to solve various local problems. The discussion also enhances the esteem for local knowledge systems apart from speeding up the process of technological change in regions where formal technology generation system has not been very successful - such as dry regions, mountainous regions and other disadvantaged areas.

SOCIAL INNOVATION FUND

The main objective of Social Innovation Fund (SIF) is to provide mentoring, financial, fabrication, validation, support, and value addition facilities in labs, fields, and R&D Institutions for nurturing creativity in culture, education, technology, and governance.

SRISTI INNOVATIONS

A sec 8 company was set up with the objective of strengthening the capacity of grassroots inventors, innovators and ecopreneurs in the area of conserving biodiversity and developing eco-friendly solution to local problems and is engaged inter alia in the areas of documentation, experimentation, search, development and diffusion of sustainable technologies and institutions. It now hosts the BioNEST incubator besides publishing HBN newsletters and other books in Hindi, Gujarati and English languages. It also develops commercialization products ensuring a fair share of benefits going back to knowledge providing communities.

Gandhian Young Technological Innovation (GYTI) Awards celebrates the spirit of students' innovation in engineering, biotechnology, agriculture, pharmacy, material science, design and other applied technological domains through extremely affordable/frugal solutions or the ones pushing the technological edge. It is SRISTI's initiative to foster youth-driven tech innovations. Gandhian Young Technological Innovation Awards 2020 were given virtually by the former Union Health Minister of India Shri Harsh Vardhan on November 05, 2020.

Other Activities:

SATTVIK FOOD FESTIVAL:

SATTVIK is the festival to celebrate traditional nutritious food and associated knowledge systems. It was started fourteen years ago at IIMA to provide market based incentives for conserving agro-biodiversity and creation of demand for rarely or less cultivated nutritionally rich crops and varieties to stimulate their cultivation. In the regions with low rainfall, minerals inside of the soil don't leach much and hence crops which are grown there- like millets, sorghum, and pulses- are rich in nutritional value. The paradox

of development is that the food that rich eat is often poor while food that poor grow (in poorer regions) is rich in nutritional value. This festival aspires to put the lesser known but nutrient-rich food from various states on the plate of urban communities, helping them to adopt healthier food habits and lifestyle. The festival also hopes to encourage farmers to grow more nutrition-rich crops and thus help them in augmenting their incomes. http://sattvik.sristi.org/

SHODHYATRA

Shodhyatra is a journey in some of the remotest areas of the country to search for knowledge, creativity, and innovations at the grassroots. It is an attempt on the part of SRISTI with a firm belief that the hardships and challenges of natural surroundings are prime motivators of creativity and innovations. It aims at unearthing such traditional knowledge and grassroots innovations. It is also a journey of mutual exchange and sharing of knowledge. Whatever knowledge and practices that are pooled in over various Shodhyatras are also shared back with the villagers during subsequent Shodhyatras, along with sharing of the various databases of the Honey Bee Network. During Shodhyatras, women and children are also included to display their ecological knowledge through recipe and children competitions respectively. Over the past 22 years, 46 Shodhyatras have been organised covering all the states of the country. https://www.sristi.org/shodhyatra/

SRISTI LAB:

SRISTI believes that adding value to indigenous knowledge will help local communities co-exist with biodiversity by reducing primary extraction and generating long term benefits. Such an approach will lead to augmenting sustainable resource use and livelihood support systems. it converts local knowledge and resources into value added products with simultaneous development of processing facilities in rural region where natural resources exist but not enough *in situ* value addition takes place. More at http://www.sristi.org/sristi-lab/

AASTIIK

Academy for Augmenting Sustainable Technological Inventions, Innovations, and Traditional Knowledge (AASTIIK) began as an independent programme in 2005. It aims at creating a virtual and real knowledge community of professionals and experts in the field of invention, innovation and traditional knowledge.

TECHPEDIA (www.techpedia.in)

Techpedia, an initiative of SRISTI, aims at putting the problems of micro, small and medium enterprises (MSMEs), informal sector, grassroots innovators and other social sectors on the agenda of young technology students across the country. For the past sixty years, India has not utilised much of the technological outputs of millions of students. But, this apathy will continue no more. Can a knowledge society really afford to ignore the huge talent, distributed in thousands of polytechnics, diploma and degree colleges of engineering, pharmacy, medical science, agriculture etc.? SRISTI is providing a platform for the industry and academic institutions to collaborate, cocreate and foster distributed and horizontal frugal innovations.

Goals of Techpedia:

Promotion of originality among technology students by making it impossible for them to repeat what has already been done before. This will be possible only when they can find out what has been done before. Techpedia has 204,000 technology projects done by about 600,000 students from more than 600 colleges in India.

- Connecting the technical students with the problems of informal unorganised sectors and grassroots innovators.
- To harness collaborative potential of students across disciplines and colleges to solve persistent problems of our country in formal and informal sectors.
- Explore kho kho model (relay) of product development; the idea is that if one student group has brought the solution of a particular problem to a specific stage, the next group of the same/other department should be able to build upon it and take it forward.
- To pose challenges for students to address unsolved problems of our society. Gandhiji had announced an award of 7,700 pounds (Rs 100,000) to redesign charkha (spinning wheel). Today, the value of this prize will be more than Rs 10 crore. Industry association, government and others can offer attractive prizes for solving those problems which have remained unsolved for so long.
- Developing high-tech capabilities through network platforms so that India becomes a hub for high-tech outsourcing for the world in future and does not serve only the low-tech needs.
- Promoting both IPR protected and open-source technology and eventually develop techpedia.in into an online virtual sanctuary of innovations and not just an incubator.
- Creating real-time online National Mentoring Network (NMN) to harness skills, insights and experiences of senior tech experts, for mentoring young students. Also, remote reverse mentoring by young start-ups and students.
- Encourage some of the innovations through SRISTI Social Innovation Fund, set up recently to promote frugal and extremely affordable socially useful ideas.
- Leverage policy and institutional changes to make innovation ecosystem more responsive to societal needs and aspirations of young talent.
- Organize summer schools to address specific social challenges so that young students can try to overcome institutional inertia by coming out with new prototypes for removing child labour, enhance women safety or supporting autonomy of physically-challenged people etc.
- Build global linkages so that collaborative open-innovation

models, pioneered by the Honey Bee Network, are further diffused among student communities worldwide.

Summer School on Inclusive Innovations

SRISTI has been engaging with children for tapping their creativity to address unmet social needs for over 30 years. World over, children are often treated as a sink of sermons rather as a source of ideas.

The children creativity workshops are organized to see the societal inertia through the children's eyes. They are empowered to do research and identify the unmet social needs, and suggest solution. Later, the engineering and other students take some of these ideas besides others for fabricating solutions for addressing these problems. The purpose is to generate extremely affordable solutions over next three weeks which improve the quality of life of poor children, women, workers and other disadvantaged social segments. It is possible that solutions developed during summer school may not be fully finished. We will give opportunity to some of the participants or external designer to finish these in coming months in partnership with the potential users.

Even if some of the problems remain unsolved, there will be better appreciation of the pathways that will not resolve these problems. SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions) has organized this Summer School on Inclusive Innovation through open, reciprocal and responsible frame work guided by the Honey Bee Network Philosophy. It is hoped that young students will learn not to be patient with inertia. They may be sharpen their perceptions to learn the transition from samvedana to srijansheelta (empathetic way of creative problem solving).

A palm leaf broom maker has to beat the leaves on a wooden plank mounted with nails to tear a leaf into fine fibres. The drudgery involved in this act drains much of the energy of women who generally do this task.

Similarly, hundreds of thousands of tribals have to crack mahua nut to get the seed out for oil extraction. The construction workers carry brick on their heads straining their necks and spines.

Women in Saurashtra and many other regions get hurt while harvesting the fruits from cactus like opuntia growing on the field bunds. Amla harvesting in the forest often involves cutting branches rather than just harvesting the fruits.

These and many other problems have been mobilized by the Honey Bee Network to challenge the young people to design solution to get over the indifference or inertia of formal design and technology institutions.

Every institution in the country will have to take the responsibility of mapping the unmet social needs in their hinterland and address them through student projects and summer and winter schools. Like every initiative that Honey Bee Network has taken, it may take years before policy and institutional reforms follow. The structure of governance in any society cannot remain indifferent to the persistent problems of the disadvantaged people for too long.

Email: summerschool@sristi.org Web: ss.sristi.org

In the memory of Dr. A.P.J. Abdul Kalam, the Honey Bee Network, SRISTI, and GIAN have jointly organized an annual competition of innovative ideas by students. Dr. A.P.J. Abdul Kalam Children Ignited Mind Creativity and Innovation Award competition accepts entries from students up to class 12 and also from school dropouts. This award aims to develop a culture of the "Samvedna" among children to find solutions to the local problems addressing unmet social needs. The idea is to make children aware of the problems and hardships which are faced by common people in their day-to-day life, problems with which many of us have learned to adjust and adopt. It is believed that if children start becoming impatient with social inertia at an early age, it is likely that they will bring about more creative and compassionate changes in the society as they grow up.

SITARE BIIS: Opportunity for technology students to work on grassroots innovations

SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions) in collaboration with BIRAC (Biotechnology Industry Research Assistance Council, Department of Biotechnology, Govt. of India) has been organizing a three-week SITARE BIIS (Students Innovations for Translation & Advancement of Research Explorations-Biotech Innovation Ignition School) for validating, value-adding and product development around grassroots innovations since 2017. The BIIS tries to develop solutions for grassroots applications for humans, animals, and agricultural applications including herbal technologies, medical devices, and microbial applications.

Due to COVID-19 pandemic, we have conducted BIIS (BIIS-5: June 8- June 27, 2020, BIIS-6: September 22- October 12, 2020, BIIS-7: December 1- December 21, 2020, BIIS-8: January 25 – February 14, 2021 and BIIS-9: May 20-June 9, 2021)course as a webinar, where the prime focus has been to build the capacity of primarily undergraduate students to develop skills in the field of phytochemistry, pharmacognosy, extraction, separation of compounds, microbial diversity screening, pest control, development of extremely affordable solutions for farmers, livestock keepers, pastoralists, human applications, besides patent, biostatistics and ethical guidelines for work on grassroots knowledge and innovations.

The topics for the online course BIIS are designed based on the following fields and as a part of webinar we will assign some projects to the students primarily in five action-research areas drawing upon the Honey Bee Network Database:

- Pharmacognosy/Phytochemistry - SRISTI's Grassroots database contains many traditional knowledge practices as well as contemporary innovations from across the country. These projects would involve validation/ value addition to these practices. A few of these practices are presented here- http://www.sristi.org/ hbnew/honeybee_database.php
- Soil Microbiology-SRISTI has a Microbial diversity bank containing 8000+ organisms (bacteria, fungi, and actinomycetes) isolated from the soil samples collected during ShodhYatras (learning walks for scouting and sharing innovations and local practices) in different parts of the country (http://www.sristi.org/cms/shodhyatra). An extensive study of screening these

isolated microbes for novel human, animal, and agricultural applications would be conducted.

- Veterinary Medicine- Validation of traditional practices for the improvement of livestock health, nutrition, and productivity.
- Agriculture- validation of grassroots practices by conducting trials in the lab, on the station, and in the field for product development/improvement.
- Medical devices- Value addition/product development of any of the open-source projects listed on our summer school website (http://summerschool.sristi.org/) or medical devices for human and animal health care or meeting any other unmet social needs.

Eligibility to apply:

Students pursuing bachelors programs in life sciences can apply. The student should have a valid ID issued by the Institution/University. A few seats are reserved for post graduates too. In exceptional cases, even school children with interesting ideas may be considered.

The reading material for each subject will be shared with the selected students in advance. The participants would be expected to do literature review before joining the school. These students will be having expert lecture of various life science fields like, microbiology, agriculture, medical devices, biostatistics, phytochemical extraction procedures, live experiments and demonstration of various lab equipment (AAS, HPTLC, HPLC, ELISA, PCR, BSL-I & II etc.) during the webinar. They are likely to develop a project proposal as well as work plan. These students would receive an expert feedback on their proposals from the reviewers.

The assignment, quiz and work done by students during the BIIS webinar will be assessed on the last day of the school. The outstanding studies (up to 10 per BIIS) may be identified for further support of INR 1 lakh each as SITARE-Appreciation Award Grant. The grantees are expected to conduct further research on the topic given either at home institution or at SRISTI lab.

Above all, students would get an invaluable opportunity to interact with both national and international experts as well as grassroots practitioners/innovators in their respective fields. It is hoped that each participant becomes a volunteer of the Honey Bee Network which has helped in scouting and disseminating rural creativity and innovation over the last three decades. All the output will be credited to the grassroots knowledge providers and can be published thereafter with prior written concurrence of the BIIS team and knowledge providers.

Highest ethical code of biotech research is expected to be followed. Team spirit and willingness to develop open source solutions will be highly encouraged. Peer learning will be strongly encouraged. The findings will be shared with knowledge providers in local language with the help of SRISTI and Honey Bee Network team.

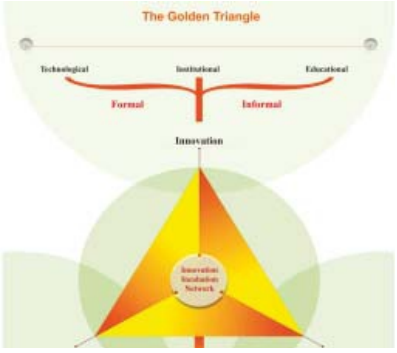
Undergraduate student from life sciences can apply through the link https//birac.nic.in/ gyti_registration.php?scheme_type=23

Grassroots Innovation Augmentation Network [GIAN]

One of the major reasons why grassroots innovations are not able to scale up in many regions and sectors is lack of handholding support for reducing their transaction cost in leveraging linkages with investors and entrepreneurs. The grassroots innovators cannot often make or present a business plan, nor can they construct scenarios under different assumptions of demand subject to availability of varying capacity for fabrication, manufacturing or development of other products and services. GIAN was set up in 1997 as a follow up of ICCIG (International Conference on Creativity and Innovations at Grassroots) held at IIMA in collaboration with Society for Research and Initiatives for Sustainable Technologies and Institutions [SRISTI] and Honey Bee Network.

The golden triangle for rewarding creativity thus became the purpose of GIAN. The reduction in ex-ante and ex-post transaction cost of innovators, investors and entrepreneurs was to be achieved by several operating principles: Never to ask innovators to come to office, instead provide them support at their doorstep; and organize financial, intellectual property, product and business development and dissemination support.

With a small team and limited funds, GIAN has achieved an admirable track record. So much so that it shared the best incubator award with IIT Madras at the hands of the then President, Dr. A.P.J. Abdul Kalam by Department of Science and Technology, 2003. GIAN worked in close collaboration with SRISTI which scouted various innovations for incubation purposes. In fact, the model of GIAN was scaled up in 2000 in the form of National Innovation Foundation [NIF].



GIAN has an independent board and a small team of professionals trying to experiment with new models of incubation, innovation and inculcation of experimental ethic at different levels in society.

Genesis

Being a pioneer is not easy. One has much higher expectations from pioneers. There is no template to copy from and much of learning takes place by doing.

The GIAN was set up in collaboration with Gujarat Government, IIMA and SRISTI besides volunteers of Honey Bee Network as a

follow up of ICCIG (International Conference on Creativity and Innovations at Grassroots) held at IIMA. Its only assets were: the commitment of state government to support grassroots innovations from the state to become entrepreneur, access to SRISTI's Honey Bee Network Database of innovations by common people and guidance and support by faculty and support of students from IIMA.

Having got the best Incubator award in 2002 by the hands of then President, Dr A P J Abdul Kalam, jointly with IIT Madras, it made a point. India's first grassroots innovation incubator was a viable pathway to reduce transaction cost of innovators, investors and entrepreneurs. The golden triangle (see fig one) for rewarding creativity, now well known, summarizes the purpose of GIAN, handholding a grassroots innovator in her journey to become a social and/or economic entrepreneur. With passage of time, GIAN has expanded its scope work. It now works with women's groups, tribal communities, students of ITIs and polytechnics particularly women polytechnics besides farmers.

It works in all sectors of human survival and adds value to people's knowledge ín collaboration with other HBN institutions such as SRISTI and NIF. It has an independent board having three additional chief secretaries of agriculture, industry and rural development departments, independent industry reprsentatives, faculty, IIMA, Director, EDI and Director, IIMA and NID are permanent invitees.

Mission

GIAN aims at sustaining the spirit of innovation, encouraging experimentation and nurturing creativity at grassroots level of knowledge rich economically poor people, students, mechanics, workers, young start-ups by contributing to the creation of a knowledge network. This Network empowers the innovators, stems the erosion of traditional knowledge systems, recognises and augments contemporary innovations, and facilitates diffusion of grassroots green innovations through commercial as well as non-commercial public, private and voluntary channels

Objectives

- To identify socially, economically and ecologically viable innovations from Honey Bee data base which are amenable for scaling up, prototype development, diffusion with or without further value addition.
- To participate in the process of value addition being done by other research organizations in grassroots innovation so that eventual scaling up can be achieved effectively.
- To mobilize resources from regional, national and international private, public and other organizations and high net-worth individuals to strengthen the ecosystem of grassroots innovations.
- To undertake market research, project development, provide design, IP related and entrepreneurial support and help in protection of their intellectual property protection.
- To influence policy at micro and macro level to make it more responsive to the needs and expectations of green innovators so that society becomes more inventive and accommodative of local knowledge systems, innovations and practices.

- To publicize innovations and products through exhibitions, shodhyatras, media and workshops.
- To organize entrepreneurial development workshops in collaboration with expert institutions for the innovators
- To trigger a rural development process that provides an alternative model of poverty alleviation in a fair, just and dignified manner through local resources, knowledge or otherwise

What does it do?

GIAN provides product development, business planning, innovation augmentation through design and development, dissemination and entrepreneurship support. It supports farmers and artisans, primarily in the informal sector in Gujarat, Maharashtra and Goa. However, it can mobilize innovation from any other regions for application in these states. Likewise, it can disseminate innovations from this region to other parts. It has recently started work with the students of ITI and polytechnic, besides school children. It has set up community innovation labs in one of the government primary schools in Ahmedabad. It has also experimented with community food and nutrition lab so that poor people [but also others] can get more nutrition out of available food materials for healthier future. It is well known that despite economic growth, many regions in our country suffer from high anaemia among women and malnutrition among children.

How can you support GIAN?

Besides CSR and other kinds of funding support, GIAN will appreciate professionals on short term sabbatical, internship, apprenticeship with innovators or incubators; remote mentoring support, exposure for its staff, infrastructural support, mobile food and nutrition labs for women, community innovation lab, sponsorship for summer and winter schools for inclusive innovation to address the unmet social needs, shodhyatas, etc. GIAN also wishes to join hands with SRISTI in online courses in different languages on how to invent and innovate. GIAN wishes to organize mobile exhibition, also build a stationary centre for inclusive innovations; public books, collaborate in bringing out Honey Bee newsletter started 29 years ago, in different languages.

Trust, transparency and accountability

GIAN is committed to uphold highest standards of ethical responsibility in managing resources and other non-material contributions. GIAN welcomes opportunities for social audit where the people with whom it works evaluate its working and various contributions.

Search

Unless young students go out into the field, villages, urban workshops, slums and other MSME clusters to find out innovations by common people as well as others, they would not know the creative potential that already exists in our country. They can mobilize ideas from school children, college students, roadside mechanics, farmers, artisans, homemakers and others for solving various problems or improving the quality of life through incremental innovations. Every time a hidden innovation is brought to surface, many more people feel encouraged and may start trying to solve problems through their own genius. If every college and university starts mapping creativity in its hinterland, the whole society will bristle with positive energy and unleash tremendous dynamism in the economy. The innovations in different fields such as technology, education, institutions, public services, private enterprises, cultural creativity, governance at different levels, etc., will be documented first in a synoptic way and then detailed documentation will be taken up of the more significant ideas. In different courses, these ideas and documentation can be incorporated as a part of curriculum. The social, cultural, ecological, industrial and institutional connection are extremely important for overcoming possible alienation of people in certain areas.

Spread

Diffusion of existing innovations whether sourced from Honey Bee Network and National Innovation foundation [NIF] or other depositories have to be shared with the local communities in a systematic manner through various creative pedagogies and performances. In fact, searching innovations without sharing may neither appear very credible nor even ethical. In the process of sharing, the students and faculty will themselves become aware of how creative our country is and how limited is the support extended to these people/communities by the formal sector including academia. Such a realization will do more to trigger introspection and generate empathetic culture for blending ideas from formal and informal sector. The students can organize exhibitions, have street theatre performances or follow other means of creating awareness about innovations in the nearby villages, schools, communities, clusters of industry, government departments, etc.

Sense

There are a lot of problems in our society which have remained unsolved for long. Unless we benchmark the persistent problems and try to address them within the means available, we may develop an attitude of living with them indefinitely. Such an attitude will never let our society progress in the long term. Idea here is that students from different discipline should benchmark unsolved problems or challenges in different sectors, at various scales affecting numerous social groups. In technology institutions, third year students can go to both MSME clusters and units and informal rural and urban sector and benchmark the problems to be addressed. They can be given credit for identifying the problem and writing a synopsis on it. In the final year, they can

take up projects to address these problems in one or two terms. Accordingly, they can get credit for that too. Practical examples of such a process are given at www.techpedia.in. The innovative solution can be given prizes at university level and also at national level through competition like Gandhian Young Technological Innovation Awards. In social sciences, one can identify gender and other cultural problems and address them likewise through action research approach. Language related students can help improve the linguistics skill of school children and develop innovative pedagogies. If every student develop one lesson for any one topic and for any class, a huge repository of open source local language lesson for school children can be developed to overcome the asymmetry in access to basic education. Different challenges can be sensed and responded.

Celebrate

During the interactions with different social and institutional segment, a lot of outstanding achievers will be identified in the hinterland. There may be an outstanding doctors who may have contributed in big way for making the communities almost disease free or a teacher who has created a very rich learning environment in a school or an innovator who has solved a problem or a public or private functionary who has created public goods for larger social development. There may also be outstanding artists, writers or other change agents who need to be invited in the universities to inspire students and create and insatiable desire to excel and serve society.

Honey Bee Network Innovation Clubs can be coordinated by the students under the oversight of empathetic faculty members. Students should have as much flexibility and freedom as possible. They should organize interaction with innovators in different fields and try to add value where possible, help in diffusion, create markets, provide linkage with other innovators and stakeholders and forge a knowledge network around innovations. They should not remain restricted only with local innovations. They should also mobilize ideas from outside for local development and vice versa. If a few session can be organized in different course to rigorously analyze the heuristics, triggers, motivations, outcomes and ecosystem characteristics, more and more student feel encouraged to take risk and try new ideas.

HBN will support the value chain development in the case of innovations from informal sector and by school children. The mandate of HBN is restricted to support ideas, innovations and outstanding traditional knowledge practices from the unorganized sector by individuals or communities who have not received any professional training or support. The educational, cultural, institutional and other governance related innovations will be pooled by Society for Research and Initiatives for Technologies and Institutions [sristi.org] and linked to various other programmes. In due course, support may be mobilized to give traction to these ideas. At present, the major contribution will be to give voice and visibility to the innovative ideas in various sectors. Volunteers from among faculty, staff and students will hopefully join hands with the innovators at different levels and in different sectors to ensure widest application for creative and compassionate ideas. Collaborative culture is likely to emerge when learning across formal and informal boundaries get reinforced. During the visit of the Hon'ble President, such clubs can be inaugurated and the team of volunteers can be blessed by the President so as to motivate them to excel in search, spread, sense and celebrate the creativity and innovation in our country.

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Minds on the Margin are not Marginal Minds

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290	Dr. Chetan Gadgil	Scientist, CSIR National Chemical Laboratory, Pune
291	Dr. Chinmaya Kumar Sarangi	Scientist, CSIR - Institute of Minerals and Materials Technology, Bhubaneswar
292	Dr. D.S. Arya	Professor, All India Institute of Medical Sciences, New Delhi
293	Dr. Debabrata Sethi	Scientist, ICAR-Indian Institute of water management, Bhubaneswar
295	Dr. Debasis Chattopadhyay	Scientist, National Institute of Plant Genome Research, New Delhi
296	Dr. Debasis Das	Scientist, Tata Institute of Fundamental Research, Mumbai
297	Dr. Debi. P Sarkar	Head, Indian Institute of Science Education & Research, Chandigarh
298	Dr. Debojyoti Chakraborty	Senior Scientist, CSIR-Institute of Genomics and Integrative Biology, New Delhi
299	Dr. Debrupa Lahiri	Associate Professor, Indian Institute of Technology, Roorkee
300	Dr. Deepak Govil	Senior Consultant GI Surgery, Indrapastha Apollo Hospitals, New Delhi
301	Dr. Devayani R. Tipre	Associate Professor, Gujarat University, Ahmedabad
302	Dr. Devendra Verma	Assistant Professor, National Institute of Technology, Rourkela
303	Dr. Dhananjay Bodas	Associate Professor, Agharkar Research Institute (ARI), Pune
304	Dr. Dhanasekaran Shanmugam	Scientist, National Chemical Laboratory, Pune
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313	Dr. G.N. Nikhil	Assistant Professor, National Institute of Technology, Jalandhar
314	Dr. Gaurav Trivedi	Associate Professor, Indian Institute of Technology, Guwahati
315	Dr. Gautam Shroff	Chief Scientist, TSR Darashaw Consultants Private Ltd, Mumbai
316	Dr. Girdhari Lal	Scientist, National Centre for Cell Science,Pune
317	Dr. Giriraj Chadak	Scientist, CSIR-Centre For Cellular And Molecular Biology, Hyderabad
318	Dr. Giriraj Sahu	Assistant Professor, National Institute of Pharmaceutical Education and Research, Ahmedabad
319	Dr. Gokul Krishnan	Associate Professor, National Institute of Mental Health and Neurosciences, Bengaluru
320	Dr. Gopabandhu Jena	Assistant Professor, National Institute of Pharmaceutical Education and Research, Ahmedabad
321	Dr. Govinda Kapusetti	Assistant Professor, National Institute of Pharmaceutical Education and Research, Ahmedabad
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323	Dr. H. G. Prakash	Director, Chandra Shekhar Azad University of Agriculture, Kanpur
324	Dr. Hardik J Pandya	Assistant Professor, Indian Institute of Science, Bengaluru
326	Dr. Harinder Singh Oberoi	Scientist, ICAR-Indian Institute of Horticultural Research, Bengaluru
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331	Dr. Hiralal Pramanik	Professor, Indian Institute of Technology, Varanasi
332	Dr. Howa Begam	Faculty, National Institute of Technology, Raipur
333	Dr. Iboyaima Singh	Scientist, Central Food Technological Research Institute, NewDelhi
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336	Dr. Indra Mani	Head, Indian Agricultural Research Institute, New Delhi
337	Dr. Indramani Dhada	Assistant Professor, Indian Institute of Technology, Ropar
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339	Dr. Ira Bhatnagar	Scientist, Centre for Cellular and Molecular Biology, Hyderabad
340	Dr. Iti Gupta	Associate Professor, Indian Institute of Technology, Gandhinagar
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342	Dr. J. B Prajapati	Professor & Head, Dairy Microbiology, Anand Agricultural University, Anand
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346	Dr. Jayakumar R	Professor, Amrita Institute of Science and Research Center, Kochi
347	Dr. Jayant Halder	Associate Professor, Jawaharlal Nehru Centre for Advanced Scientific Research Jakkur, Bangalore
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378	Dr. M S Muthu	Associate Professor, Indian Institute of Technology,Uttar Pradesh

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384	Dr. Madhuri R. Thakar	Scientist,National AIDS Research Institute, Pune
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420	Dr. Neeraj Seth	Assistant Professor, Anand Agricultural University, Anand
421	Dr. Neetu Singh	Associate Professor, Indian Institute of Technology, Delhi
422	Dr. Neha Arya	Assistant Professor, National Institute of Pharmaceutical Education and Research, Ahmedabad
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427	Dr. Oindrilla Mukherjee	Assistant Professor, National Institute of Technology, Durgapur
428	Dr. Om Prakash Singh	Associate Professor, Indian Institute of Technology, Varanasi
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430	Dr. P Balasubramanian	Professor, Centre for Plant Molecular Biology Tamil Nadu Agricultural University, Tamil Nadu
431	Dr. P Uday Kumar	Scientist & ICMR-National Institute of Nutrition, Telangana
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436	Dr. Pandiyarasan Veluswamy	Assistant Professor, Indian Institute of Information Technology, Kancheepuram
437	Dr. Pankaj Kalita	Assistant Professor, Indian Institute of Technology, Guwahati
438	Dr. Pankaj Tiwari	Associate Professor, Indian Institute of Technology, Guwahati
439	Dr. Paritosh Mohanty	Professor, Indian Institute of Technology, Roorkee
440	Dr. Partho Sarothi Ray	Associate Professor, Indian Institute of Science Education & Research, Kolkata
441	Dr. Perugu Shyam	Assistant Professor, National Institute of Technology,nWarangal
442	Dr. Pinky Agarwal	Scientist, National Institute of Plant Genome Research, New Delhi
443	Dr. Pooja Bohra	Scientist, ICAR- Central Island Agricultural Research Institute, Port Blair

444	Dr. Pooja Mukul	Doctor, Jaipur foot, Rajasthan
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448	Dr. Pradip Paik	Associate Professor, Indian Institute of Technology (BHU), Varanasi
449	Dr. Pradosh Chakrabarty	Principal Scientist, CSIR Indian Institute of Chemical Technology, Hyderabad
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453	Dr. Prasoon Kumar	Assistant Professor, NIPER Ahmedabad
454	Dr. Prati Pal Singh	Professor, National Institute of Pharmaceutical Education and Research Campus, Punjab
455	Dr. Pratik Kumar	Professor, All India Institute of Medical Sciences,NewDelhi
456	Dr. Praveen Kumar	Associate Professor, Indian Institute of Technology, Guwahati
458	Dr. Praveen Kumar Vemula	Institute for Stem Cell Science and Regenerative Medicine, Bangalore
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461	Dr. Probodh Borah	Coordinator BIF and Head, Assam Agricultural University, Jorhat
462	Dr. Prof. Hari Varma	Associate Professor, Indian Institute of Technology, Delhi
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465	Dr. R. Prasanna Venkatesh	Associate Professor, Indian Institute of Technology, Guwahati

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468	Dr. Radhika Venkatesan	Assistant Professor, Indian Institute of Science Education and Research, Kolkata
469	Dr. Raghvendra Gupta	Associate Professor, Indian Institute of Technology, Guwahati
470	Dr. Rahul Goyal	Assistant Professor, Indian Institute of Technology, Roorkee
471	Dr. Rahul Pal	Scientist, National Institute of Immunology, New Delhi
472	Dr. Rahul Vaish	Associate Professor, Indian Institute of Technology, Mandi
473	Dr. Raj Paroda	Founding Chairman,Trust for Advancement of Agricultural Sciences, NewDelhi
474	Dr. Rajanikant G K	Professor, National Institute of Technology, Calicut
475	Dr. Rajesh MK	Principal Scientist, ICAR-Central Plantation Crops Research Institute, Kerala
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477	Dr. Rajiv Srivastava	Associate Professor, Indian Institute of Technology, New Delhi
479	Dr. Rajnish Kumar	Professor, Indian Institute of Technology, Madras
480	Dr. Rakesh Maurya	Scientist, Central Drug Research Institute, Lucknow
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482	Dr. RamaKrishna Kancha	Assistant Professor, Osmania University, Hyderabad
483	Dr. Ramakrishnan Parthasarathi	Principal Scientist, CSIR-Indian Institute of Toxicology Research, Lucknow
484	Dr. Raman Govindarajan	Consultant, Pharmaceutical and Biotechnology Industry, Global Translational Medicine
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487	Dr. Ramjee Repaka	Associate Professor, Indian Institute of Technology, Ropar
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493	Dr. Raviraj Vankayala	Assistant Professor, Indian Institute of Technology, Jodhpur
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497	Dr. Ritobrata Goswami	Assistant Professor, Indian Institute of Technology, Kharagpur
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506	Dr. S. Jeyakumar	Scientist, National Dairy Research Institute, New Delhi
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508	Dr. Saakshi Dhanekar	Assistant Professor, Indian Institute of Technology, Jodhpur
509	Dr. Sabyasachi Sanyal	Senior Principal Scientist, Central Drug Research Institute, Lucknow
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511	Dr. Samrat Mukhopadhyay	Professor, Indian Institute of Science Education and Research, Mohali

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516	Dr. Sanjay Kumar	Scientist, Center for Stem Cell Research (CSCR), Bagayam
517	Dr. Sanjay Somasundaram	Co-founder and Chief Operating , Eichiba Labs Inc, California
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521	Dr. Sanjib Banerjee	Assistant Professor, Indian Institute of Technology, Bhilai
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524	Dr. Santhakumar Mohan	Associate Professor, Indian Institute of Technology, Palakkad
525	Dr. Santosh K Misra	Assistant Professor, Indian Institute of Technology, Kanpur
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528	Dr. Sarat Dalai	Assistant Professor, Nirma University, Ahmedabad
529	Dr. Sarvjeet Kaur	Principal Scientist, ICAR- National Institute for Plant Biotechnology, New Delhi
530	Dr. Sathish Dyawanapelly	Professor, Assistant Professor, Institute of Chemical Technology, Mumbai
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534	Dr. Shamik Sen	Professor, Indian Institute of Technology, Bombay

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539	Dr. Shashank Mauria	Assistant Director General, Indian Council of Agricultural Research, New Delhi
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552	Dr. Soumen Kumar Maiti	Associate Professor, Indian Institute of Technology, Guwahati
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561	Dr. Subha Narayan Rath	Associate Professor, Indian Institute of Technology, Hyderabad
562	Dr. Subrat Kar	Professor, Indian Institute of Technology, Delhi
563	Dr. Sudarshan Kumar	Scientist, National Dairy Research Institute, Karnal
564	Dr. Sudeshna Mukherjee	Assistant Professor, Birla Institute of Technology & Science, Rajasthan
565	Dr. Sudhanshu Shukla	Assistant Professor, Indian Institute of Technology, Dharwad.
566	Dr. Sudhanshu Vrati	Dean Academics & Head, Vaccine and Infectious Disease Research Center, Gurgaon
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571	Dr. Sulakshana P. Mukherjee	Assistant Professor, Indian Institute of Technology, Roorkee
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573	Dr. Sunanda Gupta	Senior Professor, Geetanjali Medical College, Rajasthan
574	Dr. Sunil Sharma	Head, Bhabha Atomic Research Centre, Anushaktinagar
575	Dr. Suptendra Nath Sarbadhikari	Professor, National Health Portal (NHP), New Delhi
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584	Dr. T. Pradeep	Professor, Indian Institute of Technology, Madras
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594	Dr. Tulsi Satyanarayana	Professor, University of Delhi South Campus, New Delhi
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614	Dr. Vikas Pandey	Innovator, Indian Institute of Technology, Delhi
615	Dr. Vinay M. Bhandari	Scientist, CSIR-National Chemical Laboratory, Pune
616	Dr. Vinayak Nath	Co-Founder, Managing Partner Venture Catalysts, Mumbai
617	Dr. Vipin Kumar	Director and Chief Innovation Officer, National Innovation Foundation, Gandhinagar
618	Dr. Virander S Chauhan	Director, International Centre for Genetic Engineering and Biotechnology, New Delhi
619	Dr. Vishal Bhardwaj	Scientific Consultant, Centre for Cellular and Molecular Platforms, Bangalore
620	Dr. Vivek Verma	Associate Professor, Indain Institute of Technology, Kanpur
621	Dr. Vivekanandan Perumal	Assistant Professor, Indian Institute of Technology, Delhi.
622	Dr. Vivekanandan Perumal	Professor, Indian Institute of Technology, Delhi
623	Dr. VM Chariar	Associate Professor, Indian Institute of Technology, Delhi

624	Dr. Yashveer Singh	Assistant Professor, Indian Institute of Technology, Ropar
625	Dr. Yogesh Kumar Sharma	Associate professor, Indian Institute of Technology, Roorkee
626	Dr.Gangagni Rao Anupoju	Sr. Principal Scientist, CSIR-Indian Institute of Chemical Technology, Hyderabad
627	Dr.Syed Nasimul Alam	Assistant Professor, National Institute of Technology, Rourkela
628	Dr.Ulka Malode	Assistant Professor, Bajaj College of Science, Maharashtra

LIST OF GYTI AWARDEES (2012 - 2020)

List of GYTI Awardees (2012 - 2020)

GYTI Award 2012

Sr.	Title	Student Name	Institute Name	Supervisor Name
1	Tiles Measurement and Grade Classifying Equipment	Deep M. Bhimani	Government Engineering College, Rajkot	Dr. C. H. Vithalani
2	Multi Desire Wheelchair	Pratik Gandhi, Chintak Dholakia	L.D. College of Engineering	Prof. B. H. Parmar
3	Incense Stick Maker	Keshav G	Indian Institute of Technology, Gandhinagar	Dr. Murali Damodaran
4	LPG based Refrigerator	Chintan Patel, Mayank D Patel, Mayank Patel and Biren Patel	Laljibhai Chaturbhai Institute of Technology, Mehsana	Prof. Y. L. Raol, Prof. A. B. Patel
5	Domestic Refrigerator with Water Heater	Dhruv Patel	Gandhinagar Institute of Technology, Gandhinagar	
6	LPG based Refrigerator	Jainil Bhatt, Dhruvin Kagdi, Tirth Jani, Kunjal Jadav	LDRP-ITR College	Prof. Tushar Patel
7	Jeevan Dhara Hand Pump with Integrated Filtering System	Kirti Ranjan	Indian Institute of Technology, Kharagpur	
8	Automobile Air Conditioning using Engine Exhaust	Harish Umashankar Tiwari	Pimpri Chinchwad College of Engineering, Nigdi, Pune	Prof. G. V. Parishwad
9	Design, Synthesis & Evaluation of Novel Steroidal Aromatase Inhibitors in Breast Cancer	Dr. Prafulla M. Sabale	Parul Institute of Pharmacy, Vadodara	
10	Image, Speech Recognition and Speech Synthesis for physically disabled	Saurabh Saket	Bhutta College of Engineering	Inderdeep Singh Grewal

11	Smart Grid Forecasting Technique	V S K Murthy, Balije palli	Indian Institute of Technology, Bombay	
12	Ultra Sensitive, Low Cost Hand Held Explosive Detector System	Neena Avinash Gilda	Indian institute of Technology, Bombay	Prof. V. Ramgopal Rao, Prof. Dinesh K. Sharma, Prof. Maryam S. Baghini
13	A Tsunami Warning System using Ionospheric Measurements	Jhonny Jha	Indian Institute of Technology, Bombay	Prof. Krishna Sudhakar
14	Vardaan: Stair Climbing Wheelchair	Shanu Sharma	Indian Institute of Technology, Kanpur	Dr. J. Ramkumar, Prof. Shatrupa Thakruta Roy, Dr. Satyaki Roy
GYTI Award 2013				
1	Electronic Support System for Physically disabled(Deaf & Dumb)	Margie Ashok Joshi	C.K. Pithawalla College of Engineering and Technology	Prof. Dipti Patel
2	Saral Parikshan - An Advancement in Cutting Edge Technology for Rural Area to Detect Vitamin B12 for Pernicious Anemia	L. Sagaya Selvakumar	Council of Scientific & Industrial Research-Central Food Technological Research Institute	Prof. M. S. Thakur
3	E-diagnoser: An Advanced Low Cost Patient Monitoring Watch	Libin Varghese, Pillai Sareesh, Shibin Joseph, Adarsh.S, Chithira Jacob, Nithya Merin, Anoop.P	Amal Jyothi College of Engineering	Prof. Reshmi V
4	Hydro-Operated Square-Bottom Paper And Jute Bag Making Machine	Anirudh Thakur	Llriet moga	
5	Nano finishing of Freeform Surfaces of Prosthesis Knee Joint Implants	Sidpara Ajay Muljibhai	Indian institute of technology Kanpur	Prof. V. K. Jain, Prof. V. K. Suri, Prof. R. Balasubramanian
6	Digital Pen	Kalpesh Wani	Visvesvaraya National Institute of Technology, Nagpur	

7	Multifunctional Nano-in-Micro Alginate Microspheres for Biosensing, Drug Delivery and MRI	Rashmi Dilip Chaudhari	Indian Institute of Technology, Bombay	Prof. Rohit Srivastava
8	Highly Gas Impermeable Elastomeric Rubber-Rubber Blend Nano Composites	Ajesh K Zachariah	Mar Thoma College	Prof. Sabu Thomas
9	A Portable and Efficient Electronic Filter for Sub-Micron Particles from Fluids	Aswathi R Nair	Indian Institute of Science	Prof. Sanjiv Sambandan
10	Laser Ignited Internal Combustion Engine	Kewal Dharamshi	Indian Institute of Technology, Kanpur	Prof. Avinash K. Agarwal
11	Novel Stand-alone 1-Phase AC Generator for Rural Electrification using Renewable Energy	Sandeep Vuddanti	Indian Institute of Technology, Delhi	Prof. S. S. Murthy, Prof. Bhim Singh
12	Ultra Low Cost Tunable Nano Scale Patterns	NandiniBhandaru	Indian Institute of Technology, Kharagpur	Dr. Rabibrata Mukherjee
13	Vision for the Blind Using Ultrasonic Sensors	Santosh Kumar Bhandari	SRM, Kattankulathur	
14	Spectral Eye	Sai Vijay Gole, Saket Choudhary, Yashesh Gaur	IIT Madras,IIT Bombay, DA-IICT	
15	Automatic Fish Scaling Machine	M. Rajesh Kanna	Velammal College of Engineering and Technology, Madurai	Dr. P. Rajesh Kanna
16	Chetna - Celebrate Your Pregnancy	Keyur Sorathia	Indian Institute of Technology, Guwahati	Keyur Sorathia
17	VAJRA(vessel desk)	Raghunath P lohar	Ganesh Institute of Engineering	
18	SHE- Society Harnessing Equipment	Manisha Mohan	SRM University, Chennai	
19	Clubfoot Orthosis	Kanwaljit Singh	Indian Institute of Technology, Delhi	Dr. P. M. Pandey

20	The Third Eye	Naveen Kumar Rai	Indian Institute of Technology, Guwahati	Dr. Amit Sethi
21	Reactor & Catalyst development for oxygen evolving step in Sulfur-Iodine cycle for Hydrogen production	Kishore Kondamudi	Indian Institute of Technology, Delhi	Dr. Sreedevi Upadhyayula
22	Apparatus for Making Silk Fiber Based Lamellar Biomaterials to Solve Problem of Lower Back Pain	Maumita Bhattacharjee	Indian Institute of Technology, Delhi	Dr. Sourabh Ghosh, Prof. Alok R Ray
GYTI Appreciation 2013				
23	Ambulatory Health Network App	Jayesh Vrujlal Khasatiya	Narnarayan Shastri Institute of Technology, Jetalpur	Prof. Ankita Shah
24	Re-arranging Unused Contacts in Mobile Phones for Quick Access	Bala Vishnu R	kongu Engineering College	Prof. P. Natesan
25	Development Bamboo-epoxy nano composites for manufacturing of helmets and other structural applications	Vivek Kumar	Indian Institute of Technology, Delhi	Dr. Sanat mohanty
26	Mosquitocidal Endotoxin from Vellore Poultry Farm Wastes	Bishwambhar Mishra	VIT University, Vellore	Dr. Suneetha Vuppu
27	Sancharak: A Cell-Phone for Blind People	Rohit Bharatkumar Singh	Padmabhushan Vasantdada Patil Pratishthan College of Engineering	Dr. K. T. V. Reddy
28	Target Oriented Niosome Based Delivery of an Antitubercular Drug, Development and Characterization	Gyanendra Singh	Indian Institute of Technology Banaras Hindu University, Varanasi	Prof. Shubhini Saraf
29	Semi-Automatic Rubber Tapping Machine	G. R. Malarmannan	Velammal College of Engineering and Technology, Madurai	Dr. P. Rajeshkanna
30	Cow Dung based Microbial Fuel Cells (CDFCs) to Light up Indian Villages	Vishnu Jayaprakash	University of California, Berkeley	Prof. T. S. Natarajan

31	Development of a Geo-hazard Warning Communication System	Devanjan Bhattacharya	Indian Institute of Technology, Roorkee	Dr. Jayanta Kumar Ghosh, Dr. Narendra Kumar Samadhiya
32	Prognosis of Pre-Diabetes and Type 2 Diabetes Based on the Non-Invasive Estimation of Blood Glucose Using Infrared Thermography against the Bio-Marker	Sivanandam S	SRM University	Dr. M. Anburajan
33	Saree cutting machine for mat making handlooms	Alap Kshirsagar	Indian Institute of Technology, Bombay	Prof.Suhas Joshi
34	Hybrid Classifier for Marine Vessel based on Propulsion	Piyush Aggarwal	Jaypee Institute of Information Technology University, Noida	Prof. Mukta Goyal
35	Design of a Smart Automotive Ventilation System for Parked Vehicles	Gaurav Kumar Jaiswal	Vellore Institute of Technology, Vellore	Dr. Vasudevan R.
36	Snippets-Memory Aid for People With Disability	Devender Goyal	Indian Institute of Technology, Hyderabad	Kshitij Marwah
37	Graphics Model for Power Systems in CIM Framework and Design of Online Web-based Network Visualizations and Integration of Control Center Applications	Gelli Ravi kumar	Indian Institute of Technology, Bombay	Prof. S. A. Khaparde
38	Cross Linked Antibaterial Hydrogel	Mr. Chakavala Soyeb Rafikbhai	Anand Pharmacy College	Dr. Nirav V Patel, Dr. Tejal R. Gandhi
39	Robotic Dredger	Amit Dinanath Maurya	Indian Institute of Technology, Bombay	C. Amarnath
40	Comprehensive Protection from Electrocution	RAMDAS M U	Vidya Academy of Science and Technology, Thrissur	Dr. Sudha Balagopalan, Prof. Mary P Varghese
41	High Performance Cooking Stove	Mayur Rastogi	Indian Institute of Technology, Kharagpur	Prof. S Ray
42	Self-Cleaning Functional Molecular Material	M. B. Avinash	JNCASR	T. Govindaraju

GYTI Awards 2014				
1	Performance Enhancement of Microthruster using Nano-engineered MEMS Structure for Long Term Space Mission	Pijus Kundu	Indian Institute of Technology, Kharagpur	Prof. T. K. Bhattacharyya, Prof. Soumen Das
2	Parichaya - a Low-cost Medical Device to Increase Adherence among Tuberculosis Patients in Rural Assam	Himanshu Seth	Indian Institute of Technology, Guwahati	Prof. Keyur Sorathia
3	A Simple and Cost Effective Retrofitting to Improve the Thermal and Combustion Performance of Traditional Cook Stoves	Vijay Hanmant Honkalaskar	Indian Institute of Technology, Bombay	Prof. Upendra Bhandarkar
4	Bio mimicked Polymer Surfaces Exhibiting Super hydrophobic and Anti-Reflective Properties	Srinadh Mattaparthi	Indian Institute of Technology, Hyderabad	Prof. Chandra Shekhar Sharma
5	A Low Cost Cardiovascular Diagnostic Instrument For Rural Healthcare	Sushanth Poojary	Indian Institute of Technology, Bombay	Prof. Santosh Noronha
6	Low-cost Diagnosis of Pneumonia	Abhishek Khanolkar	Indian Institute of Technology, Madras	Vikram Shete
7	Development and Pilot Testing of Nano-Sized Tio2 Based Photocatalytic Oxidation Technology For Controlling Vocs	Indramani Dhada	Indian Institute of Technology, Kanpur	Prof. Mukesh Sharma
8	Microfluidic Immunosensor	Ramchander Chepyala	Indian Institute of Technology, Kanpur	Prof. Siddhartha Panda
9	Laser light Based Fully Computerized automated breast Cancer and Muscle Screening System development	Samir Kumar Biswas	Indian Institute of Science, Bangalore	Prof. K. Rajan
10	Injectable silk Fibroin Hydrogel for Tissue Engineering and Drug Delivery	Surojeet Das	Indian Institute of Technology, Guwahati	Dr. Biman B. Mandal
11	Fabrication of Stable Liquid Crystal Based Biosensor	Arun Prakash Upadhyay	Indian Institute of Technology, Kanpur	Dr. Sri Sivakumar

12	Paper-pencil Based self-pumping and Self-breathing Fuel Cell	Ravi Kumar Arun	CSIR-Central Mechanical Engineering Research Institute, Durgapur	Prof. Suman Chakraborty
13	Development and Evaluation of Women Friendly Vaginal In Situ Hydrogel for Sperm Immobilisation.	Dr. Vaishali Thakkar	Anand Pharmacy College, Anand	Dr. Tejal R. Gandhi
GYTI Appreciation 2014				
14	Voice Activated Safety App	Mithila Harish	Vellore Institute of Technology, Vellore	Prof. Monica Subashini M
15	Integrated Circuit (IC)-based Flexible Electronic Devices and Displays (ICFEDD)	Prakash Kodali	Indian Institute of Science, Bangalore	Sanjiv Sambandan
16	Android application for women safety	Akhil Aggarwal, Shubham Jindal, Siddharth Garg, Rajan Nagpal	Indian Institute of Technology, Delhi	Dr. Rajesh Prasad
17	Microwave Coplanar Sensor System for Detecting Contamination in Food Products	Makkattary Shaji	Indian Institute of Technology, Kanpur	Dr. M. J. Akhtar
18	Amsler Grid Test	Jagjeet Singh	Indian Institute of Technology, Guwahati	Anthony Vipin Das
19	Inhalable Multiparticulate Carrier Systems for Sustained and Targeted Delivery of Isoniazid	Dr. Sanjay Tiwari	Indian Institute of Technology, Varanasi	Dr. B. Mishra
20	Wireless Communication and Security System Embedded Safety Helmet	M. Sivagurunathapandian	Easwari Engineering College, Chennai	Dr. N. S. Bhuvaneswari
21	Cost Effective Vegetable Chiller for Rural Small Farmers	Vishnu Padmanaban	Amrita School of Engineering, Coimbatore	Dr. M. Elangovan
22	Jaivik Prakash: A Simple Tool for Detection of Hazardous Materials and Sanitary Condition at Rural Level	Rajeev Ranjan	CSIR-Central Food Technological Research Institute, Mysore	Prof. M. S. Thakur

23	Concept of Breaker Dipeptides and Its Application in Alzheimer's Amyloid Disruption	Nadimpally Krishna Chaitanya	Indian Institute of Technology, Guwahati	Dr. Bhubaneswar Mandal
24	3D model Generation from 2D X-Ray Images	Vikas Dhruwdas Karade	Indian Institute of Technology, Bombay	Prof. B. Ravi
25	Identification of Safest Path using Crime Records	Puneet Singh	Indian Institute of Technology, Kanpur	Prof. Bhiksha Raj, Prof. Rita Singh
26	Laser Technology Detects Hidden Materials: Applications to Security and Medicine	Sanchita Sil	Indian Institute of Science, Bangalore	Prof. Siva Umapathy
27	Open Source E-Mailing System for the Visually Impaired	Aakash Anuj	Indian Institute of Technology, Kharagpur	Prof. Anupam Basu
28	Development of Microbial Fuel Cells with Improved Performance	Jayesh Manohar Sonawane	Indian Institute of Technology, Bombay	Prof. Prakash Chandra Ghosh
29	Fabrication of Organic Thin Film Transistor using Single Drop of Organic or Hybrid Insulator, Conductor and Semiconductor Materials	Gunda Manideep	Indian Institute of Technology, Kanpur	Dr. Monica Katiyar
30	Adsorptive Removal of Phenolic Compounds Using Mixed Matrix Membrane of Cellulose Acetate Phthalate and Alumina Nanoparticle	Raka Mukherjee	Indian Institute of Technology, Kharagpur	Prof. Sirshendu De
31	Ultra-High Actuation in a Carbon Nanotube Actuator	Prarthana Gowda	Indian Institute of Science, Bangalore	Prof Abha Mishra
32	A Transceiver for Satellite Based Communication during Emergency Using TV White Spaces	Rajan Kapoor	Indian Institute of Technology, Patna	Dr. Preetam Kumar

33	Macrophage-specific Targeting of Mannose-functionalized Biodegradable Polymeric Nano particles of Some Anti-leishmanial Drugs- Development, Optimization and Efficacy Evaluation	Pramila Chaubey	Indian Institute of Technology (BHU), Varanasi	Prof. Brahmeshwar Mishra
34	Stampede Control Using Image Analysis Technology	S. Vidya Sagar	Kongu Engineering College, Erode	Prof. D.Leela
35	Synthesis and Design of Indigenous Polycentric Knee for Transfemoral Prosthesis	Anand T.S.	Indian Institute of Technology, Madras	Dr. Sujatha Sreenivasan
36	Highly Stable Metallic Nano particle-Semiconductor Hetero structures via Click Chemistry for Photoelectro/ Photocatalytic Applications	Arun Prakash Upadhyay	Indian Institute of Technology, Kanpur	Dr. Sri Sivakumar
37	Novel Algal Bioreactor for Wastewater Treatment And Bio fuel (Lipid) Production	Durga Madhab Mahapatra	Indian Institute of Science, Bangalore	Dr. T V Ramachandra, Dr. H N Chanakya
38	Care Mother-Mobile Pregnancy Care	Shantanu Pathak	INHS Asvini, Mumbai	Prof. Vaibhav Tidke
39	Paper and Pencil Micro Fluidic Device for Point-of-Care diagnostics	Ranabir Dey	Indian Institute of Technology, Kharagpur	Prof. Suman Chakraborty
40	Touchpad for Malignant Tumour (Epithelial) Detection and Imaging	Sritam Parashar Rout	Indian Institute of Technology (BHU), Varanasi	Prof. Anoop Jayaram
BIRAC GYTI Award 2015				
1	RIGHTBIOTIC: The Fastest Antibiotic Finder	Shivani Gupta	Birla Institute of Technology & Science University, Pilani	Dr. Suman Kapur
2	Redefined Spoon for Parkinson's Patient	Dhyey Mayank kumar Shah, Eepsit Tiwari, Rajesh Patidar	Indian Institute of Technology, Gandhinagar	Prof. Bhaskar Bhatt, Prof. Harish P. M.

3	Development of a Powerful New Antibiotic That Kills All Drug-Resistant Bacteria	Venkateswarlu Yarlagadda, Padma Akkapeddi, Goutham B Manjunath	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)	Prof. Jayanta Haldar
4	Real Time Wound Management System Wound Segmentation & Analysis using Image Processing on Mobile Platform (Android)	Abhiraj Gupta	Manipal Institute of Technology	
SRISTI GYTI Award 2015				
5	Sway: The Rhythm Within	Janhavi Joshi	MIT Institute of Design, Pune	Prof. Sanjay Jain
6	Double Disk Ultrasonic Assisted Magnetic Abrasive Polishing Device	Prateek Kala	Indian Institute of Technology, Delhi	Dr. Pulak Mohan Pandey
7	Development of Shape Controlled Palladium Structures as Electrocatalysts for Fuel Cell Applications	Kranthi Kumar Maniam	Indian Institute of Technology, Madras	Dr. Raghuram Chetty
8	Reduced Converters and Brushless Generators Based Standalone Microgrid for Rural Electrification	Krishan Kant	Indian Institute of Technology, Delhi	Prof. Bhim Singh
9	Novel Nanozyme Technology for Combating Oxidative Stress Related Disorders	Amit Ashok Vernekar	Indian Institute of Science, Bengalore	Prof. G. Mugesh
10	FLEXICAST: A Breathable, Washable and Customized Cast For Immobilization of Fractured Limb	Jamdade Nikhil Kailas, Pankaj kumar K. Chhatrala, Devanshi Saksena	Indian Institute of Science, Kanpur	
11	Novel Technique for Energy Generation Coupled with Treatment of Wastewater and Resource Recovery Using E-Waste As Electrode Material In Microbial Fuel Cell	Praveena Gangadharan, Jaganathan Senthil nathan	Indian Institute of Technology, Madras	Dr. Indumathi M Nambi

12	Evaluation of Blood Pressure and Arterial Compliance by the Radial Arterial Pulse Pressure Waveform obtained using Fiber Bragg Grating Pulse Recorder	Sharath Umesh	Indian Institute of Science, Bangalore	Prof. Sundarrajan Asokan
13	Targeting Lymphatics to Treat HIV Using Lipid Based Formulations	Rashmi Jain, Vivek Makwana, Komal Patel	B. V. Patel PERD Centre	Prof. Amita Joshi
14	TAPARCH: A Visually Challenged People Footwear	Krishna Sai	Gitam University	
15	Valproic Acid Prevents Progression of the Diabetic Nephropathy: Elucidation of Molecular Mechanisms and Proof of Concept for Promising Therapeutic Usefulness	Sabbir Khan	National Institute of Pharmaceutical Education and Research (NIPER), S.A.S. Nagar	Dr. Gopabandhu Jena
16	Gift of New Abilities	Shiva Kumar H R	Indian Institute of Science, Bangalore	Prof. A. G. Ramakrishnan
SRISTI GYTI Appreciation 2015				
17	Recyclable Porous Sheets for Low-Cost Water Filter	Abhishek Gandhi	Indian Institute of Technology, Delhi	Prof. Naresh Bhatnagar
18	TEDKIT- An Audio Tactile Storybook for Visually Impaired Children	Ankita Gulati	Indian Institute of Technology, Delhi	Prof. M. Balakrishnan
19	Food Vending Machine for Schools	Subrahmanya Shridhar Shetty	NMAM Institute of Technology	Prof. Pradeep Kanchan
20	Nano emulsions as a Vehicle for Delivery of Omega-3 Fatty Acids for Serum and Tissue Lipids	D. Sugasini	CSIR-Central Food Technological Research Institute	Dr. B. R. Lokesh
21	Rapid Non-Invasive Diagnostics Kits for Diabetics Patients to Check Glucose Level Thrice a Day	Yadav Vijay Dukhran	Institute of Chemical Technology, Mumbai	Dr. Prajakta Dandekar Jain
22	Injection Mouldable Polymeric Composite Based Passive Polycentric Knee Joint	S. Arun	Indian Institute of Technology, Guwahati	Dr. S. Kanagaraj

23	A Novel Process To Commoditize Carbon Dioxide Gas Into Fuels And High Value Nutraceuticals At Commercially Viable Scale	Dilip Singh, Preeti Mehta, Ravi P. Gupta	DBT-IOC Centre for Advance Bio Energy Research	Dr. D. K. Tuli
24	Development of X-ray Visible Polymers via In Situ Iodination-Crosslinking for Non-Invasive Real Time Imaging	Paulomi Ghosh, Arun Prabhu Rameshbabu	Indian Institute of Technology, Kharagpur	Dr. Santanu Dhara
25	Affordable Power-Assist For Wheelchair	Sri Priya Kalidoss, Karthikeyan S D, Viveksarda	Indian Institute of Technology, Madras	Dr. Sujatha Srinivasan
26	Utilization of Marine Algae As Substrate And Methanogen Inhibitor In Microbial Fuel Cell	Rajesh P P	Indian Institute of Technology, Kharagpur	Prof. M. M. Ghangrekar
27	Prashamana- A Smart Hospital Bed	Toshib Bagde, Jamdade Nikhil Kailas	Indian Institute of Technology, Kanpur	Dr. Ramkumar Janakarajan
28	Linearly Polarised Planar Inverted F-Antenna For Global Positioning System And Worldwide Interoperability for Microwave Access Applications	Mayank Agarwal	Indian Institute of Technology (BHU), Varanasi	Dr. Manoj K. Meshram
29	Use of High Nutrient, Low Cost Natural Materials for Preparation of Well-Engineered Emulsions for Variety of Applications	Lad Virang kumar Nanubhai	Sardar Vallabhbhai National Institute of Technology, Surat	Prof. Z. V. P. Murthy
30	Clubfoot deformity measuring device	Kanwaljit Singh Khas	Indian Institute of Technology, Delhi	Dr. P. M. Pandey, Prof. Alok. R.Ray
31	Virtual Reality Based Minimally Invasive Surgical Simulator with Haptics Feedback	M.S. Raghu Prasad, Abhijit Biswas	Indian Institute of Technology, Madras	Manivannan M
32	Electrospun Cellulose Acetate Nanofibers for Female Hygiene Applications	Shital Yadav, Illa Mani Pujitha, Tulika Rastogi	Indian Institute of Technology, Hyderabad	Dr. Chandra Shekhar Sharma

33	One Drug to Cure Them All	Chandradhish Ghosh	Jawaharlal Nehru Centre for Advanced Scientific Research	Dr.Jayanta Haldar
34	Fabrication of Nano Object Imaging Probe Using Simple & Fast Hydro -Mechanical Etching Technique	Fazle Kibria	University College of Science & Technology	Rajib Chakraborty
35	Agriculture	Abitha R	Indian Institute of Science, Bangalore	Dr. H. N. Chanakya
36	Rapid diagnosis of brain injury-A novel approach using citrate-capped gold nano particles	Srishti Agarwal	Indian Institute of Technology, Hyderabad	Dr. Anindya Roy
37	Biodegradable LiposAu Nanoparticles for photothermal ablation of Cancer	Aravind Kumar Rengan, Amirali B. Bukhari	Indian Institute of Technology, Bombay	Rohit Srivastava
38	Biomechanical Investigation of Extracorporeal Irradiation and Reimplantation Therapy in Malignant Bone Tumours	Sakshi Chauhan	Indian Institute of Technology, Delhi	Dr. Anamika Prasad, Dr. Shah Allam khan
39	Suchi-Ahvana	Pratik Raj, Deepak Nagar, Kewal Chand Swami	Pandit Dwarka Prasad Mishra Indian Institute of Information Technology, Design & Manufacturing, Jabalpur	
40	Development of Membrane Technology for Industrial Progress, Societal Benefit and Environmental Safety	Siddhartha Moulik, Dr. Sundergopal Sridhar, Y. V. L. Ravikumar, M. Madhumala, Dasari Manjunath	CSIR - Indian Institute of Chemical Technology	Dr. S. Sridhar
41	Methane Sensing Module: From Concept to Prototype	Anwesha Mukherjee, Pavan Kumar R, Goutam PrasannaKar, Sanjay Rao A, Vaibhav V Rao	Indian Institute of Science, Bangalore	Dr. Abha Misra
42	Energy Efficient Robust Controller for Autonomous Underwater Vehicle	Meenakshi Sarkar	CSIR - Central Mechanical Engineering Research Institute	Dr. Sambhunath Nandy

43	Inch Worm Mechanism for Solar Panel Cleaning Robot	Bhivraj Suthar	Indian Institute of Technology, Delhi	Prof. Sudipto Mukherjee
BIRAC GYTI Award 2016				
1	Simple Low- cost Bioactive Titanium Foam via Novel Route for Skeletal TissueReunion	Kausik Kapat	Indian Institute of Technology, Kharagpur	Santanu Dhara
2	Flexible Biodegradable Anti-Microbial New Advanced Form of Intra Uterine Contra-ceptiveDevice (IUCD)	Bhuvaneshwaran Sub-ramanian, Selvakumar M Dibyendu Gouri	Indian Institute of Technology, Kharagpur	Dr. Sujoy K Guha
3	Automated Opto-Fluidic Microscope for Cellular Diagnostic Testing	Veerendra Kalyan Jagannadh, Jayesh V. Adhikari, Albina L. Nirupa, Rashmi S, Bindu Bhat	Indian Institute of Science, Banga-lore, Karnataka	Dr. Sai Siva Gorthi
4	3D Printed Hydroxyapatite Tray for Segmental Mandibular Bone Reconstruc-tion By Stem Cell Delivery for Oral Cancer Patients	Sanskrita Das, Dr. PraveshMehra	Indian Institute of Technology, Delhi	Dr. Sourabh Ghosh
5	NStomoz – Vascular anastomosis assist device	Anand Parikh	Indian Institute of Technology, Madras	Prof. Venkatesh Bala-subr amanian, Dr. V B Narayanamurthy
6	Wearable Drug Delivery Device Based on Microneedles For Efficient Management of Chemotherapy Induced Nausea And Vomiting (CINV) and Nausea And Vomiting in Pregnancy(NVP)	Bhushan N Kharbikar	Indian Institute of Technology, Bombay	Prof. Rohit Srivastava
7	Automatic Urine and Fecal Disposal System	Neenu Jose, Athul K.Raj, Athira K.R, Neenu P	Sahrdaya College of Engineering and Technology	Prof. Jinu Sebastian
8	Device for Intrapartum Materno-Fetal ZCare	Vichal P M	BMS College of Engineering, Visvesvaraya	Prof. Appaji M Abhishek

9	Rapid Endotoxin Entrapment and Detection on Surface- engineered Glass Substrates	Sachin Kumar, Prasanta Kalita, Ruchika Sharma, Nitish Goel	Indian Institute of Technology, Delhi	Dr. Shalini Gupta
10	Near Infra-Red light Activable Iron(III) Complex as a Remarkable and Organ-elle- Targeted Anti- Cancer Agent for the Photodynamic Therapy Application	Aditya Garai	Indian Institute of Science, Bangalore	Prof. A. R. Chakravarty
11	Energy efficient Combined Processof Microbi-al Fuel Cell (MFC) and Membrane Bioreactor (MBR) For High Efficiency And Reliable Treatment Of Organic Waste Water	Sreemoyee Ghosh Ray, Gourav Dhar Bhowmick	Indian Institute of Technology, Kharagpur	Prof. M. M. Ghangrekar
12	A Novel Compound Restores Obsolete Antibiotics to NDM-1Superbugs	Divakara SS Murthy, Uppu, Goutham B Manjunath, Padma Akkapeddi	Jawaharlal Nehru Centre For Ad-vanced Scientific Research (JNCASR)	Prof. Jayanta Haldar
13	Development of a Novel, Non- Biological Pyrogen/Micro Cellular Components Detection Technique for Purification and Dehydrogenation of Water.	Yadav Vijay Dukhran, Rohan Chhabra, Nikhil Kalane, Anomitra Dey, Tejal Pant, Ratnesh Jain	Institute of Chemical Technology, Mumbai	Dr. Prajakta Dandekar Jain
14	A Compact Microwave Sensor for Char-acterization of Radomes and Dielectric Signature Detection of Materials in 3G and 4G GSM Bands	Abhishek Kumar Jha	Indian Institute of Technology, Kanpur	Dr. M. J. Akhtar
15	Development of Portable Device Based on Polarized Fluorescence for Detection Of Cervical Pre- Cancer	Bharat Lal Meena, Seema Devi, Asima Pradhan, Kiran Pandey, Asha Agrawal	India Institute of Technology, Kanpur	Prof. Asima PrdhanP

SRISTI GYTI Awards 2016				
16	X-Niff: Microcantilever Based Electronic-Nose Platform for Airborne Chemical Vapor Sensing	Gaurav Gupta, Vijay Shrinivas Palaparthy, Shambhulingayya Ningayya Doddapujar, Pallabi Das	Indian Institute of Technology, Bombay	Prof. Valipe Ramgopal Rao
17	Design of an Innovative Retrofitted Tricycle for a Disabled Person	Pushkaraj Sonawane	Maharashtra Institute of Technology, Pune	Prof. Pushkaraj D. Sonawane, Prof. Sandip T. Chavan
18	Soya Nuggets - A novel Drug Delivery Vehicle	Utkarsh Bhutani	Indian Institute of Technology, Hyderabad	Dr. Saptarshi Majumdar
Hari Om Ashram Prerit Dr. Amulya K.N. Reddy GYTI Award 2016				
19	Air-Assisted Electrostatic Sprayer (AAESS)	Manoj Kumar Patel	Academy of Scientific and Innovative Research (AcSIR-CSIO), Chandigarh	Prof. C. Ghanshyam
20	High Altitude Wind Energy Using Kite- A revolution in Renewable Energy	Roystan Vijay Castelino	Srinivas Institute of Technology, Merlapadavu, Mangaluru	Prof. Lokesh B
21	Low Cost Sanitary Napkin Disposal Machine	Aiswarya Paramadathil	Adi Shankara Institute of Engineering and Technology	
22	Design And Development of Semi- Automatic Flower Knotting Device	C. Cornelius Durai, S. Lakshmana Raja, S. Sriram	Velammal College of Engineering and Technology	Dr. G. Senthil Kumar
23	Automatic Sugarcane Juicer	Nilkantha Dashrath Gadakh	K. K. Wagh Institute Of Engineering Education and Research, Nashik	
GYTI Appreciation 2016				
24	An Indigenous Oxygen Dosing Device To Conserve Oxygen Using Patient MonitoringSystem	Srividhya Sakthi	Sri Ramakrishna Engineering College	

25	Neuronal Cells Produced From Non-Neuronal Cell Line UsingWalnut Oil	Dr. Varsha Singh	Chitkara University	
26	Cost effective self-stabilizing smart hand held platform (spoon/pen) for elderly or Parkinson'sdisease patients	Debjyoti Chowdhury	Heritage Institute of Technology	Dr. Madhurima Chatto padhyay
27	Paper Microfluidic Chip	Avisekbarla Sameer Sharma	Indian Institute of Technology Madras	
28	Multimechanist ic Polymer Based Novel DrugElutingStentCoating	Dr. GovindaKapusetti, Ms. Shiva KalyaniAdepu	National Institute of Pharmaceutical Education and Research, Ahmedabad	Prof. Kiran Kalia
29	Harnessing Micro Air Jets for Spraying Viscous Non- Newtonian Fuels	Manisha B. Padwal, Prof. D. P. Mishra	Indian Institute of Technology, Kanpur	Prof. D. P. Mishra
30	Paper Based Resistive Touch-pad For Electronic Applications	Mitradip Bhattacharjee	Indian Institute of Technology, Guwahati	Dr. Dipankar Bandyopa dhyay
31	Nano Material Based Flexible Aqueous Power Cell for Energy Conversion and Storage(Self- Charging and Flexible Aqueous Power-Cell)	Vinay Gangaraju	Visvesvaraya Technological University	Prof. Dinesh Rangappa, Dr. D. S. Prasanna
32	Handicap Support Device	Vishrut Bhatt, Sumanth Mudaliar, Joshi Ashay, Dave Kaushal	L J Polytechnic	Prof. Harshul Bhrambhatt
33	Biobased Adhesive Formulation for Construction Applications	Neelima Tripathi	Indian Institute of Technology, Guwahati	Dr. Vimal Katiyar
34	CHECKit –A low cost mobile OMR system	Rahul Patel	Institute of Engineering &Technology	Prof. Mehul Raval, Prof. Dhruv Gupta
35	Green flexible conducting paper from edible bacteria derived 3D nanocellulose matrixand polyaniline	Divya Anand	Indian Institute of Technology, Hyderabad	Dr. Mudrika Khandelwal
36	Latex (Natural Rubber) Carry Backpack	Ajin Omanakuttan	Amal Jyothi College of Engineering, Kanjirappally	Prof. Abi Varghese

37	Bio-Inspired Flapping Near Surface Underwater Vehicle	Mannam Naga Praveen Babu	Indian Institute of Technology, Madras	Prof. Krishnankutty. P
38	E-Droid Meter	Bitu C. Ghoniya, Shruti B. Patel, Jigisha M. Karangiya, Jinal N. Modi	Sarvajanik College of Engineering & Technology	Urmi Desai
39	Design and development of multipurpose Electric cycle	Patel Krunal, Brijesh patel, Prashant Solanki, Jigar parmar	Shri Satasangi Saketdham	Sandip Godse
40	Cost Effective Mechanical Testing Equipment For Characterising Creep Behaviour Of Materials Under Combined Tension-torsion Loading	Vineesh K P	Indian Institute of Technology, Kharagpur	Prof. Vikranth Racherla
41	Application Of Nano Material to Analyze The Strength Of Concrete	Dhrafani Ishita Mayurkumar	College of Engineering, Rajkot	Prof. Hitesh Rameshchandra Ashani
42	mSleep - Measure your Sleep	Shuchita Gupta, Yashovardhan Sharma	Indraprastha Institute of Information Technology, Delhi	Dr. Vinayak Naik
43	Straut AERO : Solar Industrial Hot Air Generator	Sharad Parekh	Universal College of Engineering & Technology	Dr. Nilesh Bhatt
BIRAC GYTI Award 2017				
1	White Light Emission from Vegetable Extracts	Dr. Vikram Singh	Indian Institute of Technology, Madras	Prof. Ashok Kumar Mishra
2	Rotary Ultrasonic Bone Drilling	Dr. Vishal Gupta	Indian Institute of Technology, Delhi	Dr. Pulak M. Pandey
3	A Novel Hybrid System for Textile Dye Waste Water Treatment.	Bhaskar Bethi	National Institute of Technology, Warangal	Dr. Shirish Hari Sonawane
4	Revealed: Dual functional characteristics of Escherichia coli outer membrane protein Wzi and its implications in the design of novel antibiotics	Shivangi Sachdeva, Narendar Kolimi	Indian Institute of Technology, Hyderabad	Dr. Thenmalarchelvi Rathinavelan

5	Targeted Theranostic Nanomedicines for Brain Cancer Therapy	Sonali, Rahul Pratap Singh, Poornima Agrawal	Banaras Hindu University, Varanasi	Dr. M.S. Muthu, Prof. B. L. Pandey
6	Blood Quality Assessment Using Digital Holographic Microscopy	Mandeep Singh, Azhar Muneer	Indian Institute of Technology, Delhi	Dr.Kedar Khare, Dr. Sarita Ahlawat
7	STERI-FREEZ: Flash Freeze Sterilization	Saugandha Das, Archit Devarajan	Institute Of Chemical Technology, Mumbai & Ramnivas Ruia Junior College, Mumbai	Prof. Padma V. Devarajan, Prof. Vasihali Kavishwar
8	Prophylactic Transdermal Patch Against Neurotoxin Poisoning In Biological Warfare Situations.	Subham Banerjee	Defence Research Laboratory, Tezpur & Birla Institute of Technology, Mesra.	Prof. Pronobesh Chattopadhyay, Prof. Animesh Ghosh
9	Low cost and field-portable smartphone platform water testing kit for detection and analysis of contaminants in drinking water	Iftak Hussain, Kamal Uddin Ahamad	Tezpur University, Assam	Dr. Pabitra Nath
10	Near Infrared Fluorescence Probes for Diagnosis of Alzheimer's disease	K Rajasekhar, Kavita Shah	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	Prof. T. Govindaraju
11	Low Cost Automated Handheld Melamine Detection Device (for Testing Melamine in Milk)	Dhiraj Indana, S.C.G. Kiruba Daniel, Varun S., Prateek Katare	Indian Institute of Science, Bangalore	Dr. Sai Siva Gorthi
12	NeuroBuds - Brain Wave Mapping Smart Earphones	Nitin Vasanth	Cochin University of Science & Technology, Kochi	Prof. Unni A M
13	Affordable and Rapid Paper-based Test Kits for Antimicrobial Susceptibility Assays	Shantimoy Kar, Tarun Agarwal, Shubhanath Behera, Varun Varma	Indian Institute of Technology, Kharagpur	Prof. Suman Chakraborty, Prof. Tapas K. Maiti
14	Portable biosensing platform based on conducting polymer decorated optical fiber for bacteria as well as heavy metal sensing in tap water	Sutapa Chandra, Arvind Dhawangale, Rosna Binish	Indian Institute of Technology, Bombay	Prof. Soumyo Mukherji

15	Affordable Kit for Cervical Cancer detection.	Appidi Tejaswini, Syed Baseeruddin Alvi, Anurag Meena	Indian Institute of Technology, Hyderabad and Indian Institutes of Technology, Bombay	Dr. Aravind Kumar Rengan, Dr.Rohit Srivastava
16	Non-invasive, Point-of-care Diagnostic System for Early Detection of Oral Cancer using Digital Infrared Thermal Imaging	Manashi Chakraborty, Santanu Patsa, Nishat Anjum	Indian Institute of Technology, Kharagpur	Dr. Sudipta Mukhopadhyay, Prof. Swapna Banerjee, Dr. Sourav Mukhopadhyay, Prof. Jay Gopal Ray
GYTI Award 2017				
17	A Virtual Reality (VR)-based Immersive Simulator For Endoscopy Training	Shanthanu Chakravarthy	Indian Institute of Science, Bangalore	Prof. G. K. Anantha-suresh
18	Navyo-The Smart Glove	Madhav Aggarwal, Mohd. Suhail, Bhavesh Pachnanda	Delhi Technological University, Delhi	Prof.Vikas Rastogi
19	A Novel Bio-engineering Approach to Generate an Eminent Surface Functionalized Template for the Selective Detection of Female Sex Pheromone of Certain Agriculturally Hazardous Pests	Parikshit Moitra, Deepa Bhagat, Rudra Pratap	Indian Institute of Science, Bangalore & Indian Association for the Cultivation of Science, Kolkata	Prof. Santanu Bhattacharya
20	ANUBHAV - AN EFFICIENT WRITING TOOL FOR VISUALLY IMPAIRED	Sachin N P, Vimal C	Indian Institute of Technology, Kanpur	Prof. Shantanu Bhattacharya
21	Swayam - Passively Stabilized Communication Satellite	COEP Satellite Initiative	College of Engineering, Pune	Dr. M.Y. Khaladkar, Dr. B.B. Ahuja
22	Indigenous Technology of Soft Body Armour for Defence Applications Using 3D Woven Aramid Fabrics	Animesh Laha	Indian Institute of Technology, Delhi	Prof. Abhijit Majumdar

GYTI Appreciation 2017				
23	Affordable paper microfluidic device for blood glucose and cholesterol detection	Avisek Barla,Abrar Ali Khan, Sameer Sharma, Vijay Anand, Nitish Kumar Singh	Indian Institute of Technology, Madras	Dr. Vignesh Muthuvijayan
24	Never Ending Learning of Sound	Ankit Parag Shah, Rohan Badlani, Benjamin Elizalde, Anurag Kumar	National Institute of Technology, Surathkal	Prof. Bhiksha Raj Ramakrishnan
25	OCR++: A Robust Framework For Information Extraction from Scholarly Articles	Mayank Singh, Barnopriyo Barua, Priyank Palod, Manvi Garg, Sidhartha Satapathy, Samuel Bushi, Kumar Ayush, Krishna Sai Rohith, Tulasi Gamidi	Indian Institute of Technology, Kharagpur	Dr. Pawan Goyal, Dr. Animesh Mukherjee
26	Paper-based Device For Rapid Detection Of Dengue	Sanjay Kumar, Pulak Bhushan	Indian Institute of Technology, Kanpur	Prof. Shantanu Bhattacharya
27	Trolley Straw Baler by Ram Compressing Mechanism with Traction Force	Ramalingam.Pl, M. Prakash, M. Prabhu, C. Logesh, Jayaprakash.P.S	Panimalar Institute of Technology, Anna University, Chennai	Prof. R.Vigithra
28	Enhancement of Distribution System performance using HVAC Boost Converter and Fuzzy Controller	Anusha Vadde	M S Ramaiah University of Applied Sciences, Bangalore	Prof. V.S.N Sitaram Gupta .V
29	Design of a Mechanical Device (Nanorobot) for Diagnosis and Removal of Plaque from Human Heart Artery System	Mallikarjunachari G	Indian Institute of Technology, Madras	Dr. Pijush Ghosh

30	"Electrolithography"- A Novel Nano Patterning Technique Using Electric Field Induced Material Transport	Santanu Talukder	Indian Institute of Science, Bangalore	Prof. Rudra Pratap, Dr. Praveen kumar
31	Cost Effective Inspection System For Automated Large Scale Cocoon Quality Assessment	Prasobh Kumar P. P.	Indian Institute of Science, Bangalore	Dr. Sai Siva Gorthi, Prof. C. R. Francis
32	Industrial Production of Poly (lactic Acid) based Biodegradable Films with Highly Improved Gas Barrier Properties for Food Packaging Application: A Potential Candidate to Replace Conventional Synthetic Polymers	Akhilesh Kumar Pal	Indian Institute of Technology, Guwahati	Dr. Vimal Katiyar
33	Fish inspired propulsion for remotely operated surface ships and underwater vehicles	Mannam Naga Praveen Babu	Indian Institute of Technology, Madras	Prof. P. Krishnankutty
34	Development And Characterization Of Smart Nanocarriers For Oral Insulin Delivery	Ashish Kumar Agrawal	National Institute of Pharmaceutical Education and Research, Mohali	Prof. Sanyog Jain
35	Design & Development Of Automated Five Axis CNC Ball End Magnetorheological Finishing Machine	Dilshad Ahmad Khan, Faiz Iqbal, Zafar Alam	Indian Institute of Technology, Delhi	Dr. Sunil Jha
36	Grid Interactive Solar PV Based Water Pumping Using BLDC Motor Drive	Rajan Kumar	Indian Institute of Technology, Delhi	Prof. Bhim Singh
37	A Mechanism for Toilet Seat Sanitation	Arvind Pujari, D V S S SKushal Kumar Reddy, Shashwat Jain, Subham Kumar Sahana, Tanay Garg	Indian Institute of Technology, Madras	Dr. Anil Prabhakar

38	Design of Highly Efficient and Inexpensive Membrane Equipment as Import Substitutes for Demineralized Water Production and Hemodialysis	Harsha Nagar, Shaik Nazia, M. Madhumala, Y.V.L. Ravi Kumar	CSIR-Indian Institute of Chemical Technology, Hyderabad	Dr. S. Sridhar
39	Portable Geo-specific Water Filtration Bottle	Ramesh Kumar, Anupam Chandra	Indian Institute of Technology, Madras	Prof. Thalappil Pradeep
BIRAC GYTI Award 2018				
1	Point of Care Nano Diagnostic Kit for Brucellosis	Rohit Shivaji Pawar	Institute of Chemical Technology	Prof. Vandana B. Patravale
2	Miniaturized Fluorescence adapter for Fluorescence Sputum Smear Microscopy using bright-field microscope	Vikas Pandey	Indian Institute of Technology Delhi	Dr. Ravikrishnan Elangovan
3	A multipurpose low cost biological air purifier	Mrs. Neeta Ganesh Wagle	Dr. D.Y. Patil Vidyapeeth	Prof. Neelu N. Nawani
4	Nano Spermviricide: A Dual Acting Aid for Prevention of Unintended Pregnancy and Unprotected Sexual Intercourse Associated HIV	Amit Mirani	Institute of Chemical Technology	Prof. Vandana B. Patravale
5	A Low-Cost Disposable Microfluidic Biochip for malaria diagnosis	Brince Paul K	Indian Institute of Technology Hyderabad	Dr. Shiv Govind Singh
6	Smartphone-based impedimetric disposable biosensor for detection of cardiac biomarkers	Debasmita Mondal, Sourabh Agrawal	Indian Institute of Technology, Bombay	Prof. Soumyo Mukherji
7	Decellularized corneal matrix (DCM) based injectable hydrogel for strengthening cornea matrix in severe Corneal Keratoconus	Shibu Chameettachal	Indian Institute of Technology, Hyderabad	Dr. Falguni Pati
8	Super Resolution Ultrasonic Imaging (SUI)	Kiran Kumar Amireddy	Indian Institute of Technology, Madras	Dr. Krishnan Balasubramanian, Dr. Prabhu Rajagopal

9	Understanding the design principles of protein nanosensor to combat multidrug resistant enterobacteriaceae	Abhishek Narayan	Indian Institute of Technology, Madras	Dr. Athi Narayanan N
10	A novel strategy to block malaria transmission	Divya Beri	Indian Institute of Science	Prof. Utpal Tatu
11	Design and Development of Phase Change Material (PCM) based Milking cum Cooling Pail	Ravi Prakash	National Dairy Research Institute	Dr. Menon Rekha Ravindra, Dr. M. Manjunatha
12	An Alternative Technology to Produce Biomass-Based Food Grade Flavors, Fuels and Value Added Chemicals	Shelaka Gupta	Indian Institute of Technology, Delhi	Dr. M. Ali Haider
13	Nano based soil conditioner for agricultural application	Pallabi Das, Kasturi Sarmah	Tezpur University	Dr. Sanjay Pratihar, Dr. Satya Sundar Bhattacharya
14	SNAP - A RAW images' based setup that can calculate nutrient concentration in leaves	Ekdeep Singh Lubana	Indian Institute of Technology, Bombay	Dr. Maryam Shojaei Baghini
15	Rolling Water Purifier - Roll Pure	Ramesh Kumar	Indian Institute of Technology, Madras	Prof. T. Pradeep
GYTI Award 2018				
16	Battery-less IoT Sensing Nodes	Anandarup Mukherjee	Indian Institute of Technology, Kharagpur	Dr. Sudip Misra
17	Road Accident Detection using Perceptual Attributes of Video	Sinnu Susan THomas	Indian Institute of Technology, Kanpur	Prof. Sumana Gupta, Prof. Venkatesh K. S.
18	Feasibility Study of Wireless Power Transfer Using Metamaterial	Amit kumar Baghel	Indian Institute of Technology, Guwahati	Sisir Kumar Nayak
19	Design of Low Cost Infrared Vein Detector	Trivikram Annamalai	Institute of Chemical Technology	Prof. Purba Joshi, Prof. B. K. Chakravarthy

20	Window Solar Cooker	Avinash Prabhune	Indian Institute of Technology, Hydrabad	Prof. B. K. Chakravarthy
21	Magnetic tool for nano finishing the holes, vertical and horizontal surfaces	Girish Verma	Indian Institute of Technology, Delhi	Prof. Pulak Mohan Pandey
22	Origgon - A Social Search Engine	Abhik Saha, Harshit Jain	Indian Institute of Technology, Hydrabad	
23	A novel low cost polyvinyl alcohol-Nafion-borosilicate membrane separator for microbial fuel cell treating distillery wastewater	Bikash Ranjan Tiwari		Prof. M. M. Ghangrekar
GYTI Appreciation 2018				
24	3D bioprinted skin scar model for drug and cosmetic testing	Shikha Chawla	Indian Institute of Technology, Delhi	Dr. Sourabh Ghosh
25	A Non-contact Optical Device for Online Multiplexed Monitoring of Diseases of Military Importance in Fragile and Conflict-Affected Settings	Probir Kumar Sarkar		Prof. Samir Kumar Pal
26	Performance Evaluation and Process Optimization for Production of Ready-to-Eat Therapeutic Food Paste in Pilot Scale Unit	Rakesh Kumar Raigar	Indian Institute of Technology, Kharagpur	Prof. H N Mishra
27	3D-NuS: A Web Server for Automated Modeling and Visualization of non-canonical 3-Dimensional Nucleic Acid Structures	L Ponoop Prasad Patro	Indian Institute of Technology, Hyderabad	Dr. Thenmalarchelvi Rathinavelan
28	Eco-Friendly Water Retention Natural Polymer	Narayan Lal Gurjar	Maharana Pratap University of Agriculture & Technology	Prof. S. M. Mathur
29	New generation periscope fruit picking device	Tania Dutta	Birla Institute of Technology & Science	
30	Nano-biosensor and methods for detecting potassium ion concentration	Jaymin Kanubhai Jadav	Junagarh Agricultural University	Dr. B. A. Golakiya

31	Development of Graphene Coated Conductive Fabrics based Smart Wearable Body Warmers for Defense and Medical Applications	Nagarjuna Neella	Indian Institute of Science, Bangalore	Prof. K. Rajanna
32	Buzzing Band	Saka Naveena	Jawaharlal Nehru Technological University	Ravuri Viswanadhan
33	Brain wave nerve excitation for physically disabled	Sarath S, Shilpa M Biju, Nanda Kiran, Hridhya Jolly K, Shilpa P Prasad, Midhun Raj, Sachin Suresh	A.P.J. Abdul Kalam Technological University	Dr. Sunil Jacob
34	A computational alternative to analyze and understand Ebola virus pathogenesis in human	Abantika Pal	Indian Institute of Technology, Kharagpur	Dr. Pralay Mitra
35	Open Source Augmented Reality Wearable Smart Assist Device for Blind	Sarang Nerkar		Prof. Steve Mann
36	White Cane - A Virtual Assistant for the Visually Impaired	Barnopriyo Barua	Indian Institute of Technology, Kharagpur	
37	Ionic movement bases desalinator	Ravindranath Ragunathan		S.Anbumalar
38	Rapid Cervical Cancer Detection Using Neuromorphic Hardware	Narayani Bhatia	Indian Institute of Technology, Delhi	Dr. Manan Suri
39	Design And Development Of Intelligent And Robust Grid Integrated Solar PV System With Improved Power Quality For Roof Top Applications Especially For Abnormal Indian Distribution Feeder	Amresh Kumar Singh	Indian Institute of Technology, Delhi	Prof. Bhim Singh
40	Cerium impregnated activated carbon composite as a filtering material for fluoride removal from groundwater	Mahipal	Indian Institute of Technology, Patna	Dr. Trishikhi Ray Choudhury

41	Loco-Pilot Vision Enhancement System: TRINETRA (Third eye) for Indian Railways	Anand Kumar K.S.	Indian Institute of Technology (BHU), Varanasi	Dr. R. K. Saket, Dr. R. Rajendran
42	Katha	Ritika Singh		Koumudi Patil
43	Aadharv - A Multi Utility Assistive Device For Elders And People With Mobility Impairment	Vimal C	Indian Institute of Technology, Kanpur	Dr. J. Ramkumar
44	Augmentative Rehabilitation of SCI and Stroke Patients	Kashif Sherwani	Other	Dr. Neelesh Kumar
45	Detection of hydrocarbons by laser assisted paper spray ionization mass spectrometry (LAPSIMS)	Pallab Basuri	Indian Institute of Technology, Madras	Prof. T. Pradeep
46	An indigenous technology for development of cost-effective and energy-efficient engine intake air filters	Ajay Kumar Maddineni	Indian Institute of Technology, Delhi	Prof. Dipayan das
47	Smartphone based portable low-cost continuous wave Doppler Ultrasound system	Biswabandhu Jana	Indian Institute of Technology, Kharagpur	Prof. Swapna Banerjee, Prof. Goutam Saha
48	SIT: Smell Your Health	P. Sri Lekha	Jawaharlal Nehru Technological University	Dr. Pushpa Kotipalli
49	On Board Diagnostic Data Analysis System (OBDAS)	Archit Agarwal	University of Petroleum and Energy Studies	Dr. Rajesh Singh
50	NOWAH (No Waste at Household) Technology - A novel, sustainable, smart and complete treatment technology for both Feacal sludge and Organic waste management	Anu Rachel Thomas	Indian Institute of Technology, Madras	Prof. Ligy Philip
51	Bioelectric toilet: A novel approach for treatment of human waste and generating onsite electricity for lighting toilets	Indrasis Das	Indian Institute of Technology, Kharagpur	Prof. M. M. Ghangrekar

SITARE GYTI Award 2019				
1	Novel Hybrid Technology for Bioseparation	Jayeshkumar Sevantilal Mevada	Institute of Chemical Technology, Mumbai	Prof. Aniruddha B. Pandit
2	Development of engineered E.coli for high-throughput drug screening against Malaria and Kala-azar	Preeti Yadav	Jawaharlal Nehru University, Delhi	Dr.Shailja Singh, Dr. Swati Garg, Dr.SoumyaPati
3	Anti-pesticide dermal gel	Ketan Thorat, Subhashini Pandey	Institute For Stem Cell Biology and Regenerative Medicine, Bangalore	Dr. Praveen Kumar Vemula, Dr. Sandeep Chandrashekharappa
4	Yog-I - An affordable insulin pump for Type-1 diabetic patients in resource constrained settings	Deval Karia, Rohit S. Nambiar	Indian Institute of Science, Bangalore	Dr. Manish Arora
5	Magnetic-field actuated hybrid nanofiber scaffold and apparatus for 4D tissue engineering	Uday Kumar Sukumar, Vinay Kumar	Indian Institute of Technology, Roorkee	Dr. P. Gopinath
6	Modernization of traditional anti-malarial drug artesunate via nanomedicine approach.	Deepika Kannan, Nisha Yadav	Shiv Nadar University, Uttar Pradesh	Dr. Shailja Singh, Dr. Bimlesh Lochab, Dr. Soumya Pati
7	Revelation of G-quadruplex formation as a molecular basis of fragile X tremor/ataxia syndrome (FXTAS) leads to a new direction in the drug discovery	Yogeeshwar Ajjugal, Narendar Kolimi	Indian Institute of Technology, Hyderabad	Dr. Thenmalarchelvi Rathinavelan
8	Low-cost, easy-to-use, in-house developed electric cell impedance sensing (ECIS) system for studying the dynamic behaviour of the biological cell	Uvanesh K asiviswanathan	Indian Institute of Technology (Banaras Hindu University), Varanasi	Prof. Neeraj Sharma, Dr. Sanjeev Kumar Mahto
9	Growth factor free strategy for therapeutic neo-vascularization	Shivam Chandel, Abel Arul Nathan S	Indian Institute of Technology, Madras	Dr. Madhulika Dixit
10	Real Time Surrogate Visual Tracking of Lung Tumours for Effective Radiotherapy	Priya Singh, Darshan Ramesh Shet	Indian Institute of Technology, Kanpur	Prof. Venkatesh K Subramanian

11	Patient-specific spheroid-on-chip for cancer treatment: combinatory drug screening	Sharanya Sankar, Viraj Mehta	Indian Institute of Technology, Hyderabad	Dr. Subha Narayan Rath
12	Pneumatic Damping Prosthetic Leg For Above-knee Amputees	Muhammed Janish U, Abhijitnath A	MES College of Engineering, Kuttippuram	Prof. Padmakumar K
13	Actin Mimetic ATP Driven Controlled Supramolecular Polymerization	Ananya Mishra	Jawaharlal Nehru Centre For Advanced Scientific Research, Banglore	Prof. Subi J. George
14	Image Analyzing Drying Patterns Of Blood And Plasma Droplets For The Rapid Detection Of Thalassaemia Carriers	Manikuntala Mukhopadhyay, Rudra Ray	Indian Institute of Technology, Kharagpur	Prof. Sunando Das Gupta, Prof. Maitreyee Bhattacharya
15	Development Of Rapid And Non-destructive Method For Detection Of Insect Infestation In Stored Cereal Grains	Gayatri Mishra, Ranjana Rani	Indian Institute of Technology, Kharagpur	Dr. H N Mishra, Prof. Shubhangi Srivastava
GYTI Award 2019				
16	Utilisation of Real-World Waste Plastic for the Production of Fuel Range Liquid Hydrocarbons using Two-step approach	Uma Dwivedi	Indian Institute of Technology, Delhi	Prof. K. K. Pant, Prof. S. K. Naik
17	Non- Catalytic Deep Desulfurization Process Using Hydrodynamic Cavitation	Nalinee B. Suryawanshi	CSIR-National Chemical Laboratory, Pune (CSIR-NCL)	Dr. Vinay M. Bhandari
18	Dual action of SPIONS in effective removal of heavy metals and mosquito larvae from water.	Roshini S. M, Karthika M, Lavanya Agnes Angalene J.	Sathyabama Institute of Science and Technology, Chennai	Dr. Antony V Samrot
19	Formic Acid-powered Ferrobots For Clean Energy Technology	Amit Kumar Singh, Saptak Rarotra, Viswanath Pasumarthi	Indian Institute of Technology, Guwahati	Prof. Dipankar Bandyopadhyay, Prof. Tapas Kumar Mandal
20	Early Diagnosis Of Osteoporosis Using Metacarpal Radiogrammetry And Texture Analysis	Anu Shaju Areeckal	National Institute of Technology, Surathkal	Prof. Suman David S

21	Novel and eco-friendly light weight thermal insulating ceramics from thermal power plant waste	Yogesh D. Urunkar, Chandrakant S. Bhogle	Institute of Chemical Technology, Mumbai	Prof. Aniruddha B. Pandit, Prof. J.B. Joshi
GYTI Appreciation 2019				
22	Artificial Biomarkers of Knee Osteoarthritis	Nikhil Gupta	Indian Institute of Technology, Delhi	Prof. Tapan Kumar Ghandhi, Dr. Alok Prasad
23	Developing Labscale Magneto-Mechanical Experimental Setup to Predict the Plaque Growth of Human Heart Coronary Arterial Layer System	Mallikarjunareddy Reddy Boreddy	Madanapalle Institute of Technology and Science, Andhra Pradesh	Dr. Mallikarjunachari G
24	Development of low grain arsenic rice by the fungal arsenic methyltransferase via bio-volatilization	Shikha Verma, Pankaj Kumar Verma	CSIR - National Botanical Research Institute, Lucknow	Dr. Debasis Chakrabarty
25	Towards Application of Helical Nanorobots for Biomedical Applications.	Malay Pal, Debayan Dasgupta, Arijit Ghosh, Neha Somalwar	Indian Institute of Science, Bangalore	Prof. Ambarish Ghosh, Dr. Deepak K Saini, Prof.Ramray Bhatt
26	Development of improved biocatalysts for D-allulose production utilizing the low-cost agro-industrial residues	Satya Narayan Patel	Center of Innovative and Applied Bioprocessing, Punjab	Dr. Sudhir P. Singh
27	Design and development of interlock mechanism based bio-compatible, user-friendly and cost-effective elbow disarticulation prosthesis	Mrutyunjay Maharana, Bhabani Shankar Nayak	Indian Institute of Technology Guwahati & All India Institute of Physical Medicine And Rehabilitation (AIIPMR), Mumbai	Dr. Sisir Kumar Nayak, Prof. Deepak P. Prabhu
28	Production of effective and low cost dapsone-phytochemical hybrid candidate for use in multidrug therapy against Mycobacterium leprae	Shasank Sekhar Swain	Institute of Medical Sciences and Sum Hospital (IMS and Sum Hospital), Bhubaneswar	Prof.Rabindra Nath Padhy, Prof. P. Sudhir Kumar

29	Proteasome Activation: A potential drug target for treatment of Parkinson's Disease.	Mohd Ahsan, P Chinmai	Indian Institute of Technology, Madras	Prof. Sanjib Senapati
30	A more accurate detection and intrinsic subtype classification of breast cancer using machine learning.	Bikash Ranjan Samal	Indian Institute of Technology, Kharagpur	Dr. Ranjit Prasad Bahadur
31	Fighting resistance in cancer cells due to bacterial infections with modular drug platforms: An idea towards personalized medicine	Rohini Singh	Indian Institute of Technology, Delhi	Prof. Shalini Gupta
32	Economical Paper-Strip For Early Stage Mastitis Disease Detection In Cow	Harika Chappa, Avisek Barla, Navin V Narayanan, Sudip Chakraborthy, Ahila Yegappan	Sri Venkateswara Veterinary University, Tirupati	Prof. Y. Hari Babu
33	Anemia meter	Jeethu Raveendran	Amrita Vishwa Vidyapeetham University, Coimbatore	Dr. T. G. Satheesh Babu
34	Understanding Sequence-Disorder-Function Relationship of an Intrinsically Disordered Protein to Design Soil Salinity Sensor	Sneha Munshi	Indian Institute of Technology, Madras	Dr. Athi Narayanan N
35	A Simple, Non-invasive, Low Cost, Point of Care, Colorimetric Method, using Reactive Oxygen Species induced Lipid Peroxidative changes in Saliva, to Assess the Risk of Oral Pre-cancerous Lesions and Oral Squamous Cell Carcinoma in Chronic Smokers	Nikhiya Shamsher	Greenwood High International School, Bangalore	Prof. Aloysius D'Mello
36	Multifunctional Granulator (MFG) -A Multi functional device to prepare dried spherical granules	Rajendra Prasad Moturu	Andhra University College of Pharmaceutica Sciences, Visakhapatnam	Prof. K.V. Ramana Murthy
37	Audience response device for Deaf and mute classroom	Manasi Mishra	Indira Gandhi Delhi Technical University for Women	Prof. S. RN Reddy

38	Development of Process Technology for Manufacture of RTD Carbonated Grain Beverage	Anjali Thakur, Pooja Pandey	Indian Institute of Technology, Kharagpur	Dr. H N Mishra
39	Manufacture of Micronutrient Fortified Rice Kernels through Extrusion Technology	Dalbhagat Chandrakant Genu, Jayshree Majumdar	Indian Institute of Technology, Kharagpur	Dr. H N Mishra
40	An Automated Panipuri Vending Machine	Abhijit Nath, Saurav Jyoti Sarma, Chandeep S. Gogoi	Tezpur University, Assam	Prof. Polash Pratim Dutta
41	Fibonacci Series based Rectangular Microstrip Patch Antenna	Deven G. Patanvariya, Kalyan Sundar Kola	National Institute of Technology, Goa	Dr. Anirban Chatterjee
42	Smart Signalling And Interlocking System	S. Karthikeyan, S. Umasankar, Karthikeyan S.	M. Kumarasamy College of Engineering, Tamil Nadu	Dr. C. Ramesh
43	Bhu-goal : Predicting Moods Of India	Kartik Vij, Rahul Kinra, Rouble Gupta, Debarshi Ghosh	Chitkara University, Punjab	Dr. Nitin K. Saluja
44	Pyrophosphate and Metaphosphate as Next-generation Cathode Material for Energy Storage Devices	Ritambhara Gond, Krishnakanth Sada, Anshuman Chaupatnaik	Indian Institute of Science, Bangalore	Prof. Prabeer Barpanda
SITARE-GYTI Award 2020				
1	A Portable Diagnostic Platform for Rapid Label-free Phenotyping of Breast Cancer	Anil Vishnu G K, Saeed Rila B.C., Arun Baby, Midhun C.Kachappilly	Indian Institute of Science, Bengaluru	Prof. Hardik J. Pandya, Prof. Annapoorni Rangarajan
2	Multipurpose Proctoscope	Siddhant Shrivastava, Dr. Arshad Ahmad, Dr. K S Venkatesh	Indian Institute of Technology Kanpur	Dr. J RamKumar
3	An Affordable and Easy-to-Use Optical Biosensor for Mannosylated Lipoarabinomannan (manLAM) in Urine for TB Diagnosis	Divagar M, Kuzhandai Shamlee J, Lakshmana Swamy V V	Indian Institute of Technology Madras	Dr. V. V. Raghavendra Sai, Dr. Vani Janakiraman

4	An Automated Cardiovascular Replicator for Online Assessment of Cardiac Assist Devices, Prosthetics and Beyond	Sumanta Laha, Pulak Ray, Aritra Rakshit	Indian Institute of Technology Kharagpur	Prof. Prasanta Kumar Das
5	Development of Poly-unsaturated Fatty Acid PUFA and Antioxidant Rich Vegetable Oil Powder for Healthy Hearta	Monalisha Pattnaik, Dr. Mousumi Ghosh	Indian Institute of Technology Kharagpur	Prof. Hari Niwas Mishra
6	A User Friendly, Affortable Device for Self Blood Microsampling for Diagnostics and Pharmaceutical Applications	Vaibhav Shitole	National Institute of Pharmaceutical education and Research Ahmedabad	Prof. Prasoon Kumar
7	Artificial Deep Learning Brain Actuated Lower Limb Exoskeleton For Paralysed	Vinoj P.G, Varun G Menon, Saira Joseph	SCMS School Of Engineering & Technology, Kerala	Dr. Sunil Jacob
8	Nanofiber Yarn Suture: A Medical Device	Arthi Sunil Richard	Indian Institute of Technology Madras	Dr.Rama Shankar Verma
9	Development of Electrochemical Impedence based Aptasensor for Semen sorting in Cattle	Sumit Kumar Singh	National Dairy Research Institute	Dr. Sudarshan Kumar
10	A Novel, Low-cost, Non-invasive Eye Tracker Using Fiber Optic Sensora	Shweta Pant, Sharath U, Srivani Padma, Sumitash Jana, Varsha V	Indian Institute of Science Bengalore	Prof. Sundarrajan Asokan
11	Frustum CAM in Medical Ventilators	Prem Dakshin	Birla Institute of Technology & Science University, Pilani	Dr. Shashank Khurana
12	Continuous Monitoring of Gasotransmitters for Early Stage Management of Systemic Inflammatory Response Syndrome (SIRS) Using Microfluidics Platform	Ravindra Gaikwad	Indian Institute of Technology, Madras	Dr Ashis Kumar Sen
13	A Non-Electric and Affordable Surface Engineered Particle Based Point-of-Use Water Disinfection	Deepa Dixit	Indian Institute of Technology, Gandhinagar	Prof. Chinmay Ghoroi

14	Nanotechnology Based Intranasal Spray Formulation for the Effective Treatment of the Alzheimers Disease	Shivraj Vasantrao Naik	Institute of Chemical Technology, Mumbai	Prof. Vandana Bharat Patravale
SITARE-GYTI Appreciation 2020				
1	Real-time Ultrasound-Based Acoustic Parameter Imaging to Track Spatio-temporal Evolution of Hotspot in High Intensity Focused Ultrasound and Microwave Hyperthermia	Aliarshad Kothawala	Indian Institute of Technology Madras	Prof. Arun K. Thittai
2	Tannin-based Mouth Fresheners	Sonali Naik	National Chemical Laboratory, Pune	Dr. Kiran S
3	Development of Protocol of Commercial Cultivation of Nobel Wild Edible Mushrooms of Tripura, Northeast India and Evaluation of their Biological Properties	Sanjit Debnath	Tripura University, Tripura	Prof. Ajay Krishna Saha
4	A Low Cost Passive Microdevice for Platelet Rich Plasma PRP Separation from Human Blood	Vijai Laxmi,	Indian Institute of Technology, Bombay	Prof. Amit Agrawal, Prof. Suhas S. Joshi
5	Breath Volatile Organic Compound Detection Using Conducting Polymer Coated Chemiresistive Filter Paper Sensors	Aswathy M. Nair, Debasmita Mondal, Sourabh Agrawal	Indian Institute of Technology, Bombay	Prof. Soumyo Mukherji
6	Production of Bioactive Chicken IL-17A by Genetically Engineered Food Grade Lactic Acid Bacteria Lab : From Gene to Biomedical Application in Poultrya	Aritraa Lahiri	Indian Institute of Science Education and Research, Kolkata	Dr. Amirul Islam Mallick
7	Development of Sustainable Antimicrobial Wrapping Material from Biopolymers	Puja Kumari	Indian Institute of Technology, Madras	Prof. Mukesh Doble
8	Crop Productivity and Related Value Addition Black Rice by Co-inoculation with Nanoembedded Mycorrhizal Fungus Piriformospora Indica Serendipita	Shubhangi Mahajan	Amity University, Noida	Prof. Ajit Varma

9	Colorimetric Yes/No Type Swab Based Detection of Pesticides on Agricultural Produce	Tathagata Pal,	Indian Institute of Technology, Bombay	Prof. Soumyo Mukherji
10	Development of Polymer Based Nano Medicine for the Treatment of Cerebral Malaria	Sukanya Patra, Himadri Medhi, Somedutta Maity	Indian Institute of Technology(BHU), Varanasi	Dr. Padip Paik
11	Smart Gloves for Assisted Physiotherapy	Krishna Sivanand, Deepika Gunasekaran	Kumaraguru College of Technology, Coimbatore	Dr. B.L.Lakshmi Meera
SRISTI-GYTI Award 2020				
1	An Inexpensive Deep Tissue Blood Flow Measurement System Using Low Frame Rate Camera	Murali K	Indian Institute of Technology, Bombay	Prof. Hari M Varma
2	A Novel CD4 cell Count Method for HIV Infected Patients Using a Hematology Analyzer	Rajesh Srinivasan, Vikram S, Niraj N Jadhav	Indian Institute of Science, Bengalore	Prof. Sai Siva Gorthi
3	AbleFit: Wearable Device for Orthopedic and Neurological Disorderes Patients	Gunjan Patel	Indian Institute of Technology, Madras	Dr. Sujatha Srinivasan Dr. Rajdeep Ojha
4	MOKSH-Convert Crop Waste into Wealth	Amrinder Singh, Gurditt Singh, Varinder Singh Nitika Dhingra	Chitkara University, Punjab	Dr. Nitin Saluja
5	A Method and a System for Remotely Controlled Manipulation of Nanomaterials in Fluids	Souvik Ghosh	Indian Institute of Science, Bengalore	Prof. Ambarish Ghosh
6	Development of Patient Specific Customized Shape Vascular Stent by 3D Printing Technology	Jasvinder Singh, Gurminder Singh	Indian Institute of Technology, Delhi	Prof. Pulak Mohan Pandey
7	Sediment Microbial Fuel Cell as a Renewable Power Source in Remote Area	Jeetendra Prasad	Motilal Nehru National Institute of Technology, Allahabad	Prof. Ramesh Kumar Tripathi

SRISTI-GYTI Appreciation 2020				
1	Disposable Onsite kit for Discriminating Raw/Synthetic/Pasteurized Milk Based on Alkaline Phosphatase Indicator	Kuldeep Mahato, Buddhadev Purohit, Ashutosh Kumar	Indian Institute of Technology, Guwahati	Dr. Pranjal Chandra
2	A Ready-to-use Haemostatic Bandage for Military and Civilian Trauma Care	Syed Muntazir Andrabi	Indian Institute of Technology, Kanpur	Prof. Ashok Kumar
3	Design of an Indigenous Atmospheric Water Generator for Economical Production of Drinking Water in the Water Scarce HILLY, rid and Coastal Regions	Bukke Vani, Sajja. S. Chandrasekhar, Dileep Kumar Fothedar, Mr. B. Govardhan Shiva Prasad Nandala, M. Madhumala, Karishma Mishra	Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad	Dr. Sundergopal Sridhar, Dr. Nivedita Sahu, Dr. Sugali Chandra ekhar, Mr. Mukkavilli Rama Krishna
4	Self-sustainable E-waste Recycling: Generating Wealth from Waste via Zero Discharge Technology	Prashant Ram Jadhao, Ramdayal Panda, Snigdha Mishra	Indian Institute of Technology, Delhi	Prof. K. K. Pant, Prof. K. D. P. Nigam Prof. Ejaz Ahmad
5	Smart, Flexible, and Multi-Functional Thermal and Energy Management Systems for Next-Generation Electronic Devices	Sri Ganesh Subramanian	Indian Institute of Technology, Kharagpur	Prof. Sunando Das Gupta, Prof. Justin A Weibel
6	Harvesting Delayed Fluorescence in Mn-doped Perovskite Quantum Dots Using Vibrationally Assisted Delayed Fluorescene (VADF)	Pradeep K R	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	Prof. Ranjani Viswanatha
7	Design of Acetone Breath Gas Analyzer in the Evaluation of Diabetes Mellitus	Ramji K.	SRM University Chengalpattu	Dr. U. Snekhalatha
8	Design and Development of Advanced CNC Micro-machining System	Ashish Kumar Sahu, Harish Kumar, Hardik Arvindbhai Patel, Jitin Malhotra	Indian Institute of Technology, Delhi	Prof. Sunil Jha

9	Not-IS : A Currency Identification Aid for the Visually Impaired in India	Sri Navya Kondaveeti	Indian Institute of Technology, Bombay	Prof. Swati Pal
10	Recovery of Lithium Cobalt and Manganese Values from Discarded Lithium-Ion Batteries	Singh Rahulkumar Sunil	Indian Institute of Technology, Roorkee	Dr. Nikhil Dhawan
11	Electrical Power Generation from Wet Textile	Sankha Shuvra Das, Vinay Manaswi Pedireddi	Indian Institute of Technology, Kharagpur	Prof. Suman Chakraborty, Prof. Aditya ndopadhyay, Prof. Partha Saha
12	Development of New Electro-mechanical Muscle Fatigue Measurement Device	Parth Joshi, Poojan Gajjar	Indian Institute of Technology, Jodhpur	Dr. Kaushal A. Desai, Dr. Prathamesh H Kamble
13	Highly Sensitive, Scalable Reduced Graphene Oxide with Palladium Nano-composite as Strain Sensor	Suresh Nuthalapati, Vijay Shirhatti, Vaishakh Kedambaiboole	Indian Institute of Science Bengalore	Prof. K Rajanna, Prof. M. M. Nayak
14	Development of Sustainable Mosquito Repellent Cum Multifunctional Textile using Microencapsulation of Essential oils	Nagender Singh	Indian Institute of Technology, Delhi	Dr. Javed N. Sheikh
15	Deposition Reactor Designed for Low cost Low-temperature Deposition of High-quality Oxides Films for Next Generation Electronics	Vivek Singh	Indian Institute of Science Bengalore	Prof. Sushobhan Avasthi
16	A Machine Learning Package to Design Novel Functional Glasses	Ravinder, Hargun Singh Grover, Suresh, Sourabh	Indian Institute of Technology, Delhi	Prof. N. M. Anoop Krishnan

HBN Database Link and QR Code

	(1) http://honeybee.org/honeybee_database.php Methods of low-cost farming, animal husbandry and rural modification, published in the Honey Bee English Newsletter.
	(2) http://honeybee.org/honeybee_innovation.php More than four thousand farming, animal husbandry and rural modification practices are present in this database. This database is available in four languages namely Gujarati, Hindi, English and Tamil.
	(3) http://honeybee.org/plant_db.php There is an illustrated database of medicinal plants in which 250 plants and their uses have been mentioned. This database is available in four languages namely Gujarati, Hindi, English and Tamil.
	(4) https://techpedia.in/search_project.php This is a compilation of specific projects done by engineering students from across the country. More than two lakh projects are present in it.
	(5) https://techpedia.in/search-projects This database contains over four lakh abandoned and expired USPTO patents.

	(6) http://www.sristi.org/cpri/ This is a database Common Property Resource Institutions (CPRI).
	(7) http://www.inshodh.org Teachers from Gujarat and Maharashtra have invented new methods in teaching children. These experiments have been included in this database.
	(8) https://grid.undp.org.in/#3.01/22.82/82 This is a database on rural artisans, farmers and holders of traditional knowledge as well. This database has been created by the Honey Bee Network in association with UNDP.
	(9) https://gyti.techpedia.in/view-project/all/ This is a database of the projects of the GYTI Awards winners.

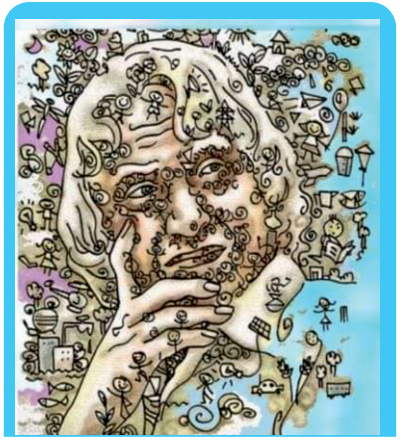
Honey Bee Network www.sristi.org www.gian.org

SRISTI: Grambharati Campus, Gandhinagar Mahudi Road,
Dist. - Gandhinagar, Gujarat - 382650 (M) 9427939170

NOTES

Dr A P J Abdul Kalam Ignited Mind Children Creativity and Innovation Awards 2023

Honey Bee Network



...Celebrating children as Source of ideas and not just a sink of sermons...

If you are aged under 19 years and have original Technological ideas to solve day to day problems.....send your entries at

SCAN FOR APPLY

Also send entries at
Email:ignitedmind@honeybee.org
WhatsApp: 93132 46772
www.sristi.org, www.sristi.org/ignited-mind/
Apply link: www.bit.ly/IgnitedMind2023

- You can send any number of entries with or without a proof of concept (POC) or prototype, those who have converted their idea into a POC will get additional credit.
- It is earnestly requested to parents/teachers not to send their ideas in children's name, they can submit their own creative ideas at **hbncriia@honeybee.org** for separate awards.
- The children from families associated with Honey Bee Network institutions will not be eligible to apply for awards, though they can submit creative ideas.
- The Children should be allowed to share their ideas on their own without any outside tutoring or help.

GYTI Based Enterprises

Department of Biotechnology
Government of India

birac

Honey Bee Network

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INNOVATIONS

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