Photo: Sasank Gurajapu

## IIT Guwahati researchers discover new ways to prevent memory loss due to Alzheimer's disease

Researchers at Indian Institute of Technology Guwahati has worked on out-of-the-box ideas that can help prevent or reduce short-term memory losses associated with Alzheimer's disease.

The research team headed by Prof.Vibin Ramakrishnan, Professor, Department of Biosciences & Bioengineering, IIT Guwahati, and Prof. Harshal Nemade, Professor, Department of Electronics and Electrical Engineering, IIT Guwahati, studies the neurochemical principles of Alzheimer's, and explore new ways to prevent accumulation of neurotoxic molecules in the brain, that are associated with short-term memory loss due to Alzheimer's disease.

The IIT Guwahati team reports interesting methods such as application of low-voltage electric field, and the use of 'trojan peptides' to arrest aggregation of neurotoxic molecules in the brain. The scientists are assisted by research scholars Dr. Gaurav Pandey and Mr. Jahnu Saikia in their work, and the results of

their studies have been published in reputed journals such as ACS Chemical Neuroscience, RSC Advances of Royal Society of Chemistry, BBA and Neuropeptides.

The development of a cure for Alzheimer's disease is important especially for India, which has the third highest number of Alzheimer's patients in the world, after China and US, with more than four million people falling prey to the memory loss associated with it. While current treatments only alleviate some of the symptoms of the disease, there is no disruptive therapeutic approach yet that can treat the underlying causes of Alzheimer's.

"Approximately hundred potential drugs for treatment of Alzheimer's disease have failed between 1998 and 2011, which shows the gravity of the problem," says Dr.Ramakrishnan, who participates in worldwide efforts at finding cures for the disease.

A defining hallmark of Alzheimer's is the accumulation of Amyloid beta peptides in the brain. Dr.Ramakrishnan and Dr.Nemade seek methods to reduce the accumulation of these peptides, in order to arrest the progression of Alzeimer's.

In 2019, the IIT Guwahati scientists found that application of a low-voltage, safe electrical field can reduce the formation and accumulation of toxic neurodegenerative molecules that cause short-term memory loss in Alzheimer's disease. They found that external electric/magnetic field modulates the structure of these peptide molecules, thereby preventing aggregation.

"Upon exposure to electric field, we could retard the degeneration of nerve cells to an extent of 17 – 35 %. Objectively, this would translate to about 10 years delay in the onset of the disease", says Dr.Ramakrishnan.

Working further in this area, the scientists explored the possibility of using 'Trojan peptides' to arrest aggregation of these neurotoxic molecules. The idea of using 'Trojan peptide' comes from mythological "Trojan Horse" used as subterfuge by the Greeks in the battle of Troy. The researchers have designed Trojan peptides by adopting a similar approach of 'deceit' to impede the aggregation of the amyloid peptide, arrest the formation of toxic fibrillar assemblies, and reduce poisoning of nerve cells that leads to memory loss.

"Our research has provided a different path that may extend the onset of the Alzheimer's disease. However, it would take testing in animal modelsand clinical trials before bringing in such new therapeutic approaches into human treatment"says project coordinators, Dr. Ramakrishnan and Dr. Nemade.

## IIT Guwahati Designs Bamboo Hospital Furniture range

**The project is aimed towards strengthening sustainable infrastructure facilities among Primary Health Centres in rural Assam**

Department of Design at Indian Institute of Technology Guwahati completed a project in designing bamboo furniture to meet the requirements of Primary Health Centers (PHC's) for rural villages of Assam.

Bamboo craft forms an important economic driver in the northeast region of India. However, for a craft that is so prevalent in the region, its effective utilisation for public community facilities like health centres in rural areas were limited and this particular project demonstrated the potential.

Considering the present pandemic scenario, where there is an urgency in improving the basic infrastructure facilities in our primary healthcare services, it offers scope for collaborative interaction amongst the various stakeholders for the improvement of health services in particular and the overall development and the wellbeing of the community.

The project aimed for a sustainable and participatory design approach by utilization of locally available materials, craft skill manpower led by active participation of local government departments to achieve these goals.

Speaking about their project, Prof. Ravi Mokashi-Punekar, Department of Design, IIT Guwahati, said,"The current pandemic crisis has brought to the fore, the need for seeking self-reliance of sustainable solutions that are contextually appropriate for meeting the needs of the community."

IIT Guwahati team believes that the designs that they have developed are an appropriate and sustainable solution to meet local infrastructure needs and concurrently creating job opportunities for craft-persons using bamboo and cane available in the region.

Around two hundred beds can be manufactured per day.

Given the current pandemic situation, if the situation arises, the bamboo furniture range will help in meeting the high demand required for patients admitted

for treatment. The team has offered to share the designs with Guwahati Medical Hospital in Guwahati.

The design team is already in touch with two local entrepreneurs who have agreed to undertake the manufacture of a simpler version of the hospital bed.





## IIT Guwahati, in collaboration with Duke-NUS, Singapore, carry out a data-driven state-wise assessment of the COVID-19 situation in India

Researchers from the Indian Institute of Technology Guwahati, India, and the Duke-NUS Medical School, Singapore, have used data science models to analyse and predict the total number of infected people for different States in India in the next 30 days. A report solely based on anyone model can potentially mislead us. In an attempt to guard against this possibility, they have considered the exponential, the logistic, and the Susceptible Infectious Susceptible (SIS)models, along with the model-free daily infection-rate (DIR) using open-source data. They have interpreted the results jointly from all models rather than individually.

The data-driven assessment is carried out by Dr.Palash Ghosh, Assistant Professor, Department of Mathematics, IIT Guwahati, and his Ph.D. scholar, Mr. Rik Ghosh, in collaboration with Dr.Bibhas Chakraborty, Associate Professor, Duke-NUS Medical School, Singapore.Their report is based on the growth of active cases in recent times, along with the daily infection-rate (DIR) values for each State. They label a State as severeif a non-decreasing trend in DIR values is observed over the last two weeks along with a near exponential growth in active infected cases; as moderate if almost decreasing trend in DIR values is observed over the last two weeks along with neither increasing nor decreasing growth in active infected cases; and as controlled if a decreasing trend in the last two weeks' DIR values is observed along with a decreasing growth in active infected cases (See Table: restricting to only those States with enough data for prediction).

In their analysis, the logistic model under-predicts the next 30-day prediction, whereas the exponential model over-predicts the same, reflecting the worst-case scenario. They argued that, despite the nationwide lockdown, people are still out of home for essential businesses, which can contribute to the spreading of the virus. The maximum value of DIR in the last two weeks can capture how severely the COVID-19 is spreading in recent times. Note that the DIR value of 0.10 cannot be interpreted in a similar way for two different States, say, with 500 and 5000 active cases, respectively.For the first State, we see 500 x 0.10 = 50 new cases and for the second State, we observe 5000 x 0.10 = 500 new cases.

In an attempt to capture these various subtleties in a realistic prediction, they propose a combination of the logistic and the exponential predictions using the maximum value of DIR over the last two weeks as a weighting factor. Given the situation in entire India, they recommend this composite predictionto be used for assessment purposes for each State. States that are in severe category need to do much more in terms of the preventive measures immediately to combat the COVID-19 pandemic.

| State | Observed Cumulative Cases (1 May 2020) | Maximum DIR in the last two weeks | Data-Driven Assessment of COVID-19 situation | 30-day Prediction (31 May 2020) | | |
|---|---|---|---|---|---|---|
| | | | | Logistic | Linear combination of Logistic and Exponential | Exponential (Applicable only if the situation is Severe) |
| Andhra Pradesh | 1463 | 0.17 | Severe | 2313 | 4725 | 16502 |
| Delhi | 3515 | 0.17 | Severe | 4262 | 9650 | 35957 |
| Gujarat | 4395 | 0.27 | Severe | 5206 | 33736 | 110874 |
| Haryana | 313 | 0.18 | Controlled | 321 | 590 | 1815 |
| Jammu and Kashmir | 614 | 0.09 | Controlled | 724 | 1124 | 5170 |
| Karnataka | 576 | 0.06 | Controlled | 3711 | 3711 | 3713 |
| Kerala | 497 | 0.18 | Controlled | 455 | 740 | 2040 |
| Madhya Pradesh | 2719 | 0.10 | Severe | 3030 | 6521 | 37935 |
| Maharashtra | 10498 | 0.15 | Severe | 17115 | 43963 | 196103 |
| Punjab | 357 | 0.14 | Moderate | 419 | 713 | 2517 |
| Rajasthan | 2584 | 0.12 | Moderate | 2821 | 6125 | 30356 |
| Tamil Nadu | 2323 | 0.12 | Moderate | 2241 | 3967 | 16624 |
| Telangana | 1039 | 0.09 | Controlled | 1063 | 1631 | 7373 |
| Uttar Pradesh | 2281 | 0.13 | Severe | 3016 | 6566 | 30326 |
| West Bengal | 795 | 0.17 | Severe | 1261 | 3225 | 12815 |

Speaking about the data-driven State-wise assessment of the COVID-19 situation in India, Dr.Palash Ghosh, Assistant Professor, Department of Mathematics, IIT Guwahati, said, "India is a vast country with a geographic area of 3,287,240 square kilometres, and a total population of about 1.3 billion. Most of the Indian States are quite large in geographic area and population. While analyzing the novel coronavirus infectiondata, considering our entire country to be on the same page may not reveal the right picture. This is so because the first infection, new infection-rate, progression over time, and preventive measures taken by various State governments and the common public for each State are different. We need to address each State separately. It will enable the government(s) to utilize the limited available resources optimally."

Prof. T. G. Sitharam, Director, IIT Guwahati, believes that a joint interpretation from several data science models is essential to have a better perspective about the current situation and the future prediction to control this pandemic. The idea of State-wise analysis is a vital step for better management of the COVID-19 condition in India.

## IIT Guwahati's initiative, 'Scientists Beyond Borders', develops low-cost UVC light-based disinfectant box

Indian Institute of Technology Guwahati research team has developed a low-cost UVC light-baseddisinfectant box for disinfecting disposable medical accessories like gloves, masks etc. along with disinfecting the household wastes before going to the commuity bins.The innovation is uniquely designed to sanitise floors and prevent direct exposure to individuals.

IIT Guwahati faculty members, Dr. Harsh Chaturvedi, Assistant Professor, Centre for Energy, and Dr.CharuMonga, Assistant Professor, Department of Design, along with ShashaankaAshili, Director, SmartDrivInc (US), has formed the group, 'Scientists Beyond Borders'. The group comprises of entrepreneurs, engineers, scientists, researchers, and faculties from across the globe - India, Australia, UK, France, and the USA, is working on addressing the ongoing pandemic. It is collecting, analysing, disseminating data and awareness, based on this pandemic, globally.

Under this group, IIT Guwahati is leading the following projects:

1. Development of low-cost UVC light-based disinfectant box
2. Development of masks and sanitisers
3. Curation and generation of scientific content
4. Translation of scientific content in different languages (Assamese, Manipuri, Hindi, Gujarati, Marathi, Bengali, etc)

### Low-cost UVC light-based disinfectant box

IIT Guwahati team has also developed a low-cost UVC light-based smart portable appliances to disinfect disposable medical accessories along with sanitisation of rooms, and floors. The UVC light-based box is uniquely designed to be used at hospitals and public spaces for disinfecting used masks, gloves etc.

The innovation is developed by Dr. Harsh Chaturvedi and Ms. Priyadevi, a PhD student. UVC boxhas been donated to the government office in Manipur. The team is working withPropelisgroup, Pune, for commercial manufacturing of UVC based disinfectant system.

Speaking about the developments, Dr. Harsh Chaturvedi said,"Along with the necessary precautions to avoid direct exposure, UV based systems offer fast and convenient low-cost disinfecting solution for efficient sanitisation of public spaces, hospitals and household goods and disposable wastes.

The cost of the innovation is approximately Rs. 2,000.

Speaking about the commercialisation of the technology, Mr. AshutoshMuglikar, Director of Propelis, said,"We are very satisfied with the range of UV based sanitisation products developed by IIT Guwahati and are working on commercialising the technology. Since all the products are designed and made in India using available technology and components, there are very few hindrances in the commercialisation of these much-needed products."

### Development of masks

Dr. Charu Monga, Assistant Professor, Department of Design, IIT Guwahati, has designed the low-cost reusable mask which can be used multiple times with changeable filters. Dr. Charu Mongahas designed this along with the scientific team of Dr. Harsh Chaturvedi and sample manufacturing by Global Plastics, Delhi.

Speaking about her work, she said,"We are in the process to produce low-cost, mask with a swappable filter which will be beneficial for ground-level people and staff. It can be used just by replacing the filter multiple times."

The cost of the mask is approximately Rs. 40.

Sanitisers were also developed by IIT Guwahati students and alumni from Manipur.

Furthermore, relevant information, news/research articles and scientific data from authorised sources are translated and represented in graphical illustration with the help of experts of 'Scientists Beyond Borders' in simpler sentences for the common people to understand and communicated through different social networks - Twitter, Instagram, and Facebook. Circulated information is also translated into different languages of India - Assamese, Manipuri, Hindi, Gujarati, Marathi, Bengali, etc.
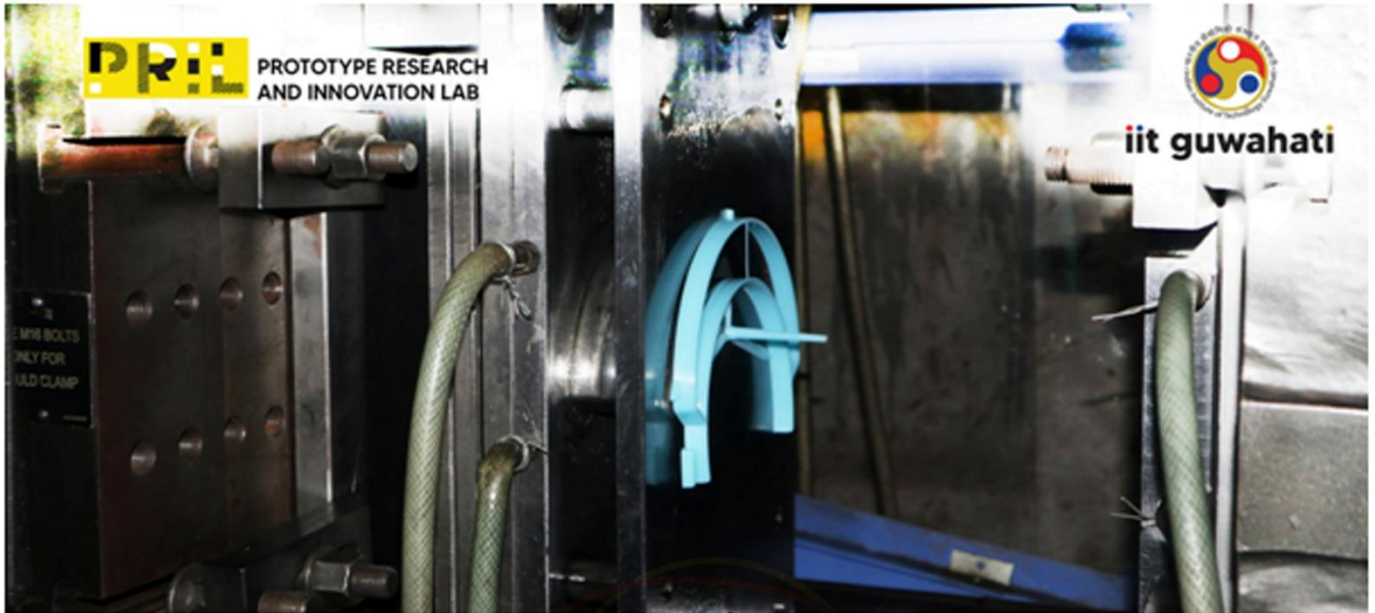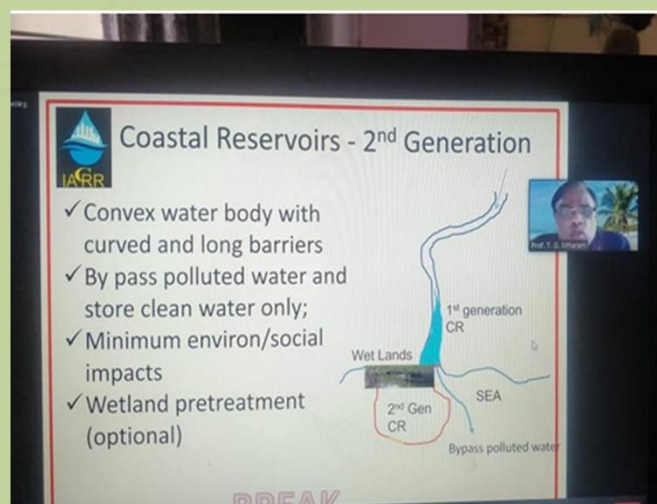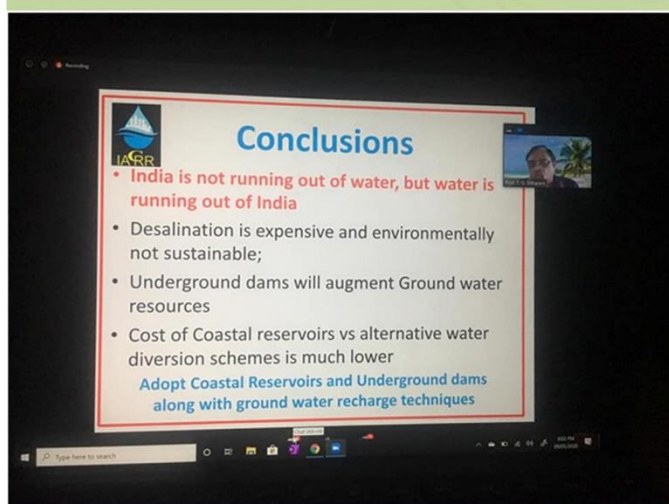
Injection Molding of Face Shield at IIT Guwahati - Dr. Supradip Das-1



Disinfectant Tunnel devloped by Vixudha Bio Product Pvt Ltd. & Oasis Fabrications - Dr. Mihir Kumar Purkait
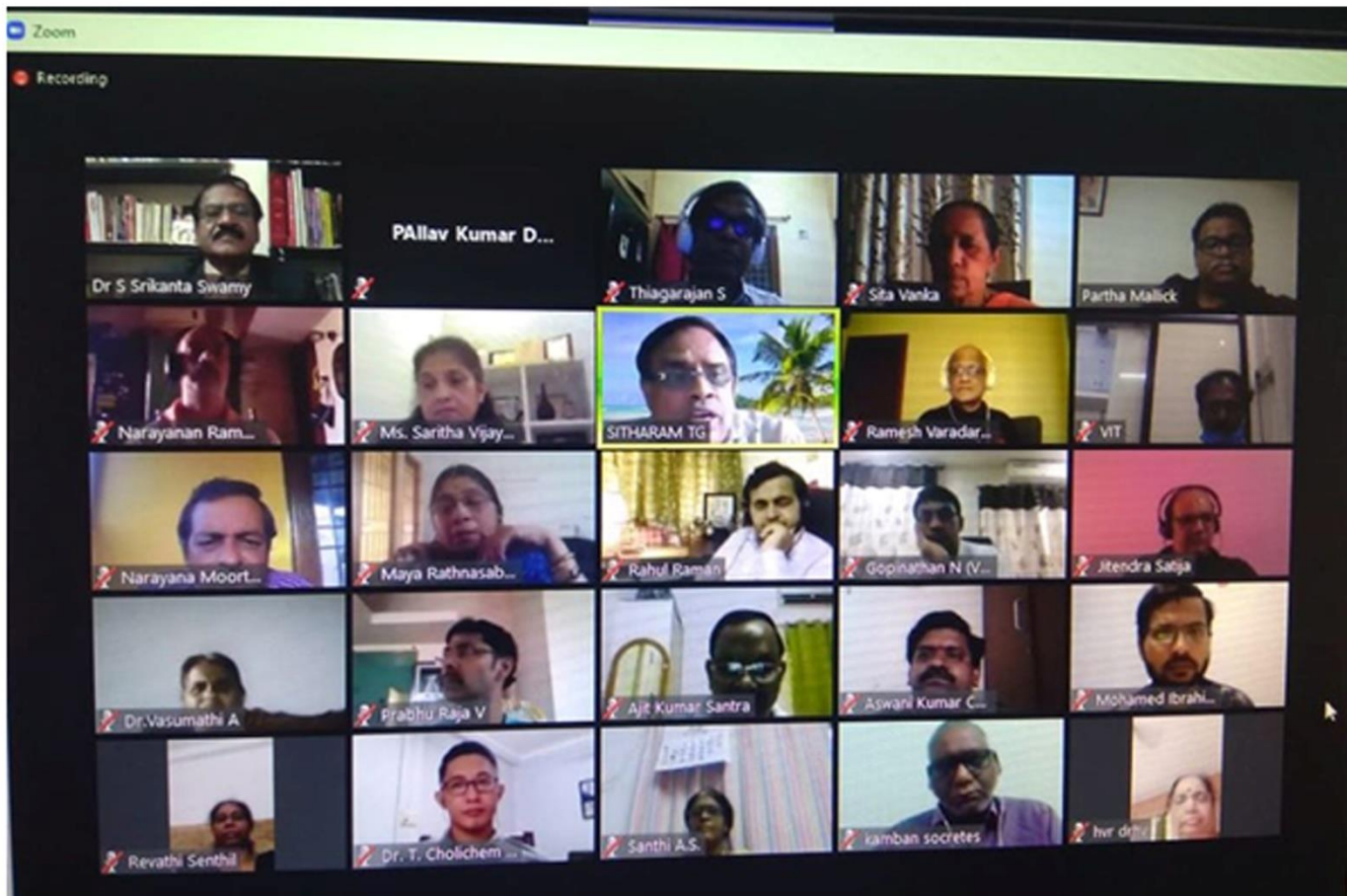
Prof. T G Sitharam, Director IITGuwahati delivered a talk through Virtual Seminar on "Quality Assurance in Online Teaching-Learning & Evaluation" today, May 19, 2020.



**Conclusions**
- India is not running out of water, but water is running out of India
- Desalination is expensive and environmentally not sustainable;
- Underground dams will augment Ground water resources
- Cost of Coastal reservoirs vs alternative water diversion schemes is much lower
  Adopt Coastal Reservoirs and Underground dams along with ground water recharge techniques

**Coastal Reservoirs - 2nd Generation**
- ✓ Convex water body with curved and long barriers
- ✓ By pass polluted water and store clean water only;
- ✓ Minimum environ/social impacts
- ✓ Wetland pretreatment (optional)

Webinar on Water scarcity to Security – Technology, innovation and ideas by Prof T. G. Sitharam Director, IIT Guwahati and President IACRR held on May 9, 2020 organized by IIT Alumni Centre, Bengaluru