

Synergy

A BIOMEDICAL NEWSLETTER



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2021

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EDITORS DESK

Warm greetings to everyone!!!

“There is no end to education. It is not that you read a book, pass an examination, and finish with education. The whole of life, from the moment you are born to the moment you die, is a process of learning.”

– Jiddu Krishnamurti

In this edition of the department’s newsletter, we share with you the great accomplishments of our students.

This edition covers the happenings in the department from the months of July to September 2021. We highlight the achievements and participation of the students and faculty.

Presenting to you the first issue of the tenth volume of SYNERGY

“Your Work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work. And the only way to do great work is to love what you do. If you haven’t found it yet, keep looking. Don’t settle.”

- Steve Jobs

Wishing you all a very Happy Diwali!

Editorial board.

HOD'S DESK



I am delighted to write the prologue for our department's quarterly newsletter- 'SYNERGY'. Firstly, I would like to congratulate the editorial team for bringing up a wonderful assimilation of the various events and achievements into the newsletter.

The Department of Biomedical Engineering offers a unique blend of technology and healthcare, which is proving to be of major demand in today's world. Each issue of SYNERGY brings light on our department activities, campus updates, faculty and student accomplishments.

I would like to convey my best wishes to our students who have got placed and those who have got admit into various universities!

As life is slowly settling into a normal pace, we look forward to having a healthy, prosperous and successful year ahead, and we wish you and your family the same!

Dr. A. Kavitha
Professor and Head,
Department of Biomedical Engineering

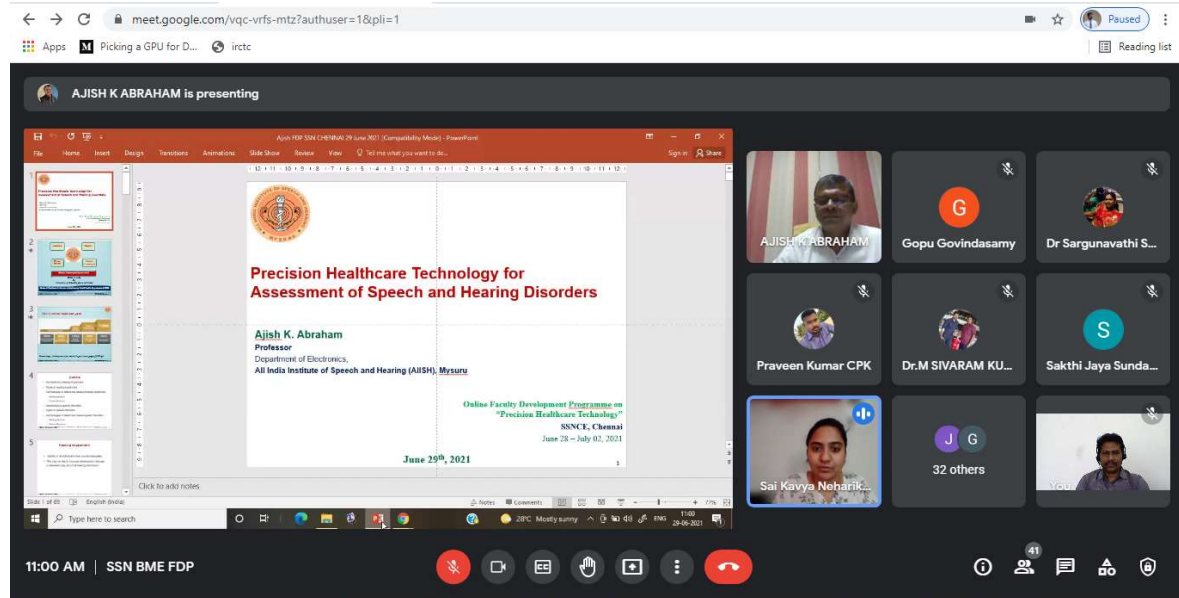
DEPARTMENT VENTURES

FACULTY DEVELOPMENT PROGRAM

The faculty development program titled “**Precision Healthcare Technology**” is a five-day event organized by the Department of Biomedical Engineering, held from the 28th of June to the 2nd of July, 2021. It focuses on creating a platform for research scholars and faculty members to broaden their knowledge and connect with professionals in the area of biomedical engineering. This platform serves as an opportunity to upgrade their knowledge of recent technologies.

The event began with an introductory speech by Dr A Kavitha, Professor & HoD, BME, who extended a warm welcome to all the participants. Then, Ms. Divya B highlighted the basic outline of the program as well as the various domains that would be covered.

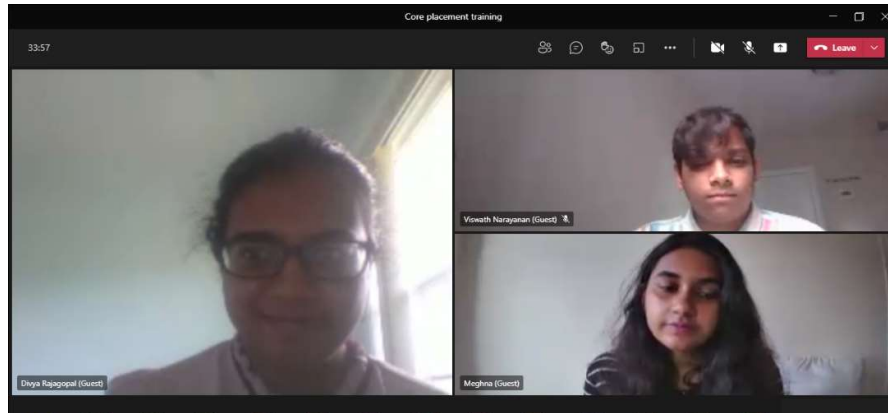
For the five days, over 16 speakers from various organizations enriched the participants with valuable information. The topics covered Artificial Intelligence (AI), Machine Learning in Molecular Imaging, Precision Healthcare Technologies, Design and calibration of Medical Devices, and wearable devices. The FDP was organized by **Dr. Vijay Jeyakumar, Dr. K. Nirmala, and Ms. B. Divya**



DEPARTMENT VENTURES

ALUMNUS TALK ON HIGHER STUDIES AND CAREER OPPORTUNITIES

On 5th July 2021, a talk by our alumnus Ms. Divya Rajagopal, Ms. Meghna Murali, Mr. R. Viswath (Siemens Pvt. Ltd) on the global career opportunities in the field of biomedical engineering. This session was attended by pre-final and final year UG students.



Alumnus of SSN giving a talk on higher studies and career opportunities

CORE PLACEMENT TRAINING

Core placement training for BME students was organized by **M. Dhanalakshmi, Assistant Professor** of the Department of Biomedical Engineering.

1. Mr. Anand Nair, Customer success leader, India head, United Imaging gave an expert talk on "Opportunities for Biomedical Engineers" to the students on 22nd July 2021.
2. Mr. U. Sunil, Service operations Manager, Indian Sub-Continent, Philips gave an expert talk on "Biomedical Engineers - career, trend, future" to the students on 23rd July, 2021.



Mr. U. Sunil, Service operations Manager, Indian Sub-Continent, Philips Electronics Ltd. delivering placement talk

DEPARTMENT VENTURES

NBA VISIT 2021

The Department of Biomedical Engineering has been accredited by NBA in the year 2015 for six years which was valid up to 30 June 2021. To renew the NBA accreditation, a pre-qualifier report was submitted on March 03, 2021, and the same was approved by NBA on March 19, 2021. Under each criterion, faculty members were deputed to consolidate and compile the information. After strenuous efforts and careful attention by the faculty members on documenting the report, the NBA e-SAR was submitted on May 17, 2021. The NBA visit date (September 17, 18 and 19) was communicated by the NBA on August 25, 2021. Dr. S. Pravin kumar, and Dr. J. Vijay were deputed as NBA coordinators. To meet up with the expectations of the NBA team, day to day framework and targets were formulated. An Internal mock audit was done by Dr. Jayaparvathy, Professor, Dept. of ECE, SSNCE on September 10, 2021. Based on her recommendations, follow-up actions were taken. A mock NBA drill was conducted on September 14, 2021, through online mode.



DEPARTMENT VENTURES

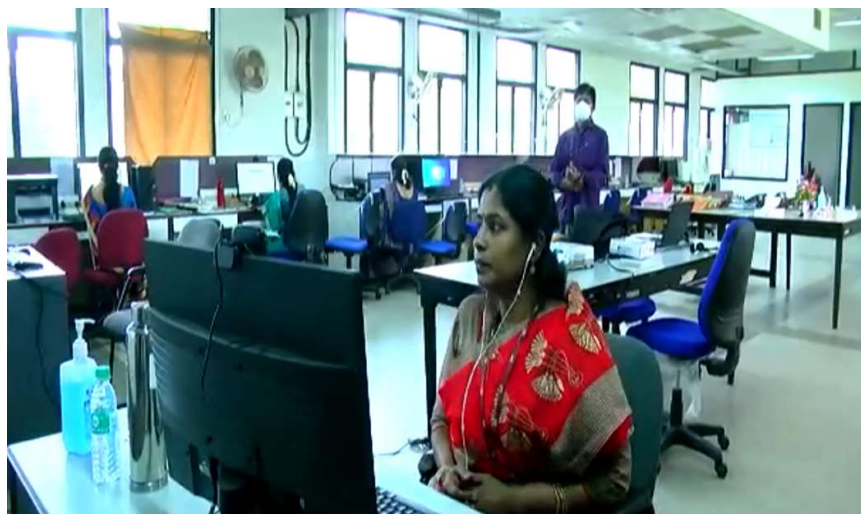
September 17, 2021

On day-1 of the visit, the NBA experts committee gathered on the Cisco Webex Platform by 09:30 am. The NBA chairman, **Prof. Prakriti Kumar Gosh, Professor, IIT Kharagpur** introduced the expert members of the NBA team. This was followed by the Principal's presentation.

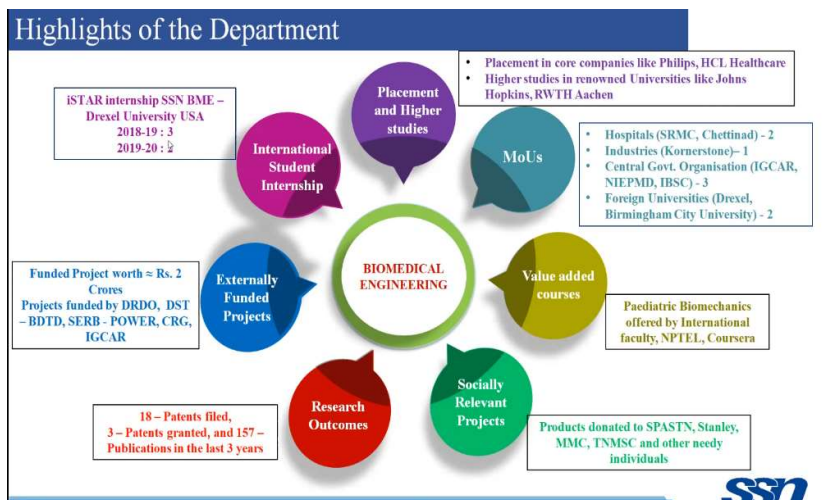


Dr Puneeet Gandhi, Professor & Head, Department of Research, Bhopal Memorial Hospital & Research Centre, was deputed as an online NBA evaluator for the department of BME.

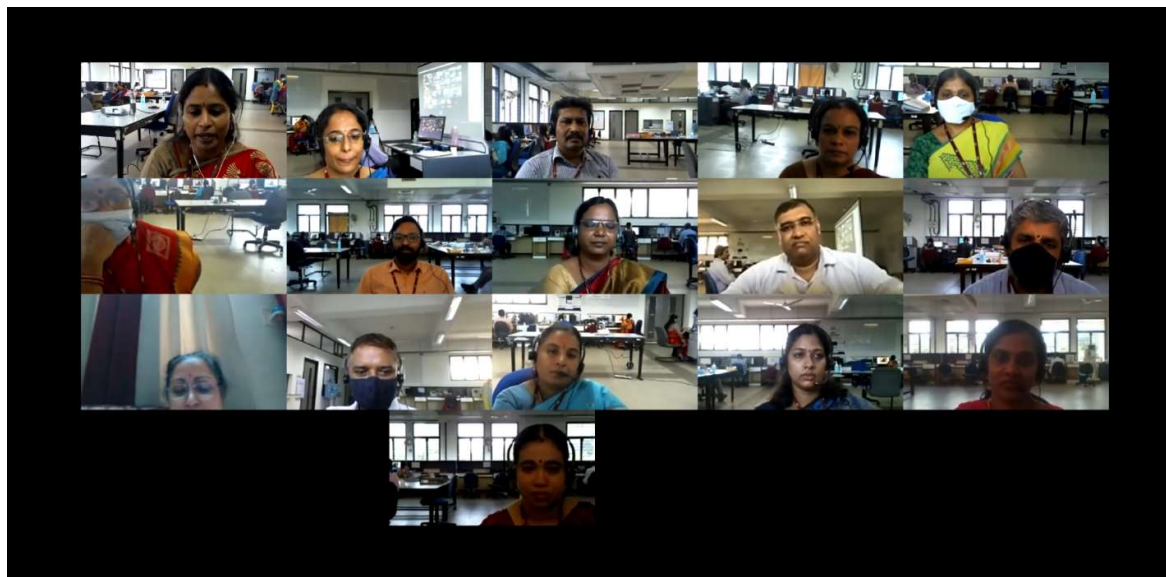
Dr Varaprasad Golla, Professor, Department of Computer Science and Engineering, BMS College of Engineering, Bangalore had been deputed as the observer to physically verify the components.



DEPARTMENT VENTURES

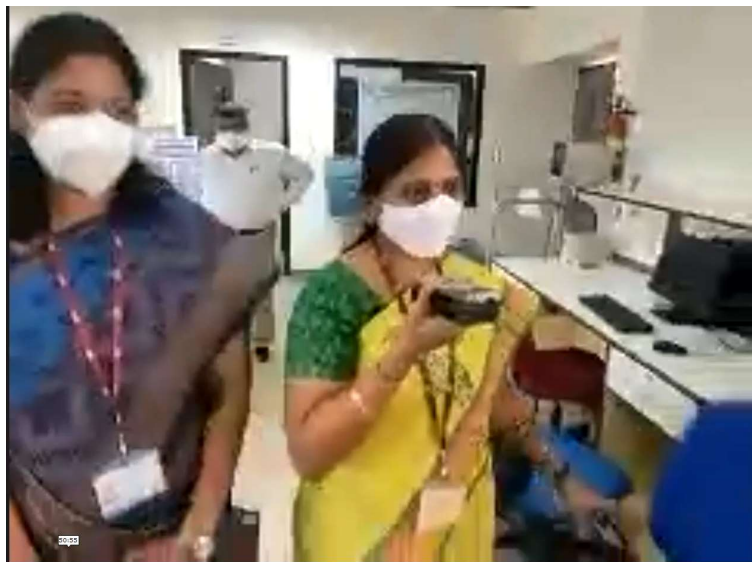


Dr. A. Kavitha, Prof. and Head, BME presented the highlights of the programme to the NBA evaluator through the zoom platform. Dr Puneet Gandhi interacted with the faculty members and they gave a self-introduction to her. A virtual lab tour was arranged. The various facilities in the department were shown to the NBA evaluator through online mode.



DEPARTMENT VENTURES

The evaluator asked for proofs and evidence for various sections of the criteria. The documents were immediately sent to her through email for assessment. The presentation and files were arranged in the DTE laboratory.



DEPARTMENT VENTURES

September 18, 2021

In the forenoon, Dr. Puneet Gandhi observed the conduction of both virtual and physical modes of classes. She interacted with the third year and final year students of BME to understand the various facilities and opportunities offered by the department.

Innovative projects were presented by the alumni and current students through virtual mode. A project exhibition was arranged in the Centre for Healthcare Technology. The students and faculty members demonstrated their innovations and final year projects to the NBA evaluator.



September 19, 2021

An exit meeting was convened by the NBA chairman to discuss the strengths and scopes for improvement of the Institute and Program. NBA visit feedback was submitted on September 20, 2021.

DEPARTMENT VENTURES

BEST TEACHER AWARD

Dr. Vijay Jeyakumar, Associate Professor and Dr. M. Dhanalakshmi, Assistant Professor of Department of Biomedical Engineering received The Best Teacher Award for the academic year 2019-2020 from Dr. Kala Vijayakumar, President, SSN Institutions.



Dr. Vijay J receiving the award from Dr. Kala Vijayakumar, President, SSN Institutions



Ms. M Dhanalakshmi receiving the award from Dr. Kala Vijayakumar, President, SSN Institutions

FACULTY INTERACTIONS

EXTERNAL RECOGNITION



❖ **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering, has attended **fourth Board of Studies Meeting** convened by the department of Medical Electronics, Vellalar College of Engineering and Technology, Erode on July 12, 2021.

❖ **Dr. A. Kavitha**, Professor & Head, Department of Biomedical Engineering was **appointed as the member of the Syllabus Sub Committee** for framing the Curricula and Syllabi for B.E._Biomedical Engineering and B.E. Medical Electronics to be offered in UG degree Programs under R-2021 by the Constituent Colleges and Non Autonomous Affiliated Institutions of Anna University, Chennai under the Faculty of Information and Communication Engineering in accordance with the Choice Based Credit System (CBCS). The meeting was organized by the Convener Committee, Anna University, Chennai.

❖ **Dr. S. Pravin Kumar**, Associate Professor, Department of Biomedical Engineering **has delivered a keynote talk** on "Influence of vocal fold upper and lower margins on the kymographic parameters" in the 5th Viennese research workshop on voice quality on 27th August 2021, organized by Medizinische Universität Wien (Medical University, Vienna), Austria.

❖ **Dr. A. Kavitha**, Professor and Head, Department of Biomedical Engineering has been **appointed as the Board of Studies member** of Pondicherry University on 16.8.2021, for deciding the curriculum of B.E Biomedical Engineering.

❖ **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering, **delivered a guest talk** on "Telemedicine for Rural Healthcare", at Two Weeks online FDP on Digital Transformation in Healthcare organized by Dept. of BME, Easwari Engineering College, Chennai on 13.8.2021.

FACULTY VENTURES

- ❖ **Dr. A. Kavitha**, Professor and Head, Department of Biomedical Engineering, **attended a meeting of the Syllabus Sub Committee** of Faculty of Information and Communication Engineering for the Non Autonomous colleges Affiliated to Anna University, Chennai on 11.8.2021. The agenda of the meeting is to give suggestions for the curriculum of I to VIII semesters and syllabi of I & II semester of B.E Biomedical Engineering and B. E. Medical Electronics.

- ❖ **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering, **attended the Syllabus Sub Committee meeting** of Faculty of Information and Communication Engineering for the Non-Autonomous Colleges Affiliated to Anna University, Chennai on 04.08.2021 (Wednesday) at 10.00 A.M through Online mode (Microsoft TEAMS). For M.E. Medical Electronics and M.E. Biomedical Engineering.

- ❖ **Dr. R. Subashini**, Assistant Professor, Department of Biomedical Engineering **delivered a guest lecture** on "Intellectual property rights and Patents" organized by the department of Chemical Engineering, Hindustan Institute of Technology and Science, Padur, Chennai on 29/9/2021 through Microsoft teams platform.

- ❖ **Dr. S. Arun Karthick**, Associate Professor, Department of Biomedical Engineering **delivered a guest lecture** on "Scaffolds for Tissue Regeneration" in the 1st International Conference on Innovative Products from Life Science Sector organized by Veridian Micro Lab Pvt Ltd, Chennai during 8-10 Sep 2021.

WORKSHOP/WEBINAR/SEMINAR/CONFERENCE/ FDP/EVENTS



ORGANIZED

- ❖ **Dr. Sachin Gaurishankar Sarate**, Assistant Professor, Department of Biomedical Engineering delivered a *research seminar* on the topic "Physiology of Vision with a perspective on Machine Vision" on 14th August 2021 for SSN faculty.
- ❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering delivered a *research seminar* on the topic "Muscle strength evaluation using Electromyogram signals" on 28th August 2021 for SSN Faculty.
- ❖ **Ms. B. Divya** and **Dr. N. Punitha** organized a BME department *PAC (Program Advisory Committee) meeting* for the R2021 curriculum on 23rd July at 2:00 pm. Dr. S. Muttan Professor (Retd), CEG Anna University (PAC-Chairman), **Dr. A. Kavitha**, Professor and Head, Department of Biomedical Engineering (PAC - Convenor), Dr. K. Kamalanand, Assistant Professor, Dept. of Instrumentation, Madras Institute of Technology (Representative from Anna University), Mr. Shantha Kumar, Director at Korerstone Devices Pvt Ltd, Mr. Baskar Balakrishnan, Head of SCM and Manufacturing Sudhir Srivastava Innovations Pvt Ltd (Industry Representatives) Mr. T. Madhusudhan Reddy, Attorney, Madras High Court (Parent Representative) , **Dr. K. Nirmala** (U.G. Program Coordinator BME), **Dr. S. Pravin Kumar**, **Dr. J. Vijay** (Senior Faculties, Department of Biomedical Engineering), Ms. P. Vardhini, Research Scholar, Non-Invasive Imaging and Diagnostic Laboratory, Indian Institute of Technology Madras, Ms. Preethi Kurian, Senior Software Engineer, HCL

FACULTY VENTURES

Technologies, Chennai (Alumni Representative), **Ms. M. Dhanalakshmi** (Faculty Placement Coordinator) were members of the meeting.

❖ **Dr. M. Dhanalakshmi**, Assistant Professor, Department of Biomedical Engineering delivered a *research seminar* on the topic “Significant sensors and parameters in assessment of dysarthric speech” on 11th September 2021.

ATTENDED

❖ **Dr. N. Punitha**, Assistant Professor, Department of Biomedical Engineering attended a five-day AICTE sponsored *ATAL FDP* on “Artificial Intelligence in Biomedical Engineering: Current Trends and Future”. It was organized by Sant Longowal Institute of Engineering & Technology from 5th July,2021 to 9th July,2021.

❖ **Dr. N. Punitha**, Assistant Professor, Department of Biomedical Engineering attended a three-day *Faculty Development Program* on “Research Perspectives in Artificial Intelligence and its Applications”. It was conducted by the R.M.K College of Engineering and Technology, Chennai from 22nd July,2021 to 24th July,2021.

❖ **Dr. K. Nirmala**, Associate Professor, Department of Biomedical Engineering attended a five-day AICTE sponsored *ATAL FDP* on “Medical Image Processing and 3D Applications”. It was held from 5th July,2021 to 9th July,2021 at the University College of Engineering.

❖ **Ms. B. Divya**, Assistant Professor, Department of Biomedical Engineering completed the AICTE sponsored *ATAL FDP* on “Artificial intelligence in Biomedical Engineering: Current trends and future”. It was organized by Sant Longowal Institute of Engineering & Technology from 5th July,2021 to 9th July,2021.

❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering attended a one-week online *FDP* on “Precision Health Technologies”. It was conducted by the Department of Biomedical Engineering, SSN College of Engineering, Chennai, Tamil Nadu from 28th June, 2021 to 2nd July,2021.

FACULTY VENTURES

- ❖ **Dr. R. Subashini**, Assistant Professor, Department of Biomedical Engineering attended the *Biotechnology Popular Expert Lecture Series - 2021*, organized by the Department of Biotechnology, AKS University and supported by the National Academy of Science, India (NASI)-Bhopal Chapter and Microbiologists Society, India-(MP Unit) on 8th July, 2021.

- ❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering attended One-week online *AICTE Sponsored FDP on Emotional Intelligence* Conducted by Government Engineering College, Thrissur from 2.08.2021-6.08.2021

- ❖ **Dr. N. Punitha**, Assistant Professor, Department of Biomedical Engineering attended *Five-day Faculty Development Program on "Instrumentation, Signals and Images for the Evaluation of Physiological Systems"* under *AICTE - ATAL* Scheme organized by the Department of Instrumentation and Control Engineering, National Institute of Technology Trichy, between 16th -20th, August 2021.

- ❖ **Dr. Sachin Gaurishankar Sarate**, Assistant Professor, Department of Biomedical Engineering attended a *webinar on "Building an Innovation/ Product for Market"* organized by the Institution Innovation Council of Sri Sivasubramaniya Nadar College of Engineering on July 15, 2021.

- ❖ **Dr. K. Nirmala**, Associate Professor, Department of Biomedical Engineering attended two days international *workshop on Mathematical foundations for Machine Learning and Data Science*, Organized by Department of Information Technology, Sri Sivasubramaniya Nadar College of Engineering, on 13-14 August 2021

- ❖ **Dr. S. Arun Karthick**, Associate Professor, Department of Biomedical Engineering attended a *guest lecture on "Alpha-Light Sheet Microscopy"* organized by Department of Biomedical Engineering, SRMIST, Kattankulathur on 18.08.2021.

- ❖ **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering attended a *webinar titled "Part 3: A Deep Dive into Deep Learning Modelling - Session 2: Advanced Neural Networks"* organized by *MathWorks Corporation* on August 03, 2021.

FACULTY VENTURES

- ❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering attended a two-day *awareness workshop* on “Improving Research & Performance Outcomes” organized by Elsevier from 31-8-2021 to 1-9-2021.
- ❖ **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering attended a *webinar* on “*How to Align Your Product Design with Your Consumer's Requirements*” by IIM, Indore and Jigsaw Academy on 29.09.2021.
- ❖ **Dr. N. Punitha**, Assistant Professor, Department of Biomedical Engineering attended an *impact lecture session* on "Funding Support for early stage of Entrepreneurship" and "Intellectual Property and Innovation Management", organized by Institution's Innovation Council (IIC) of Pragati Engineering College on 27.09.2021.

INDUSTRIAL COLLABORATION



❖ An eight-week Autodesk *training session* is being conducted by Mr. Rohit Chandran R, Education Engagement Specialist, Autodesk India Pvt Ltd. to the final year students of Biomedical Engineering as part of the course **UBM1712 Medical System Design and Modeling Laboratory**. Autodesk has offered 120 free student's educational license with one-year validity. The training session is coordinated by **Dr. Vijay J**, Associate Professor, Department of Biomedical Engineering.

❖ As part of MoU with Sri Ramachandra Institute of Higher Education and Research, a meeting was conducted on September 4th, 2021 with Dr. Shriraam M, Dr. Karthick and Dr. Sudhir G to discuss clinical issues and possible technical interventions. **Dr. Vijay J**, Associate Professor, Department of Biomedical Engineering retrieved DEXA scan report of several patients from the PACS environment during this visit.

FACULTY RESEARCH ACTIVITIES



JOURNAL PUBLICATIONS

- ❖ **M. Dhanalakshmi**, T. Nagarajan, P. Vijayalakshmi, Significant sensors and parameters in assessment of dysarthric speech, *Sensor Review*, in print, 2021, <https://doi.org/10.1108/SR-01-2021-0004>
- ❖ **Nithya Rajagopalan**, Venkateswaran N., Alex Noel Josephraj, Srithaladevi E, Diagnosis of retinal disorders from Optical Coherence Tomography images using CNN, *PLOS ONE*, 16(7) and e0254180, 2021, <https://doi.org/10.1371/journal.pone.0254180>
- ❖ Anitha Rajagopal and **Subashini Rajakannu**, Cassia auriculata and its role in infection/inflammation: A close look on future drug discovery, *Chemosphere*(2022),132345,2021,<https://doi.org/10.1016/j.chemosphere.2021.132345>Get9/24/2021.
- ❖ Amogh Gupta, Harish Balaji, R. Sundareswaran, **Mahesh Veezhinathan**, **B Geethanjali**, Group Leverage Centrality and its Applications in Brain Networks, *IOP Conf. Series: Materials Science and Engineering*, 1187, 1-10, 2021, doi:10.1088/1757-899X/1187/1/012001.
- ❖ **Nirmala Krishnamoorthi** and Vinoth Kumar Chinnababu, Hash and Prediction Error-Based Reversible Watermarking for Medical Images, Fluctuation and Noise Letters, online published, 2021. <https://doi.org/10.1142/S0219477522500079>

BOOK CHAPTER

❖ Krishnan C, Vishnuvazla S.S. and **Kumar S.P**, Ruidan Su, Yu-Dong Zhang, Han Liu, “Measurement of Q Factor from Two Dimensional Images of Osteoarthritic Knee Braces”, Lecture Notes in Electrical Engineering, Springer, Singapore, 251-259, 10.1007/978-981-16-3880-09/14/2021.

CONFERENCE PUBLICATIONS

❖ **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering, presented a paper titled **Design of Compact Coplanar Waveguide Feed Inverted - P Antenna for Biomedical Implants** in 2021 IEEE 19th International Conference on Smart Technologies (**EUROCON**), organized by IEEE Ukraine section , Ukraine on July 06, 2021.

❖ **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering, authored a paper along with Palani Thanaraj Krishnan, and Parvathavarthini Balasubramanian titled **Histogram matched visible and infrared image registration for face detection** and presented in 2021 IEEE 19th International Conference on Smart Technologies (EUROCON), organized by IEEE Ukraine section, Ukraine on July 08, 2021.

❖ **Dr. R. Subashini**, Assistant Professor, Department of Biomedical Engineering has attended and presented the paper entitled **conductivity-based salt analysis for detection of blood salt abnormalities** in the first International Conference on social work, science and technology (ICSST-online) organized by the Department of social work Vaishnav college for Women, Chennai, India, in collaboration with Global conference Hub, Coimbatore, India on 29th and 30th July 2021.

❖ **Dr. M. Dhanalakshmi**, Assistant Professor, Department of Biomedical Engineering along with Keerthi Vembu NVP has presented the paper entitled **Acoustic analysis for detection of different voice pathological conditions** International Conference on Signal Processing, Communication and Electronics Engineering (**ICSPCEE**), Chennai, 18 June, 2021, In proceedings of Asian society for academic research, pp 12-19.

FACULTY VENTURES

❖ **Dr. M. Dhanalakshmi**, Assistant Professor, Department of Biomedical Engineering, has presented a paper entitled “Sedentary Posture Alerting Device” at the International Research Conference on Science Technology, Engineering and Management (IRCSTEM) held in New Delhi, India on 01 - 02 August, 2021.

❖ Thankam Regi, **Dr. S. Arun Karthick**, Associate Professor, Department of Biomedical Engineering, A. Murugesan, Arya S.Raj presented a paper entitled "Recycled Polystyrene/MWCNT nanocomposite membrane for the efficient removal of crystal violet dye" in chemistry for next gen applications virtual international conference - 2021 (*ICCNA '21*) organized by SSNCE during 24-25 Sep 2021.

PATENTS

❖ **Dr. M. Dhanalakshmi**, Assistant Professor, Department of Biomedical Engineering had filed a FER for a patent titled, “An external aid for Amyotrophic lateral sclerosis patients”. The details for the same are as follows, Application Number: 201841010368, form number: E-91/11474/2021/CHE.

EXTERNAL FUNDING SANCTIONED

❖ A project titled, "Augmented Reality based Surgical Support Systems", has been sanctioned by *SERB* under the POWER grant for **Rs.25.94 L**. The PI of the project is **Dr. A. Kavitha**, Professor & Head, Department of Biomedical Engineering and the CO-PIs being **Dr. S. Pravin Kumar**, Associate Professor, Department of Biomedical Engineering and Dr. G. Sudhir, Consultant Ortho Spine Surgeon, Sri Ramachandra Medical University, Chennai.

❖ **Dr. S. Arun Karthick**, Associate Professor, Department of Biomedical Engineering, the PI along with **Dr. Sachin Gaurishankar Sarate**, Assistant Professor, Department of Biomedical Engineering and **Dr. S. Pravin Kumar**, Associate Professor, Department of Biomedical Engineering as Co-PI received the grant for the project titled "Design and development of 16 channels functional Near Infrared Spectroscopy system for measuring hemodynamics in Brain: Prefrontal Cortex", under *DST - BDTD* for around **Rs.25.33L**.

❖ **Dr. B. Geethanjali**, Associate Professor, Department of Biomedical Engineering, as the PI along with **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering and Dr. Bikesh Singh as Co-PI received the grant for the project titled “Enhancing Brain Cognition through

FACULTY VENTURES

Neuro-Feedback model in Indian Children with Learning Disability", under SERB-CRG, Partnering institute NIT, Raipur for an amount Rs.**44.03L**.

❖ The project proposal titled ‘Dose assessment of partial body exposure using premature chromosome condensation (PCC) assay for mass casualty accidents’, has been accepted for funding of **Rs.24.34L** for a period of 24 months. Dr. N.P. Rajesh of Physics department and **Dr. R. Subashini**, Assistant Professor, Department of Biomedical engineering department are designated as the PI.

PROJECT APPLIED

❖ **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering and **Dr. B. Geethanjali**, Associate Professor, Department of Biomedical Engineering, the PI and CO-PI respectively, along with Dr. V. Premalatha, Co-PI, Department of Music, Central University of Tamil Nadu, Thiruvarur had submitted a proposal titled, “A Scientific Approach to Preserve the Indian Musical Heritage and Emphasizing its effect on Music cognition” to **DST-SHRI** for an amount of **Rs.35.30L**.

❖ **Dr. N. Punitha** Assistant Professor, Department of Biomedical engineering department submitted an internal funding project entitled "Development of an intelligent system to characterise uterine contractions during pregnancy" for a duration of 24 months and with a budget of **Rs.2.95L**.

❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical engineering department submitted an internal funding project entitled "Quantitative tool for muscle strength evaluation" for a duration of 24 months and with a budget of **Rs.2.95L**.

❖ **Dr. R. Subashini**, Assistant Professor, Department of Biomedical engineering department submitted an internal funding project entitled "Assessment of Antimicrobial Mechanisms of Biogenic nanoparticles on Microbes" for a duration of 24 months and with a budget of **Rs.3.5L**.

RESEARCH SCHOLARS' ACTIVITIES

- ❖ **Dr. R. Subashini**, Assistant Professor, Department of Biomedical Engineering had conducted the **Public Viva-Voice Examinations** for her full-time scholar Mrs. R. Anitha (1623599128) on 23rd July, 2021.
- ❖ **Dr. M. Dhanalakshmi**, Assistant Professor, Department of Biomedical Engineering (Anna University Part-time scholar) completed her **Ph.D. public viva-voce examination** on 19.8.2021. She was guided by Dr. P. Vijayalakshmi Prof, ECE, SSNCE. Dr. Hariharan M, NIT, Uttarakhand and Dr. Venugopal G, NSS College of Engineering, Kerala were present during the defence meeting.
- ❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering (Anna University Part-time scholar) completed her **Ph.D. public viva-voce examination** on 19.8.2021. She was guided by Dr. Poonghuzhali, Associate Professor, ECE, CEG, Anna University.
- ❖ Mrs. Gowri Vidhya N (Reg. No. 21224997124) has got Ph.D. admission in Anna University under the supervision **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering and proceeding under the faculty of Information and Communication Engineering.
- ❖ Mr. Ezhilan N N (Reg. No. 21124997583) has got Ph.D. admission in Anna University under the supervision of **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering and proceeding under the faculty of Information and Communication Engineering.
- ❖ Mr. Pradeep K (Reg. No. 21144997694) has got Ph.D. admission in Anna University under the supervision of **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering and proceeding under the faculty of Information and Communication Engineering.

OTHER NOTABLE ACTIVITIES IN THE DEPARTMENT

❖ Ms. D. STELLA MERLIN of SMK FOMRA INSTITUTE OF TECHNOLOGY has successfully completed a six-week *Virtual Internship Project* titled "Designing and Implementation of Heart rate analyser" under the guidance of **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering during May - June in the Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai.

❖ Ms. Y. DEEPALAKSHMI of SMK FOMRA INSTITUTE OF TECHNOLOGY has successfully completed a six-week *Virtual Internship Project* titled "Analyzing the effect of cardiovascular parameter for mental relaxation" under the guidance of **Dr. Mahesh Veezhinathan**, Associate Professor, Department of Biomedical Engineering during May - June in the Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai.

❖ MS. SIVARANJANI KUBENDIRAN, Undergraduate with a B.Sc. Physics degree from Auxilium College (Autonomous - Affiliated to Thiruvalluvar University) – Vellore, India has joined as an *Intern* for three months under the guidance of **Dr. A. Kavitha** and **Ms. B. Divya**, Department of Biomedical Engineering.

❖ HABEEBUR RAHMAN of SMK FOMRA INSTITUTE OF TECHNOLOGY has successfully completed a six-week *Virtual Internship Project* titled "Predicting the Impact of Physiological parameters on task performance" under the guidance of **Dr. B. Geethanjali**, Associate Professor, Department of Biomedical Engineering during May - June in the Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai.

❖ V. HEMALATHA of SMK FOMRA INSTITUTE OF TECHNOLOGY has successfully completed a six-week *Virtual Internship Project* titled "Spectrum analysis of ECG and PCG signals" under the guidance of **Dr. B. Geethanjali**, Associate Professor, Department of Biomedical Engineering during May - June in the Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai.

- ❖ E. NISHANTHI of SMK FOMRA INSTITUTE OF TECHNOLOGY has successfully completed a six-week *Virtual Internship Project* titled "Time and Frequency domain measurement of Bio signals" under the guidance of **Dr. B Geethanjali**, Associate Professor, Department of Biomedical Engineering during May - June in the Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai.
- ❖ Sneka, IIIrd year Biomedical Engineering student of RVS Educational Trusts Group of Institutions has completed a six-week *Summer Virtual Internship Project* titled "Tooth Classification of X ray dental Panoramic images" under the guidance of **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering in the department of Biomedical Engineering during May - June 2021.
- ❖ Nishanthini, IIIrd year Biomedical Engineering student of RVS Educational Trusts Group of Institutions has completed a six-week *Summer Virtual Internship Project* titled "Retinal Image Analysis" under the guidance of **Dr. K. Nirmala**, Associate Professor, Department of Biomedical Engineering in the department of Biomedical Engineering during May - June 2021.
- ❖ **Dr. Vijay Jeyakumar** and **Ms. B. Divya** have done *internal audit* in the department of Civil Engineering as per the guidelines of ISO and IQAC on August 25th and 27th 2021.
- ❖ **Dr. Vijay Jeyakumar**, Associate Professor, Department of Biomedical Engineering has done an *audit* in boys' hostel as per the guidelines of ISO on August 28th, 2021.
- ❖ **Ms. B. Divya**, Assistant Professor, Department of Biomedical Engineering has done an *audit* in girls' hostel as per the guidelines of ISO on August 28th, 2021.
- ❖ *An internal audit* (AY 2019 - 20 & 2020 -21 (Odd) was held in the department of Biomedical Engineering on August 26th and 27th, 2021. **Dr. Vijay Jeyakumar**, **Dr. L. Suganthi** and **Ms. B. Divya** coordinated this audit.
- ❖ **Dr. S. Pravin Kumar**, Associate Professor, Department of Biomedical Engineering has completed an *online certified course* on "Deep learning with PyTorch: Neural Style Transfer" by Coursera Project Network offered through Coursera.

FACULTY VENTURES

❖ **Dr. S. Saranya**, Assistant Professor, Department of Biomedical Engineering successfully completed a 12-week Swayam *NPTEL Certificate Course* on "Mechanics of Human Movement" - Exam date - 08.08.2021.

❖ **Dr. Mahesh Veezhinathan** (PI) and **Dr. B. Geethanjali** (Co-PI) presented their *proposed project* to the expert committee of SHRI, DST. A project titled "A Scientific Approach to Preserve the Indian Musical Heritage and Emphasizing its effect on Music cognition" on 02.09.2021, virtually in zoom platform.

External Recognition - Co-Curricular Activities

- ❖ **Shri Thrisha Arunkumar**, II Year BME completed an Internship at Navson Technologies for two months.
- ❖ 35 Students from the II Year attended the Workshop on Higher studies in India and abroad organised by Dr. N. Lakshmi Narasimhan on 27-09-2021.
- ❖ **A. RaamaNarayanan**, III year BME participated in a webinar on “Introduction To Additive Manufacturing And Its Applications” organized by Machenn Innovations on 06/07/2021.
- ❖ **A. RaamaNarayanan**, III year BME participated in a webinar “3D Printing and its Applications on Product Design” organized by 3D Verse on 11/07/2021.
- ❖ **N.V. Saravanan**, III year BME attended a workshop on “BME MATLAB/SIMULINK” organized by the Engineering Staff College of India – An Autonomous Organ of The Institution of Engineers (India) – from 14/06/2021 - 10/07/2021.
- ❖ **R. Dhanush Babu**, III year BME participated in Proteomics Internship Program – Online organized by IIT, Bombay on 24/05/2021.
- ❖ **K. Chandramouli**, III year BME completed a course on Simulink - MATLAB offered by Mathworks in Chennai on 30/08/21.
- ❖ **K. Chandramouli**, III year BME attended a 7-day workshop on sports Management - Mad About Sports in Chennai from 12/09/21- 19/09/2021.
- ❖ **T. Janani**, III year BME participated in an online webinar hosted by Machenn on 22/9/2021.
- ❖ **T. Janani T**, III year BME Webinar, participated in Biopedia quiz conducted by SSN College of Engineering on 19/9/2021.
- ❖ **Thejaswini**, III year BME completed the Gustovalley Internship – Online conducted from 26/08/21 – 25/09/21.

- ❖ **S. Ashwini**, III year BME completed the Gustovalley Internship - Online

STUDENT VENTURES

conducted from 26/08/21 – 25/09/21.

- ❖ **N. Srinidhi**, III year BME, participated in the Imagination Hunt - Online conducted by Indus university Ahmedabad and won 2nd place on 3/08/21.
- ❖ **N. Vidhya**, I year M.E Medical Electronics participated in a 2-day webinar on “Defibrillator and Pacer testing in accordance with the MDQA and IEC Standards” conducted by Fluke Biomedical on 30/06/2021- 1/07/2021.
- ❖ **Tuhina Sheryl Abraham**, I year M.E Medical Electronics participated in the AICTE Training and Learning (ATAL) Academy Online Elementary FDP on "Artificial Intelligence in Contemporary Biomedical & Healthcare Applications: Fundamentals & Hands On MATLAB" at Gautam Buddha University, Greater Noida, U.P. from 21/06/2021 – 25/06/2021.
- ❖ **Sachin Raj**, I year M.E Medical Electronics participated in the DP on "Artificial Intelligence for Computer Vision" at IIT, Roorkee from 12/07/2021 – 16/07/2021.
- ❖ **Sachin Raj**, I year M.E Medical Electronics participated in the Python Course in Kaggle.
- ❖ **Sachin Raj**, I year M.E Medical Electronics participated in the FDP on "Precision Healthcare Technology" at SSN College of Engineering from 28/06/2021 – 2/07/2021.
- ❖ **Sachin Raj**, I year M.E Medical Electronics completed "Introduction to Tensor Flow for Artificial Intelligence, Machine Learning, and Deep Learning" by Coursera on 1/07/2021.
- ❖ **Sachin Raj**, I year M.E Medical Electronics completed "Convolutional Neural Networks in TensorFlow" by Coursera on 28/07/2021.
- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics completed an online course on " Python-Introduction to Data science and Machine Learning A-Z" from Udemy on 19/07/2021.

- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics completed a course on " Introduction to Deep Learning" from Great Learning in July 2021.
- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics attended a 7- day

STUDENT VENTURES

Bootcamp on the topic "Python and Deep Learning" conducted by Shape AI from 18/07/2021- 25/07/2021.

❖ **S. Mohammed Adhil**, I year M.E Medical Electronics attended a webinar on the topic "Mission Possible- A Physiotherapy Approach to combat Covid-19" conducted by Say It Doc Community with Koher Institute of Physiotherapy on 12/07/2021.

❖ **S. Mohammed Adhil**, I year M.E Medical Electronics attended a webinar on the topic " Different types of skin cancer using CNN" conducted by Department of ECE- MVR College of Engineering and Technology, Paritala, Vijawada in association with Pantech Elearning, Chennai.

❖ **S. Mohammed Adhil**, I year M.E Medical Electronics attended a webinar on the topic, " Deep Learning with audio signals" conducted by Department of CSE- Sree Dattha Group of Institutions, Ibrahimpattnam, Hyderabad with association with Pantech Elearning, Chennai on 30/06/2021.

❖ **Mannat Uppal**, I year M.E Medical Electronics attended a webinar on “Defibrillator and Pacer testing in accordance with the MDQA and IEC Standards” by Fluke Biomedical on 15/07/2021.

❖ **Mannat Uppal**, I year M.E Medical Electronics attended a webinar on “Defibrillator and Pacer testing in accordance with the MDQA and IEC Standards “by Fluke Biomedical on 16/07/2021.

❖ **N. Vidhya**, I year M.E Medical Electronics participated in a 2-Day Workshop on “Deep Learning for Signal Processing” organized by the IEEE SPS Madras Chapter from 7/08/2021-8/08/2021.

❖ **N. Vidhya**, I year M.E Medical Electronics participated in a 1- day webinar on “Introduction To 3D Printing & Its Applications In The Medical Industry” organized by MedCuore Medical Solutions Private Limited, Chennai on 5/08/2021.

❖ **Mannat Uppal**, I year M.E Medical Electronics attended a workshop on "Infusion Pump Testing in accordance with the MDQA and IEC Standards” by Fluke biomedical on 19/08/2021.

❖ **Mannat Uppal**, I year M.E Medical Electronics attended a 7- day workshop on "Python and Deep Learning Bootcamp" by ShapeAI.

STUDENT VENTURES

- ❖ **Mannat Uppal**, I year M.E Medical Electronics attended a 2- day workshop on "Deep Learning for signal processing" by IEEE Madras chapter from 7/08/2021-8/08/2021.
- ❖ **Mannat Uppal**, I year M.E Medical Electronics attended a webinar on "Computer Programming for Biomedical Engineers" by Medcuore medical solutions on 6/08/ 2021.
- ❖ **Mannat Uppal**, I year M.E Medical Electronics attended a webinar on "Introduction to 3D Printing and its Applications in the Medical Industry" by Medcuore medical solutions on 5/08/2021.
- ❖ **K. Manjari**, 1 year M.E Medical Electronics attended a webinar on the topic "Introduction to 3D printing and its Application in Medical Industry" by Medcuore Medical Solutions Pvt Limited Chennai on 5/08/2021.
- ❖ **K. Manjari**, 1 year M.E Medical Electronics attended a webinar on the topic "Computer Programming for Biomedical Engineers" by Medcuore Solutions Pvt Limited Chennai on 6/08/2021.
- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics attended a 5- day FDP on the topic,"IOT application in Medical Science" conducted by ATAL Academy at Women Engineering College, Ajmer from 09/08/2021-13/08/2021.
- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics participated in a 2- Day Workshop on “Deep Learning for Signal Processing” organized by the IEEE SPS Madras Chapter hosted by Centre for Healthcare Advancement, Innovation and Research, VIT –Chennai & IEEE SPS Student Chapter VIT-Chennai from 7/08/2021 - 8/08/ 2021.
- ❖ **S. Mohammed Adhil**, I year M.E Medical Electronics completed an online course on the topic," Predictive Modeling with Python" by Udemy- Online Courses on 29/08/2021.
- ❖ **Brenda Jennifer Baskar**, I year M.E Medical Electronics attended a 1- day webinar on "Introduction To 3D Printing & Its Applications In The Medical Industry" organized by MedCuore Medical Solutions Private Limited, Chennai on 5/08/2021.

STUDENT VENTURES

- ❖ **Brenda Jennifer Baskar**, I year M.E Medical Electronics attended a 1-day webinar on "Computer Programming For Biomedical Engineers" organized by MedCuore Medical Solutions Private Limited, Chennai on 6/08/2021.
- ❖ **N. Vidhya**, II year M.E Medical Electronics attended a 1-day webinar on the topic "Understanding Radiation survey meters" conducted by Fluke Biomedical on 16/09/2021.
- ❖ **Brenda Jennifer Baskar**, II year M.E Medical Electronics attended a 1-day workshop on "Power Excel" organized by LUDIFU on 16/09/2021.
- ❖ **Brenda Jennifer Baskar**, II year M.E Medical Electronics attended a 1-day workshop on "AutoCAD-2D" organized by ACADD Centre on 29/09/2021.
- ❖ **Brenda Jennifer Baskar**, II year M.E Medical Electronics attended a 1-day webinar on "Understanding Radiation Survey Meters" organized by Fluke Biomedical on 16/09/2021.
- ❖ **Mannat Uppal**, II year M.E Medical Electronics attended a webinar on "Understanding Radiation Survey Meters" by Fluke Biomedical on 16/09/2021.
- ❖ **Mannat Uppal**, II year M.E Medical Electronics attended a workshop on AUTOCAD-2D conducted by Maharashtra Technical & Self - Employment Training Society on 29/09/2021.
- ❖ **Tuhina Abraham**, II year M.E Medical Electronics completed an online course named "Crash Course on Python" authorized by Google and offered through Coursera during the month of September 2021.

STUDENT PURSUITS

External Recognition- Extra Curricular Activities

- ❖ **Kritik Varshi B**, III year BME, Won Best Delegate (1st Place) in The Delhi Diplomacy Summit conducted by Amity University held on 24th and 25th July 2021 in online mode.
- ❖ **Aishwarya V**, III Year BME performed a live Bharathanatyam recital in the Natya Festival 2021 organized by Music of Madras, Chennai on 9th Aug 2021 in online mode.



- ❖ **Jeni Christina**, II year BME, won the 3rd place in NSS-.Kahoot Quiz which took place on 24.09.2021 at the ECE block in SSN
- ❖ **Jeni Christina**, II year BME, participated in Out of the box, on online event conducted by the NSS unit of SSN on 25.09.2021
- ❖ **Jeni Christina**, II year BME, won the 3rd place in NSS-Awareness Drive, an online event conducted on 25.09.2021
- ❖ **Jeni Christina**, II year BME, won the 3rd place in NSS-Pitch the Move, an online event conducted on 23.09.2021
- ❖ **Jeni Christina**, II year BME, won the 3rd place NSS-Wealth out of waste, an online event conducted on 25.09.2021

STUDENT PURSUITS

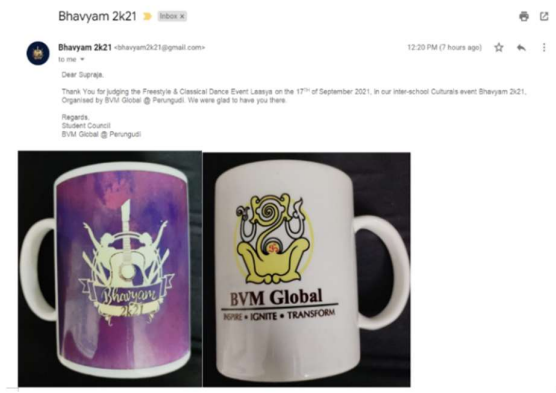
- ❖ **Jeni Christina**, II year BME, won the 3rd place NSS Guess who, an online event conducted on 26.09.2021
- ❖ **Mohammed Yaser**, II year BME participated in Out of Box, an online event conducted by the NSS unit of SSN on 26.09.2021
- ❖ **Aswin Jayaraaman**, II year BME won the second place in NSS event Panel Discussion which was conducted on 29.09.2021 at the Mini Auditorium in SSN



- ❖ **Supraja Vaidhyanathan**, II year BME published a poem in the Write order's anthology "Illusion of separation" on 03.09.2021.
- ❖ **Supraja Vaidhyanathan**, II year BME participated in REC vs SSN EDC Online Debate on Communism vs Capitalism which resulted in a draw. The competition took place on 12.09.2021.
- ❖ **Supraja Vaidhyanathan**, II year BME won the 1st Place in NSS awareness drive which was an online event that took place on 26.09.2021.
- ❖ **Supraja Vaidhyanathan**, II year BME won the 2nd Place in NSS Dukes for Dukedom conducted in SSN at the ECE block on 27.09.2021.
- ❖ **Supraja Vaidhyanathan**, II year BME judged for Lasya, Classical Dance, Bhavyam 2k21, BVMGP, an online event on 17.09.2021.

STUDENT PURSUITS

- ❖ **Supraja Vaidhyathan**, II year BME won the 3rd place in NSS Day Panel Discussion which took place on 29.09.2021 at the mini auditorium in SSN.



STUDENT PURSUITS

ALUMINI UPDATE

Pragadeesh Chidambaram, an alumnus from the BME Department, received an Accomplishment Award from MEDTRONIC, in recognition of the outstanding performance in Q1 FY22 for Field Sales Force Category.



STUDENT PURSUITS

STUDENTS PURSUING GRADUATE STUDIES

❖ **Pranav Krishna R** (Batch 2017-2021) has joined the prestigious Johns Hopkins University for his Master Program in Biomedical Engineering in Whiting School of Engineering.



March 16, 2021

Pranav Krishna (Pranav Krishna) Ramesh
pranavkrishna1901@gmail.com

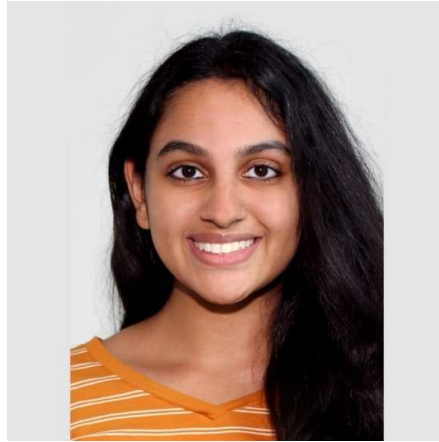
Dear Pranav Krishna,

Congratulations! On behalf of the faculty, I am delighted to inform you that you have been admitted to the M.S.E. program in Biomedical Engineering in the Whiting School of Engineering at Johns Hopkins University, beginning in the Fall 2021 term. You will be joined by classmates that share your passion and qualifications to create and develop engineering solutions that will change lives around the world.

The BME department offers two degree options: a course-based MSE (1 year) and a thesis-based MSE (1 additional year). All incoming students are considered course-based master's students and requires the completion of a minimum of 30 credits in a chosen focus area. An optional, thesis-based degree can be completed during a second year of study. Students interested in the thesis-based option must identify their intent during the first year of study.

THINK PIECE

- ❖ **Shri Harini R** (Batch 2017-2021) has joined the University of Ottawa for her Master Program.
- ❖ **Gurucharan M K** (Batch 2017-2021) has joined McGill University, Canada for his Master Program.
- ❖ **Janani Aiyer**, 2015-2019 batch, placed at Abbott Laboratories, California as Clinical Scientist. She had numerous offers from other leading Healthcare companies such as GE Healthcare, United Imaging and the Veterans Healthcare Administration, however she chose Abbott.



Janani wrote to Dr. A. Kavitha saying,

Hi Kavitha ma'am,

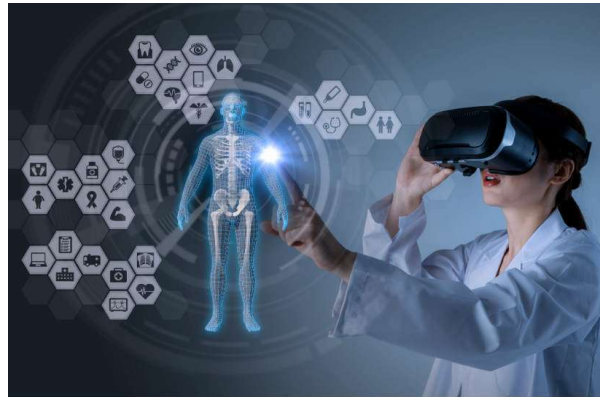
This is Janani Aiyer, an SSN BME alumni, batch 2015-19. I hope you are doing very well!

I wanted to let you know that I accepted a position as a Clinical Scientist at Abbott Laboratories in California! I had some other job offers from GE Healthcare, United Imaging and the Veterans Healthcare Administration, but I decided to go with Abbott. The location and position are wonderful and room for growth and networking is great as well.

Thank you so much for your recommendations, guidance and for the opportunity to present your research. Could not have made it this far without your help ma'am! We will keep in touch.

VIRTUAL REALITY IN HEALTHCARE

- N. SRINIDHI (III Year BME)



From fancy tales fit for enthralling sci-fi enthusiasts only a while back, virtual reality has firmly established itself as a transformational technology for various industries. Healthcare, suddenly the focus area owing to the ongoing COVID-19 pandemic, has been one of the main beneficiaries of VR innovation across multiple areas. So, what can VR do to increase efficiency, accessibility and testing in healthcare? What would the future look like as the technology evolves and offers more novelty? Let's take a look.

The VR Landscape:

The global spending on VR in the healthcare market is projected to reach \$30.40 billion by 2026, exhibiting a CAGR of 42.4% during 2019-2026.

According to another report by Statista, "by 2020, the virtual reality industry will reach revenue of USD 21.5 billion." These reports show that virtual reality in the healthcare industry will be a sizable chunk of the total market.

It has truly not just moved the imagination of science-fiction fans, but also clinical researchers and real-life medical practitioners. This field is relatively new, however as the technology grows and richer VR content is generated, it will see even greater adoption and better results. It is set to have an increasingly positive effect on patients' lives and physicians' work.

The VR that lets you pretend to be a star quarterback or space pirate can also help train young professionals or even provide pain and anxiety relief to patients. The AR that puts Pikachu in your city park can also assist physicians with real-time information to use in diagnosis or even surgery.

THINK PIECE

What makes VR invaluable is the innovative ways in which it addresses some of the problems faced by the healthcare industry. A few among such problems being:

- Ground-level problems, as the situation seems to be in a permanent state of demand greatly exceeding the supply
- Logistical issues with limited access and availability of equipment, which is often outdated, not even nearly as effective as it should be.
- And the permanent problem is with the lack of available personnel in many local institutions. The real situation is that they are often struggling to handle intense workflow not to mention emergencies.



Below are some of the pioneering virtual solutions aimed at changing the face of healthcare:

Medical Training:

Virtual Reality can transport you inside the human body – to access & view areas that otherwise would be impossible to reach. VR technology allows trainees to learn human body structure, create a real-life situation to help them practice and guide professionals to become a successful surgeon. It gives a real control, the trainee can rehearse on it as many times as he/she gets their hands on and of course, it involves less cost as it doesn't require expensive trainers, equipment, etc. trainees can just put on the VR headset and start practicing.

Treatment:

1) Robotic Surgery

Robotic surgery is a recent innovation in which surgery is performed using a robotic device, e.g. robotic arm which is controlled by a human surgeon. This means fewer risks of complications during surgery and a faster procedure. The

THINK PIECE

robotic device is accurate, meaning smaller incisions, reduced blood loss and faster recovery.

2) Patient Education

The ability to view the inside of the human body in Virtual Reality is not only useful for doctors, but also for patients. VR allows patients to be taken through their surgical plan by virtually stepping into a patient-specific 360° VR reconstruction of their anatomy & pathology. The outcome is an enhanced understanding of the treatment and therefore higher patient satisfaction.

3) Battling phobias

This is one of the most inveterate forms of VR therapy to help patients overcome their fears. The therapy is like graded-exposure therapy, where the doctors help their patients to discover their anxiety and slowly allow them to grab control over their anxiety problems one step at a time.

4) Therapy

For people with disabilities or chronic conditions virtual reality in the medical field has also been used to help people with disabilities or with chronic conditions experience things they may not be able to experience otherwise. They have helped paralyzed people learn to walk again and helped terminally ill cancer patients experience their bucket-list wishes. Similarly, the Fove headset has been used to help children with physical disabilities play the piano by tracking eye movement in an app the company created called “Eye Play the Piano”. And these are a few examples of the therapeutic uses that VR technology.

5) Pain Management & Physical Therapy

VR’s healing capabilities aren’t just limited to psychological issues but have been proved to work for pain management & physical treatment too. A study showed that full VR immersion for those undergoing physical therapy after a skin graft acted as a distraction and subsequently reduced pain levels for the patients. VR for physical therapy has also been shown to be effective in speeding up recovery time. Allowing the patient to do their prescribed daily exercises in a virtual environment makes the activity more fun, keeps the patient-focused, and helps them keep their spirits up during what can be a long recovery period.

6) Personal fitness

There are many ways virtual reality is improving healthcare by reaching patients

THINK PIECE

directly. VR personal fitness apps can gamify your workout or transport you to virtual environments to make workouts more fun. There are a wide variety of these programs already available. These programs can improve patients' overall health and prevent future health problems, VR fitness programs can help teach you workouts and give you feedback on your movements, make exercise into a series of games or encourage you to work out even when the weather is bad by providing scenic backgrounds for running on a treadmill or riding a stationary bike. These VR experiences could also play a role in physical therapy.



Future of VR:

Given the evidence for an expanding market and growth in the field of emerging technologies in healthcare, it has been estimated that health care uses of virtual reality will be the second-largest share of the VR market by 2022.

Overall, VR offers revolutionizing ways to advance patient care as well as medical procedures, training and many more opportunities. These virtual environments also help healthcare in achieving targets such as streamlined costs, more efficiency. In times to come, the technology will provide a healing touch to patients while sharpening the skills of medical practitioners, thereby adding value to the entire healthcare ecosystem.

THINK PIECE

PLASMONICS IN BIOMEDICINE

-Mannat Uppal & Mohammed Adhil S, II Year ME (Medical Electronics)

The utilization of plasmonic nanoparticles for biomedical applications has been abundantly researched, providing significant improvement in the development of ultrasensitive bioassays and effective therapy. The unique surface plasmon resonance phenomena of both plasmonic films and nanoparticles with their absorption and scattering abilities have much potential in revolutionizing diagnosis, treatment and evaluation of diseases, in particular cancer.

Bioassays

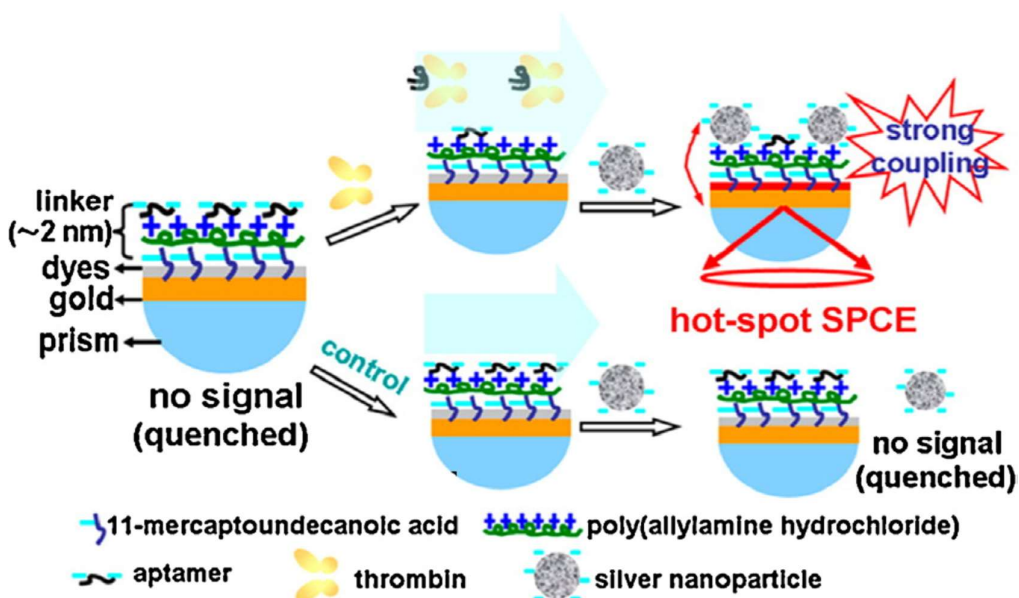
Metal-enhanced fluorescence

Plasmonic enhancement of fluorescence comes due to the coupling of fluorophores to the strongly confined electromagnetic fields of plasmonic nanoparticles or plasmonic metal films. These strongly confined electromagnetic fields are generated as a result of interaction between light and localized surface plasmons of plasmonic nanoparticles or surface plasmon polaritons for films. The plasmonic materials then relay the radiation outward, increasing the radiative scattering efficiency of the fluorophores. More recently, interactions between plasmonic nanoparticles and fluorophores were explained by the radiating plasmon model, whereby the enhanced emissions and decreased lifetimes of the fluorophores are due to the coupling of the fluorophores at their excited states with surface plasmons of the nanoparticles. For the construction of metal-enhanced fluorescence assays, the distance-dependence of metal enhanced fluorescence has been extensively employed. To further improve the sensitivity of metal-enhanced fluorescence, different strategies targeting the individual components of fluorescence assays have been developed.

Bioassays based on distance-dependence of metal-enhanced fluorescence

THINK PIECE

Two different approaches exist for the use of the distance-dependent property of metal-enhanced fluorescence for bioassays, namely the quenching-to-coupling approach and the signal enhancement approach. The quenching-to-coupling approach refers to a ‘molecular beacon-like’ approach whereby a single molecule, usually DNA, conjugated to a fluorophore acts like a molecular beacon, with initial quenching of the fluorophore due to close proximity of the DNA—fluorophore conjugate to the plasmonic nanostructure. Subsequently, the molecule of interest binds, resulting in a change in the configuration of the DNA holding the fluorophore and the increase in distance between the fluorophore and the plasmonic nanostructure, resulting in coupling and hence de-quenching. Some examples include that reported by Peng et al. who demonstrated the use of a DNA hairpin probe conjugated to a fluorophore and bound to silver nanoparticles immobilized on a glass slide. The fluorophore was thus quenched in the absence of the target DNA due to its close proximity to the silver nanoparticles while fluorescence was restored with the hybridization of the target DNA as the hairpin DNA changed its configuration, moving the fluorophore away from the surface of the silver nanoparticles.



THINK PIECE

Schematic representation of the aptamer-based bioassay whereby strong plasmonic coupling occurs between the silver nanoparticles and the gold film, inducing high fluorescence emission.

Improving sensitivity via other components of fluorescent bioassays

Other than the distance-dependence of metal-enhanced fluorescence for sensitivity improvement, strategies targeting the fluorophore, bio affinitive agents, the antibody surface as well as the type of plasmonic film have been explored. Deng et al. proposed the use of lanthanide fluorophores like europium with long fluorescence lifetimes such that a high background rejection can be achieved. By adding a europium chelate into a silver/silica core—shell nano composite, a maximum fluorescence enhancement of 9.5-fold was obtained. Despite a decrease in fluorescence lifetime accompanying the increase in fluorescence enhancement of the core/shell nanocomposite, the fluorescence lifetime of the europium chelate doped nano composite was still found to be much longer than that of cellular auto-fluorescence, thus allowing for the use of such lanthanide-doped plasmonic nano composites for cellular applications. In addition, at high intensities of excitation light, fluorescence enhancement factors significantly increased up to 146 folds for the europium chelate doped nano composite due to the fluorescence saturation in control samples while no fluorescence saturation was observed with the europium chelate doped nanocomposite.

Surface plasmon resonance and localized surface plasmon resonance assays

Surface plasmons refer to the coherent oscillations of conduction electrons on a metal surface when excited by electromagnetic radiation at the interface between a metal and a dielectric. Two surface plasmon modes are usually employed: propagating surface plasmon resonance (PSPR) at flat smooth metal—dielectric interfaces and localised surface plasmon resonance (LSPR) when surface plasmons are confined on either periodic, colloidal or other nano-systems. PSPR-based bioassays work by coupling a metallic thin film to a prism or a

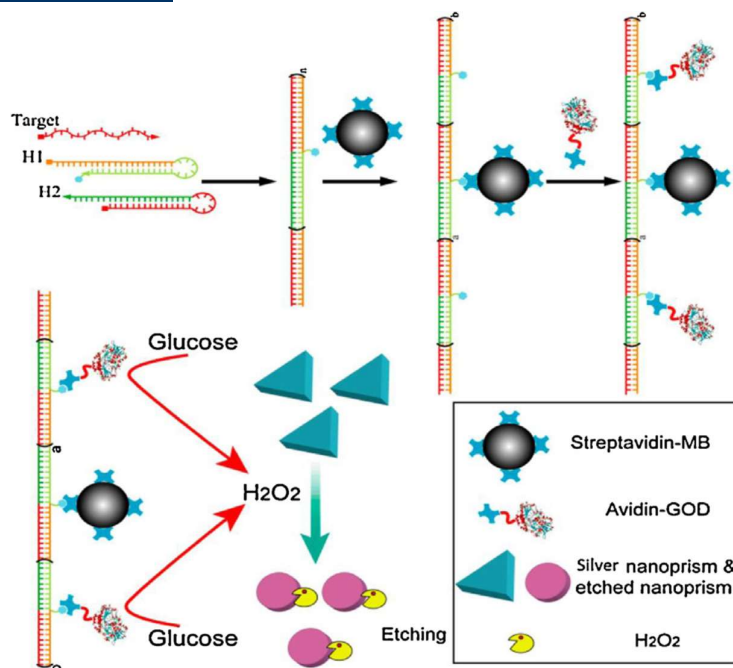
THINK PIECE

grating

PSPR-based bioassays

To improve the sensitivity of PSPR-based bioassays, the sensing of the unique properties of the PSPR film other than the PSPR shift and the coupling of other plasmonic nanostructures to modify the field have been investigated like the work done by Yu and colleagues. They studied the sensitivity of both the extraordinary emission and the surface plasmon resonance of corrugated gold films fabricated by nano imprint lithography to refractive index changes. Two surface plasmon resonance bands were observed for the corrugated gold films: one between the gold film and the polycarbonate film that the gold was deposited on and the second between the gold film and the superstrate applied on it. The intensity of the extra ordinary transmission was found to be dependent on the refractive index of the superstrate applied on the corrugated gold film, with a greater intensity observed as the refractive indexes of the polycarbonate film and the superstrate got closer to each other. The change in intensity of the extraordinary was found to have a sensitivity of up to 8.96a.u./RIU, while the sensitivity of the red shift in the surface transmission plasmon band for the plasmon mode between the gold film and the superstrate was found to have a sensitivity of up to 812nm/RIU. The latter was used for the quantification of cysteine.

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Schematic illustration of the construction of an etching assay for the detection of target DNA.

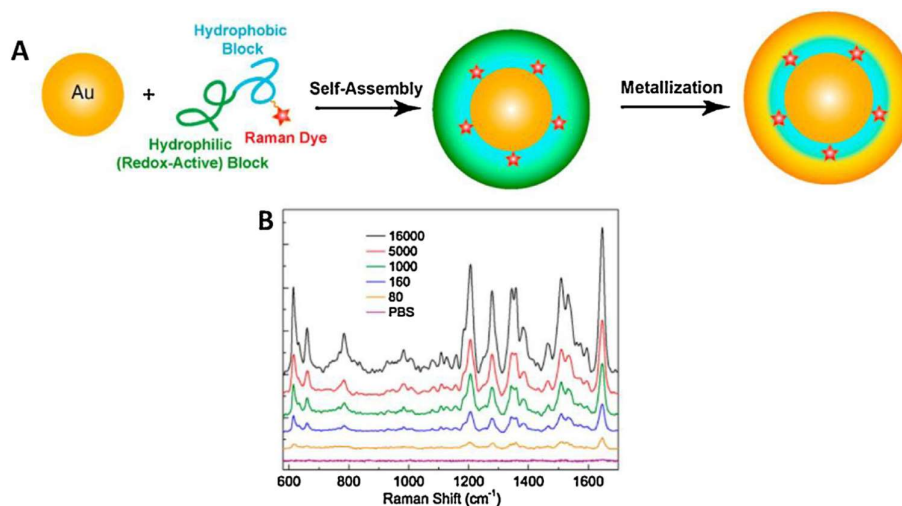
Surface enhanced Raman scattering (SERS)

Raman scattering refers to the scattering of photons that are higher or lower in frequency as compared to the incident photon that strikes an analyte due to the vibrations and rotations of an analyte. A Raman spectrum is unique to the analyte and can be used for its identification, imaging and quantification. However, Raman signals are very weak due to the extremely small scattering cross-sections of Raman active molecules. SERS thus enhances the sensitivity of Raman bioassays for qualitative and quantitative detection of bioanalyses. Two mechanisms for the surface enhancement of Raman scattering by plasmonic nanostructures have been proposed, with the electromagnetic enhancement being more widely accepted as the one with the greater effect.

Electromagnetic enhancement occurs due to LSPR of the nanoparticles concentrating the incident light, creating an intense local electromagnetic field. SERS signals are further increased when “hotspots” are formed, due to LSPR

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coupling of multiple nanoparticles. SERS can be performed with or without Raman labels, with the latter enhancing the intrinsic Raman signal of an analyte.



(A) Schematic illustration of the core—shell gold nanoparticle with the nanogap and (B) enhancement in Raman signals for the detection of MCF-7 breast cancer cells.

Therapeutic application

Many therapeutic applications of plasmonic nanoparticles have been proposed such as photothermal therapy, photodynamic therapy, drug delivery, diagnosis and even alter gene expression.

Improving the photothermal conversion efficiency

Two main strategies have been proposed in improving the photothermal conversion efficiency of gold nanostructures: the generation of new nanostructure and the coupling to improve photothermal conversion efficiency. New nanostructures have been fabricated using unique synthetic methods to improve their photothermal conversion efficiency. Studies have shown that gold nanorods of an appropriate dimension (28nm×8 nm) are most effective for plasmonic photothermal therapy amongst individual gold nanoparticles such as

nanospheres, nanoshells and nanorods. Huang et al. Further demonstrated that hierarchically assembled of gold nanoparticles allow LSPR to be fine tuned in the near-infrared (NIR) region for enhanced photothermal conversion efficiency. As

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shown in Fig. 11, bio degradable poly(ethylene glycol)-b-poly(-caprolactone) coated gold nanoparticles are capable of forming nanovesicles(BGV) of densely packed gold nano particles which induce strong plasmonic coupling between adjacent gold nanoparticles, thus displaying a photothermal conversion efficiency of 37%. Nonetheless, plasmonic nanostructures with photothermal therapeutic applications have one property in common: they have high near-infrared absorption. This is because human tissues absorb strongly in the visible region but not in the near-infrared region. Having high near-infrared absorption ensures that the plasmonic nano structures, when injected into the body for treatment, are able to exert their photothermal effect as near-infrared laser radiation can reach the site where the plasmonic nanostructures are, with minimal loss of radiation due to tissue absorption. This was demonstrated by Ye et al. and Huang et al.. The former employed gold nano crosses which were synthesized by growing along both the $_{110}$ and $_{001}$ planes. This was done by breaking the face-centered-cubic symmetry of gold nanoparticles through copper-induced formation of single and double twins. The gold nano crosses exhibited significant near-and mid-IRLSPR, and theoretical simulations revealed that the entire nano cross is excited as long as one of the branches is exposed to incident light, making the nano crosses ideal for photo thermal therapy. The near-IR absorption of the gold nano crosses led to the efficient photo thermal death of cancer cells. Using two-photon fluorescence, the photothermal process was also studied, where by at 30s with a laser power of $4.2\text{W}/\text{cm}^2$, the cell membranes of the cancer cells treated with the gold nano crosses shrank substantially, eventually collapsed with the gold nano crosses forming agglomerates. Huang et al. reported the synthesis of a unique gold bell flowers using a liquid-liquid-gastriphase system for photoacoustic imaging-guided photo thermal therapy. The photothermal conversion efficiency of 74% was much higher for the gold bell flowers than those of other gold nanostructures due to the multi-branched petals which

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enhanced the local electromagnetic field and the long narrow gaps between the petals that facilitated plasmonic coupling. The photoacoustic signal intensity was also stronger for the gold bellflowers than that of gold nano rods or gold nano stars due to the higher photothermal conversion efficiency of the gold bell flowers and the bell-shaped nano structure that can amplify photoacoustic signals. Photodynamic therapy of cancer cells can be performed without photosensitizers as shown by Kumar et al. with gold core-petal nanoparticles, which were generated through the Au(III)-induced oxidation of the catechol groups on polydopamine which was homogeneously assembled on the surface of gold nanoparticles. Partial removal of the polydopamine layer on the gold nanoparticles causes preferential growth along the petal nanostructures. Such core-petal nanoparticles were found to have both photothermal effects, as shown from its high photothermal conversion efficiency of 32%, and high photodynamic effect, as shown from the large generation of singlet oxygen as compared to gold nanoparticles. This indicated that the petal length and density is essential for singlet oxygen production. An increase in the number of protruding petals was found to decrease cell viability as shown by nanoparticles with the greatest number of and longest petals, which killed nearly all cells despite an increase in temperature only until 42 °C. The percentage contribution of reactive oxygen species in causing cell death was found to be 88% as measured by the addition of ascorbic acid, an antioxidant, while the remaining 12% was due to photothermal effects. The rapid progress of therapeutic applications of plasmonic nanoparticles has offered ample opportunities in biomedicine.

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EPISODIC RECALL IN HUMANS

-Elakiya Sivakumar (IV year)

*From her blog "the pneuma in Machine" The link to the Blog:
<http://thepneumainmachine.in/>

How does the Brain work? There are 10 billion neurons in the brain. It can be roughly assumed that every action (voluntary or involuntary) and thought (even the ones you are not “thinking” about) have a different combination of these many, many neurons firing together.

However, to make things infinitely easier, there is a rough division of labour (and their structure) within the many neurons of the brain. And hence there is clear sectioning of the region as well.

Roughly, each brain region has a different function. However, spatial navigation, episodic memory, consciousness are complex that they require different brain regions to work together.

This leads to *circuitry* within the brain. This roughly a pathway that is required to reach a particular goal. For example, let’s consider solving math problems. The first time you ever do differentiation a pathway (circuitry) is established.

The more differentiation you do, the better/faster this connection gets.

In general, neuroscientists have a saying, “neurons that fire together, tend to fire together.”

The interesting part is: when you do, say integration, half of the neurons involved in differentiation might also fire! So there is insane plasticity.

EPISODIC MEMORY: There are many different types of memories: short term-, medium term- and long term- memory (based on the life of the memory); there is also working memory, operational memory. These are associated with the skills you learn. The focus of my research episodic memory. Unlike the other types of memory where *learning* is involved, episodic memory is more about *encoding*.

This means that the brain doesn’t have a second chance to look at the same exact

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information/cues to occur. It is solely based on one-time experience. However, it is extremely powerful.

The stability of such powerful encoding arises from a number of factors: location (spatial navigation, hippocampus), emotion (frontal cortex), and time sequences (medial lobes where time cells are present) Thus, we can see that encoding of memory is a composite process involving different brain regions.

Taking an example, consider eating candy for the first time- you remember where it happened, the face of your parents, the colour of the candy- all encoded by the hippocampus; you remember feeling happy – the emotional cortex; you might even remember the taste!

The memory is distributed throughout different regions in the brain, but what is it united by? The deep brain waves- theta and gamma! These waves produce a synchronization effect that causes all the neurons to work together.

So during one particular time instant- a time cell fires and a bunch of neurons across different regions fire and an episodic memory is encoded. During the recollection process, the same set of neurons fire- the wave is recreated!

The phase relationship between Hippocampal Place Units and the EEG Theta Rhythm

BACKGROUND:

Hippocampus has special cells called “place cells” which fire during human’s navigation within any environment. It’s like a GPS system within the brain.

The place cells fire together in a complex manner: different combinations of place cells form different locations within the brain.

When the place cells fire, they form “spike patterns” which has shown to be coinciding with the peak of theta wave obtained from deep brain.

RESULTS

The spatial cells fire in bursts- this is associated a peak phase of the theta wave (deep brain wave).

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Human Hippocampal Theta Oscillations and the Formation of Episodic Memories

BACKGROUND:

Hippocampal theta is associated with synaptic plasticity, information coding, and memory function in several species.

In rodents 4-6Hz theta waves are observed during encoding and retrieval processes.

In this paper, power spectra analysis of the intracranially recorded EEG signals is performed.

The hypothesis is that there is an increase in power of the theta waves during successful memory encoding as well as retrieval.

WHY DOES THE THETA POWER INCREASE?

The synchronization between different regions of the brain increases during a successful episodic recall. This synchronization causes increase in the oscillatory activity of the brain which in turn causes an increase in the theta power. The exact generation of the theta waves is roughly because of the neuronal activity in the deep brain structures. However, the exact dynamics are still a mystery.

RESULTS

- The theta band in humans was found to be between 4-8Hz.
- The neural oscillatory studies showed an increase the power spectra analysis.
- The phase was also found to be associated with the spiking bursts of the neurons.

IMPLICATIONS ON AI

- Episodic recall in human beings is the basis for autonomous systems.
- Pattern recognition and synchronous systems also benefit from the data of episodic recall.
- Learning/teachable AI

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