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NAM S&T Newsletter

A Quarterly of the
Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)

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FROM THE DG'S DESK

Greetings and best wishes to all our Esteemed Readers!

The NAM S&T Centre's key activities during the third quarter of the year have been marked by significant progress in promoting scientific collaboration, knowledge exchange and sustainable development amongst Members of the NAM S&T Centre, Members of the NAM S&T – Industry Network and other developing countries.

The major highlights of this quarter were two important international events. The first was the International Workshop on "**Energy Efficiency, Conservation and Transition for Achieving Net Zero and Sustainable Development Goals**", jointly organized by the Energy Management Centre, Kerala and NAM S&T Centre during 9–10 September 2025 in Thiruvananthapuram, India. The second event was the International Training Workshop on "**STI Policy: Artificial Intelligence for Climate Learning Futures**", organized from 22–25 September 2025 in Malang, Indonesia jointly by ISTIC (UNESCO), Kuala Lumpur, Malaysia; Universitas Negeri Malang, Indonesia; and the NAM S&T Centre. Both the events provided valuable platforms for relevant stakeholders to exchange ideas and share best practices in advancing sustainable development and inclusive growth.

On the publication front, the NAM S&T Centre, in collaboration with the Centre for Sustainable Ocean Policy (CSOP), Universitas Indonesia; and the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC), Jakarta, Indonesia released a new **Fact File** titled "**Marine Pollution**", the ninth in its series. This publication aims to raise awareness about the pressing issues of marine pollution and its far-reaching impacts on ecosystems and human livelihoods.

The Centre's latest publication titled "**Combating Plastic Pollution in Terrestrial Environment — Challenges and Strategies for a Sustainable Future**", was launched on August 1, 2025 at the JSS Academy of Higher Education & Research (JSS AHER), Mysuru, India.

Additionally, I am pleased to report the successful completion of the Joint NAM S&T Centre – JSS AHER, Mysuru, India Fellowship by three researchers – from Mauritius, Malaysia and Indonesia, reflecting the Centre's continued commitment to fostering international scientific cooperation and capacity building among developing countries.

Looking ahead, the Centre is delighted to announce an **International Workshop** on "**Circular Economy in Leather and Leather Product Industries**," that would be jointly organized by the NAM S&T Centre, and CSIR-Central Leather Research Institute (CLRI), Chennai, India during **29–30 January 2026 in Chennai**. The **Leather and Shoe Research Institute (LSI), Hanoi, Vietnam** will participate as a Scientific Partner, bringing its extensive expertise in sustainable leather processing and footwear manufacturing to support the goals of the Workshop. In addition, the Centre is also organizing an International Workshop on "Clean Water and Sanitation in the Developing World: Perspectives, Best Practices and Future Challenges" during November 20-21, 2025 in Virtual Mode in collaboration with the Indian Ocean Rim Association (IORA) Secretariat, Mauritius.

The NAM S&T Centre remains steadfast in its commitment to enhancing scientific collaboration, promoting capacity building, and empowering researchers across developing countries. We extend our sincere gratitude to our Member Countries, Network Members, industrial partners and readers for their continued support and collaboration.

Happy Reading!

(Amitava Bandopadhyay)
Director General

International Workshop on

Energy Efficiency, Conservation and Transition for Achieving Net Zero and Sustainable Development Goals

Thiruvananthapuram, Kerala, 9-10 September 2025

Energy efficiency, conservation and the transition to sustainable energy systems are critical for achieving Net Zero emissions and realizing the Sustainable Development Goals (SDGs) outlined by the United Nations. As the world confronts the dual challenges of climate change and increasing energy demand, it is imperative to develop energy systems that reduce greenhouse gas emissions while ensuring economic growth, energy security, and environmental protection. Improving energy efficiency and adopting conservation practices offer some of the most immediate and cost-effective strategies to lower carbon footprints and enhance access to affordable energy, especially in developing nations where energy

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Centre Organised

International Training Workshop on

STI Policy: Artificial Intelligence for Climate Learning Futures

Malang, Indonesia, 22-25 September 2025

The escalating impacts of climate change are no longer a distant threat but a pressing reality - from intensifying floods to prolonged droughts. The urgency for informed and anticipatory action has never been greater. At the core of such action lies *Climate Literacy* - the ability to understand, critically assess and respond to climate-related information.

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demand is rapidly rising. According to the International Energy Agency (IEA), energy efficiency improvements are one of the most immediate and cost-effective measures for reducing global carbon emissions. With the urgency to combat climate change, achieving energy efficiency and conservation – a sustainable energy transition has become a global priority. Developing countries face distinct challenges as they work to implement energy transitions while ensuring economic stability and growth. With limited access to modern technologies, financial constraints and the need to balance social and environmental goals, these nations require tailored solutions.

In order to deliberate on the above issues, the Centre for Science & Technology of the Non-Aligned and Other Developing Countries (**NAM S&T Centre**), New Delhi, India, in collaboration with the Energy Management Centre (**EMC**), Kerala, India [the State Designated Agency to enforce the Energy Conservation Act 2001, Department of Power, Government of Kerala] – organized an International Workshop on "**Energy Efficiency, Conservation and Transition for Achieving Net Zero and Sustainable Development Goals**" in Thiruvananthapuram, Kerala, during 9-10 September 2025.

The Workshop provided a collaborative platform for knowledge exchange and capacity building among policymakers, researchers, energy practitioners and other stakeholders. It also focused on practical approaches and innovative solutions to accelerate energy efficiency and sustainable energy transitions in line with Net Zero targets and SDGs.

The International Workshop was organized over **2 days** which included **4 Technical Sessions** consisting of 17 **Paper Presentations**, **4 Knowledge Partner Sessions**; **a Panel Discussion**, **a Valedictory Session** and networking opportunities, encouraging dialogue on policy interventions, technological innovations, financing models – all designed to foster cross-sector collaboration and exchange of knowledge and expertise. Altogether **around 40 delegates** including government officials, energy experts, researchers and representatives from international organizations and academic institutions participated in this Workshop, reflecting a diverse and international engagement in the critical discussion on energy efficiency, conservation and transition. Participants hailed from **10 countries** – **Egypt, Kenya, Malaysia, Mauritius, Myanmar, Nepal, UK, Zambia and Zimbabwe**, and the host country, **India**, providing a rich diversity of perspectives on the challenges and opportunities in advancing energy efficiency and sustainable energy systems globally, especially in the developing world.

The **Inaugural Session** set the tone for the Workshop with **Welcome Remarks** by **Shri Puneet Kumar, IAS**, Additional Chief Secretary, Department of Power, Government of Kerala, who delivered his address virtually. In his address, he stated that Kerala has been recognized by the Bureau of Energy Efficiency (BEE), Government of India as one of the best-performing states in the country in terms of energy efficiency, transition and conservation. Shri Puneet Kumar also reiterated Kerala's vision to become a 100% renewable energy state by 2040 and achieve carbon neutrality well ahead of the national timeline.

Following this, the **Presidential Address** was delivered by **Shri Kadakampally Surendran**, Former Minister of Power and presently MLA, Kazhakkoottam, Kerala. He acknowledged the complexity of the energy transition challenge, particularly for developing nations, and emphasized that such knowledge-sharing forums are crucial for building actionable solutions. He reaffirmed Kerala's strong partnership with the NAM S&T Centre and emphasized that Kerala stands firm in its commitment to collective action and South-South cooperation for sustainability.

The **Opening Remarks** were delivered by **Dr. Amitava Bandopadhyay**, Director General of the NAM S&T Centre, who expressed sincere appreciation to the Government of Kerala and EMC for co-hosting this international event. Dr. Bandopadhyay underscored the relevance of this workshop in building equitable partnerships, promoting policy dialogue, and encouraging technical cooperation under both South-South and North-South collaboration models.

Dr. K. Ravi Raman, Member of the Kerala State Planning Board, offered insightful **Special Remarks** by placing the discussion in the context of Kerala's broader development strategy. He emphasized that addressing energy challenges is not only about technical solutions, but also about tackling deep political and institutional questions.

The **Felicitation Ceremony** began with **Shri G. Vinod**, Chief Electrical Inspector to the Government of Kerala, India who highlighted the growing importance of energy efficiency amid urbanization and rapid technological advancement, including AI and smart devices.

The **Inaugural Address** was delivered by **Shri K. Krishnankutty**, Hon'ble Minister for Electricity, Government of Kerala, who ***officially inaugurated the Workshop***. In his speech, he highlighted that Kerala is on track to meet its renewable energy goals by 2040 and carbon neutrality targets by 2050. He expressed optimism that the workshop would provide a valuable platform for mutual learning and the exchange of best practices among developing countries, particularly within the NAM framework.

Four Technical Sessions were chaired by **Dr. R. Harikumar,** Director, Energy Management Centre Kerala, India; **Prof. Mohammad Khalil Elahee**, Chair Professor in Energy Management, University of Mauritius, Mauritius; **Prof. Ir. Ts. Dr. Muhammad Mokhzaini Azizan**, Deputy Director, Universiti Sains Islam Malaysia (USIM), Malaysia and **Mr. Dinesh Kumar A. N.**, Joint Director, Energy Management Centre Kerala, India.

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The four **Knowledge Partner Sessions** were made by **Mr. Soumya Garnik**, country head, Global Green Growth Institute (GGGI), India on "***Policy Recommendations for promotion of Low Carbon Building Transition in India***"; **Mr. Mohit Verma**, Director, and **Ms. Sanyukta Pande**, Associate Director at PwC India, presented on "***Building Sector Energy Modelling to Inform Low Carbon Transitions***"; **Dr. Sunita Purushottam**, Country Head of GBPN India presented a paper on **"***GBPN's Bottom-Up Approach to Decarbonising the Building Sector in India***"**; and **Prof. E. Somanathan**, Head CECFEE and Professor at the Economics and Planning Unit of the Indian Statistical Institute, New Delhi, India delivered lecture on "***Learnings from the Anganjyothi program: Assessing the Impact of Induction Stove Adoption on LPG Usage and Electricity Consumption in Anganwadis***", respectively.

Dr. Ahmad Hamza, General Secretary of the Electricity and Energy Research Council, ASRT from Egypt, presented a paper titled ***"An Overview of the Egypt Energy Efficiency Strategy within the Egypt-Integrated Sustainable Energy Strategy 2040".***

Eng. Kimari Maina Patrick, Director, Dedan Kimathi University of Technology, Kenya made a presentation on ***"Techno-Economic Assessment of Energy Efficiency Improvement in the Tea Sector".***

Prof. Ir. Ts. Dr. Muhammad Mokhzaini Azizan, Deputy Director of the Research and Innovation Management Centre at Universiti Sains Islam Malaysia (USIM), Malaysia delivered a presentation titled "***Aligning Consumer Behaviour with Malaysia's NETR Goals: The Role of Time-of-Use Electricity Tariffs in Driving Sustainable Energy Use***".

Dr. Thiri Shwe Yi Win, Deputy Director, Department of Research and Innovation, Myanmar delivered a lecture on "***Driving Myanmar's Renewable Energy Transition: The Integrative Role of DRI in Research, Training, Capacity Building, and Policy Formulation***".

There were two presentations from Mauritius: **Prof. Mohammad Khalil Elahee**, Chair of Professor in Energy Management at The University of Mauritius, Mauritius gave his presentation on "***Sustainable Energy Management: How Mauritius Can Meet Its SDG and NDC 3.0 Targets?***"; and **Mr. Shravan Kumar Koobarawa**, Associate Lecturer at the University of Technology, Mauritius, delivered a detailed presentation on "***Mauritius Country Status Report: Energy Efficiency, Conservation and Transition for Achieving Net Zero and Sustainable Development Goals***".

Mr. David Nicol, Innovation Manager, WMG Catapult from UK delivered a lecture on "***Efficiency and Inclusive Innovation for Sustainable Development***". He stressed that ***technology without people is like a boat without water—it exists but cannot move forward***.

Mr. Roshan Pandey, Senior Technical Officer from Nepal Academy of Science and Technology (NAST), Nepal presented a paper on "***Electrification and Net-Zero Transition in Nepal: Bridging the Gap between Demand and Generation***".

Mr. Henry Chemba, Graduate Trainee – Research Assistant, National Institute for Scientific and Industrial Research, Zambia made virtual presentation on "***Advancing Energy Efficiency through Localized Lithium-Ion Battery Development for Electric Vehicles in Zambia***".

Mr. Proud Mundenda, Senior Manager for Information Technology, Innovation, Research and Development at the Zimbabwe Electricity Supply Authority (ZESA), Zimbabwe gave a presentation titled "***Digital Transformation in Energy Markets: The Role of IT in Enhancing Electricity and Carbon Trading Efficiency for Net Zero – A ZETDC Case Study***"

There were seven papers presentation from the host country – India by **Mr. Aby Joseph**, Scientist G, power Electronics Group, CDAC, Thiruvananthapuram; **Mr. Murthy D S**, PhD. Scholar at IIT Bombay; **Mr. Rajeev K R**, Energy Technologist, Energy Management Centre (EMC) Kerala; **Mr. Tomson Sebastian**, Energy Technologist, Energy Management Centre (EMC) Kerala; **Mr. Anoop Surendran**, Energy Technologist, Energy Management Centre (EMC) Kerala; **Mr. Sarath Krishnan S.**, Energy Technologist at the Energy Management Centre (EMC) Kerala; and **Mr. K Premkumar**, Scientist at ANERT, Govt. of Kerala. Their respective presentations were:"***Interconnected Microgrid - a model to replicate***"; "***Study of Mechanical Behaviour of the Flexible Perovskite Solar Cell Device***"; **"***Role of Hydropower Sector in India's and Kerala State's Energy Mix***";** "***Role of ECSBC & ENS in energy efficient buildings in the country***"; "***Kerala State Energy Conservation Fund***"; **"***Designated Consumers - Standards and Labelling Scheme of BEE***"**; and "***Green Hydrogen Economy and Its Future***".

A **Panel Discussion** was chaired by **Dr. R. Harikumar** which featured an esteemed group of experts, including **Prof. Mohammad Khalil Elahee**, **Mr. Kimari Main Patrick**, **Prof. Dr. Ahmed Hamza**, **Mrs. Asha P. A.** (Chief Engineer, KSEBL, Kerala, India), **Mr. Joby P. K.** (Deputy Chief Electrical Inspector, India), and **Mr. K. Premkumar.**

The Workshop concluded with a **Vote of Thanks** by Mr. Dinesh Kumar, Joint Director, Energy Management Centre (EMC), Kerala.

Dr. Amitava Bandopadhyay in his **Concluding Remarks** expressed gratitude to the Energy Management Centre (EMC), Kerala for their excellent coordination throughout the workshop.

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Meanwhile, the rapid evolution of generative Artificial Intelligence (AI) technologies, such as ChatGPT and other AI tools, is transforming how people learn and interact with knowledge. These technologies hold immense potential to make climate education more accessible, personalized and inclusive. When integrated responsibly, AI can become a powerful enabler in equipping societies to respond effectively to climate-related challenges.

Recognizing the importance of the issue, the Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, in collaboration with the International Science, Technology and Innovation Centre for South-South Cooperation under the auspices of UNESCO (ISTIC), Kuala Lumpur, Malaysia and Universitas Negeri Malang (UM), Indonesia, organized an **International Training Workshop** on "**STI Policy: Artificial Intelligence for Climate Learning Futures**" during **22-25 September, 2025** in Malang, Indonesia.

The Workshop brought together government officials, policymakers, educators, researchers and innovators to explore how AI can be strategically leveraged to strengthen climate literacy, develop inclusive policy frameworks and advance equitable, future-ready climate learning systems across the Global South. The Workshop was attended by experts and policymakers from 11 countries namely: **Cambodia, Egypt, India, Iraq, Kenya, Malaysia, Mauritius, Myanmar, Nepal, Zambia** and the host country **Indonesia.**

The **Opening Session** of the Training Workshop commenced with welcoming remarks from representatives of the NAM S&T Centre, ISTIC and Universitas Negeri Malang (UM).

In his Opening Remarks, **Dr. Amitava Bandopadhyay**, Director General of the NAM S&T Centre, New Delhi, highlighted the significance of the Workshop. Dr. Bandopadhyay underlined the objectives of the Workshop and acknowledged Indonesia's strong commitment to STI collaboration and partnerships with the NAM S&T Centre and ISTIC in organizing impactful capacity building programmes.

On behalf of ISTIC, **Madam Sharizad Dahlan**, Director, joined online for Welcome Remarks and extended a warm welcome to all participants of the Workshop. She emphasized that the theme of the Workshop focuses on using "STI Policy" to teach and educate about climate change and to make AI learning more responsive and impactful.

In his Welcome Remarks, **Prof. Dr. Hariyono**, Rector of Universitas Negeri Malang (UM), Malang, Indonesia elaborated on the theme of the Workshop, highlighting the growing collaboration between ISTIC and local partners in enhancing South-South and triangular cooperation. He mentioned that ISTIC has an ongoing research collaboration with UM, and that this technical cooperation is part of a broader partnership with ISTIC and the NAM S&T Centre.

Following Welcoming Remarks, there were two lectures - ***Strategic Insight 1*** on "**Transforming Education for Climate and AI Futures: A Perspective from Indonesia**" delivered online by **Prof Ahmad Najib Burhani**, Director General of Science and Technology, Ministry of Higher Education, Science & Technology (MoHEST), Indonesia and ***Strategic Insight 2*** on "**Advancing Malaysia's STI Diplomacy: Harnessing AI for Climate Resilience and Learning Futures**" delivered by **Dr. Balamurugan A/L Nallamuthu**, Under Secretary, International Division, Ministry of Science, Technology and Innovation (MOSTI). Malaysia.

For the "**Scene Setting**", **Ms. Hannah Norazharuddin**, Senior Programme Executive, ISTIC, set the stage by outlining the vision and opportunities of the Workshop. She mentioned that AI has the potential to shape the future, strengthen resilience and if used ethically, inclusively and sustainably - it can turn the Global South into a hub of innovation for the world.

In the end of opening session, **Introduction of Workshop** was given by **Assoc. Prof. Dr. Aini Suzana Ariffin**,Vice Chair, STI Policy & Governance – Science, Engineering, Technology & Innovation Network for Asia and The Pacific Region, STEPAN, UNESCO Jakarta Office. She provided an overview of the objectives, methodology and expected outcomes of the Workshop.

There were four **Technical Sessions** comprising various activities such as panel dialogue, country case studies, class room activities, interactive workshops and activities for drafting policy frameworks.

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Session 1 was titled **Panel Dialogue – Interlinking STI, Climate Change and AI for a Sustainable Future.** It featured thought-provoking insights from experts across the Global South. The Session was moderated by **Dr. Norshaliza Binti Kamaruddin**, Department of Intelligence Informatics, Faculty of Artificial Intelligence, Universiti Teknologi Malaysia (UTM).

Assoc. Prof. Dr. Aini Suzana Ariffin, made presentation titled "**Shaping AI Policy through Talent and Education: Building a Resilient and Sustainable Future**". She emphasized the importance of linking science, technology and innovation (STI) with climate change (CC) and AI policy (AP) for sustainable development.

Prof. (Dr.) Kiran Bhujun, Director - Tertiary Education and Scientific Research, Ministry of Tertiary Education, Science and Research, Government of Mauritius, in his talk on "**AI Strategies in Education in Small Island Developing States (SIDS)**", outlined the strategic imperatives for inclusive and resilient education systems.

Prof. Aji Prasetya Wibawa, Head of the Scientific Publication Center, Universitas Negeri Malang (UM), delivered a lecture on "**Harnessing AI for Policy Innovation and Future-Ready Learning**" highlighting how AI can be leveraged for policy innovation and future-ready climate learning systems.

Prof. Dr. Hadi Suwono, Dean, Faculty of Mathematics and Sciences, Universitas Negeri Malang (UM), in his talk on "**Empowering Climate Action through Transformative Education**" reinforced the value of transformative education in empowering communities to take meaningful climate action.

Session 2 was **Peer Learning & Mapping.** The session comprised "Peer Learning: Country Case Studies", Brainstorming and Discussion and Mapping Exercise as class room activity. During Country presentations, participants from six identified countries namely: **Egypt, India, Iraq, Kenya, Malaysia** and **Zambia** presented their respective country case studies, highlighting national experiences, innovation and challenges in integrating artificial intelligence (AI), science, technology and innovation (STI) into climate learning education systems.

Prof. Dr. Aini Suzana Ariffin and Prof. (Dr.) Kiran Bhujun were the trainers and Dr. Norshaliza was the facilitator during the session.

Session 3 was titled "**Tools, Models & Practice**". The first lecture of the session "**Designing for Readiness: AI and Institutional Support**" was delivered by Assoc. Prof. Dr. Aini Suzana Ariffin, who emphasized the importance of ensuring inclusivity, accessibility and relevance in developing AI-climate curriculum.

This was followed by **Interactive Workshop 1:** "**AI Tools for Policy Innovation and Climate Education – Future Readiness**" led by Prof. Aji Prasetya Wibawa and Dr. Norshaliza Binti Kamaruddin. They introduced participants to various AI tools, including ChatGPT, for policy innovation, educational content generation and future-oriented climate learning applications.

In the **Interactive Workshop 2:** "**Climate Pedagogy and Citizen Science**" facilitated by Prof. Dr. Hadi Suwono, the participants explored approaches to designing climate-inclusive education models using low-cost technologies and participatory learning frameworks.

The final session, "**Multi-stakeholder Roles: From Dialogue to Action**" led by Prof. (Dr.) Kiran Bhujun and Assoc. Prof. Dr. Aini Suzana Ariffin, focused on strategies for aligning ministries, institutions and communities to foster co-creation, commitment and policy implementation.

Session 4 was titled "**Policy Co-creation and Strategic Alignment".** The session began with an introduction to **Innovation Labs:** "**How to Create Enabling STI Environments: Foresight, Budgeting and Training**" by Prof. (Dr.) Kiran Bhujun, which focused on developing conducive environments for effective STI policies.

In **Innovation Lab 1:** "**Drafting Policy Frameworks**" **-** participants began group work on developing STI–AI–Climate policy frameworks using guided templates. This was followed by **Innovation Lab 2:** "**Finalizing Policy Briefs & Action Plans**" **-** where groups finalized their policy briefs and implementation roadmaps.

The "**Policy Brief Showcase**" featured presentations from each group, offering actionable recommendations for advancing AI-driven climate education in the identified countries. Trainers, Prof. (Dr.) Kiran Bhujun and Assoc. Prof. Dr. Aini Suzana Ariffin provided detailed feedback and insights to each group.

The session on "**Trainers' Insights and Participant Reflections**" synthesised key learning points and feedback from both facilitators and participants. Trainers, Prof. (Dr.) Kiran Bhujun and Assoc. Prof. Dr. Aini Suzana Ariffin, shared their perspectives on the outcomes of the Workshop.

In the end of Workshop**,** Closing Remarks were given by **Prof. Ahmad Najib Burhani**, Director General of Science and Technology, Ministry of Higher Education, Science & Technology (MoHEST), Indonesia.

Distinguished Visitors to the Centre

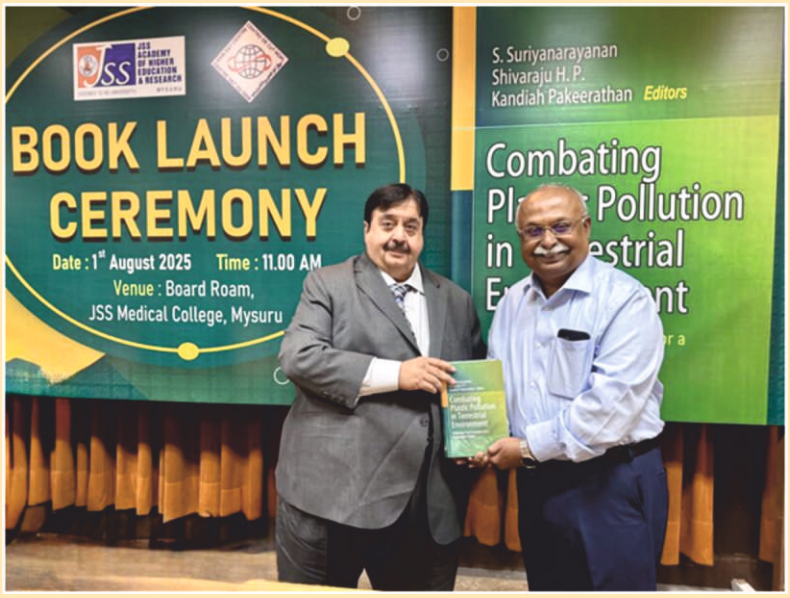
September 18, 2025

Prof. (Dr.) Kiran Bhujun, Director – Tertiary Education and Scientific Research Division, Ministry of Tertiary Education, Science and Research, Govt. of Mauritius, Republic of Mauritius; and

Dr. Vidushi S Neergheen, Director of the Doctoral School at the University of Mauritius; and Associate Professor at Biopharmaceutical Unit, Centre for Biomedical and Biomaterials Research (CBBR), University of Mauritius, Republic of Mauritius.

BOOK LAUNCH

Combating Plastic Pollution in Terrestrial Environment- Challenges and Strategies for a Sustainable Future



The book launch of the recently published book titled "*Combating Plastic Pollution in Terrestrial Environment - Challenges and Strategies for a Sustainable Future*", a joint initiative of the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre); and the JSS Academy of Higher Education and Research (JSS AHER) was held on August 1, 2025 at the Board Room, JSS Medical College, Mysuru, India.

The book is co-edited by Dr. S. Suriyanarayanan, JSS Science and Technology University; Dr. Shivaraju HP, JSS Academy of Higher Education and Research and Dr. Kandiah Pakeerathan from Jaffna University, Sri Lanka. The book is published by leading academic publisher Springer Nature, Singapore.

The book features contributions from scientists and researchers across nine countries highlighting the pressing challenges posed by plastic waste and showcasing effective management techniques. Through its 25 chapters, the book provides an extensive overview of the sources and various types of impacts of plastic pollution and exploring the innovative reuse of plastic waste. The chapters delve into various strategies for combating plastic pollution, including microbial degradation, community initiatives and advanced technological solutions, thereby offering a holistic view of the issue.

The event began with warm welcome of the guests by Dr. B. Manjunath, Registrar, JSS AHER. Dr. Suriyanarayanan, Associate Dean (Research), JSS STU, and Dr. Shivaraju, JSS AHER - the editors of the volume, briefed the gathering about the book's significance, its background and editorial process.

Dr. C. G. Betsurmath, Executive Secretary, JSS Mahavidyapeetha, in his keynote address appreciated the combined efforts of both JSS AHER and JSS STU—bringing together editorial leadership and scientific insights through this volume. He commended the teams for their academic rigor and practical relevance, and extended heartfelt thanks to the NAM S&T Centre for its ongoing support and commitment to the Global South.

Prof. A. N. Santosh Kumar, Vice-Chancellor, JSS STU, reflected on the initiatives and efforts of the university in actively contributing to environmental solutions.

Dr. B. Suresh, Director (TED), JSS Mahavidyapeetha and Pro-Chancellor, JSS AHER, in his address expressed his concern over millions of tonnes plastic produced every year. He highlighted the foresight of JSS AHER, which over 15 years ago, launched the first non-medical science department of Water and Health, and focused on environmental research, education and prevention. He also praised the NAM S&T Centre for being a reliable and visionary partner, going beyond routine programs to address critical global challenges.

Dr. Basavana Gowdappa, Vice-Chancellor, JSS AHER, reinforced the need to explore alternatives to plastics and stressed that the message must reach policymakers. He appreciated the editorial team and contributors for their efforts.

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre, recounted that the book was the outcome of the conference hosted by JSS AHER about three years ago. He commended the academic leadership of JSS AHER and JSS STU for their continued support towards sustainability and for taking up topics that are urgent but often under-addressed. He reiterated NAM S&T Centre's commitment to South-South cooperation and emphasized that this publication is a strong reflection of that partnership.

Special Feature

The Nepal Academy of Science and Technology (NAST), Kathmandu, Nepal

The Nepal Academy of Science and Technology (NAST) was established in 1982 as an apex body of Science and Technology and as an autonomous institution dedicated to advancing science and technology in Nepal. Its core objectives include advancement of science and technology, preservation and modernization of indigenous technologies, promotion of research, and facilitation of technology transfer. These are supported by a group of Academicians and Associate Academicians, as well as veteran experts from various scientific and technological sectors who serve as advisors and facilitators. The Academy is structured around four key divisions: the Faculty of Science, the Faculty of Technology, the Promotion Division, and the Administration Division. Together, they work to realize the Academy's mission. NAST receives additional institutional support from the government. The Honorable Prime Minister serves as the Chancellor, the Minister for Education, Science and Technology (MoEST) as the Pro-Chancellor, and MoEST acts as the liaison ministry and further strengthening the Academy's foundation and guiding its strategic direction.

Within its premises, NAST hosts several key facilities including the Faculty of Science, the Faculty of Technology, Administration, Secondary Standard Dosimetry Laboratory, Biomedical Research Laboratories, Pyramid Laboratory (High Altitude Research Center) and seven different Research Centres scattered across the country**.** These centers offer essential services to the public and serve as hubs for scientific research, technological innovation, and the overall advancement of Science and Technology in the country.

Following are the key activties and initiatives of NAST:

S&T Research and Innovation

NAST operates under the guiding slogan: ***"Science for Society and Innovation for Prosperity."*** In alignment with this vision, NAST undertakes a wide range of activities across the science and technology sector, conducting research in priority areas such as environmental sciences, renewable energies, biotechnology, high-altitude research, natural products, physical sciences, medicinal plants, agriculture, food technology and health, disaster risk reduction, water testing, waste management and the conservation of indigenous technologies.

To harness global and local expertise, NAST has initiated the Brain Pooling Program, which provides a supportive environment for experts from both, Nepal and abroad to contribute their knowledge for societal advancement.

NAST is also home to several specialized Centers, including the Space Research Centre, Instrumentation Centre, Science and Technology Information Centre, Analytical Center, National Microbial Culture Collection Centre (NMCCC) and the Seismology Center, all of which serve to national needs.

The Academy places strong emphasis on innovative research, not only within its own walls but also by supporting external innovators, especially youth, through grants, mentorship, and technical guidance. Innovations developed through these initiatives are documented and showcased at the Academy.

NAST has also achieved some tangible outcomes on knowledge building, technology developing activities, and validations along with societal connections. Nano satellite launch, bioprospecting of medicinal compounds, valorization of bioresources, waste management, ecosystem-based knowledge creation and others.

Through flagship programs such as the Nepal Flora Project, Model Science Village Project, and Food Green Cities initiatives, NAST continues to nurture scientific talent across the country, ensuring the dissemination and practical application of appropriate technologies for sustainable national development.

Policy Advisory

NAST serves as a key advisory body to the Government of Nepal, offering expert input on the formulation of science and technology policies, programs, and strategies aimed at fostering national development. It also provides guidance on technology transfer policies, ensuring that scientific advancements are effectively applied for societal benefit.

Functioning as a think tank, the Academy brings together a pool of academically accomplished and eminent academicians, scientists and technologists, and works in close coordination with the Ministry of Education, Science and Technology (MoEST) to drive progress in the science and technology sector.

One of its notable initiatives is Science Dialogue, a roundtable discussion program focused on critical S&T issues. The insights, recommendations and suggestions generated from these sessions serve as valuable references for the government in designing or amending relevant policies and programs.

Through active participation in meetings and discussions convened by MoEST and other key national bodies, NAST plays a central role as an executive member of various committees, mandated to represent and advocate for the needs of the science and technology community at the national level.

Science Education and Capacity Building

NAST regularly organizes seminars, workshops, conferences and exhibitions to disseminate knowledge and promote dialogue among scientists, researchers, educators, students, and the general public. One of its flagship events is the National Conference on Science, Technology, and Innovation (STI), held every four years. This much-anticipated event serves as a vibrant platform that connects scientists, policymakers, government agencies, private and public institutions, S&T experts, and students from both within the country and abroad. To date, NAST has successfully conducted nine such national conferences.

Recognizing that *science teachers are nation-builders* and that science and technology tools are fundamental to national development, NAST provides training programs for science teachers. These programs aim to improve teaching methodologies,

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emphasizing modern pedagogical approaches to enhance the quality of science education in schools. Through its Science and Technology Faculties, NAST also builds the scientific capacity of students by offering hands-on research opportunities. Students can engage as Research Fellows, Assistant Research Fellows, Research Assistants, or Interns, gaining valuable laboratory and field experience. In addition to its academic outreach, NAST extends its expertise to the public, providing training in income-generating skills to support sustainable livelihoods.

Two specialized forums operate under the NAST umbrella. The **Women Scientists Forum Nepal (WSFN)** focuses on empowering women scientists and advocating for the welfare of women and girls. The **Youth Forum Nepal (YFN)** is dedicated to youth empowerment, capacity building, and leadership development in science and technology. To further engage students and promote STEM education, NAST organizes a variety of activities such as; workshops on journal article and research methodology writing, Proposal writing training, Science exhibitions and competitions, including oratory contests, science-themed quizzes, and introductory training on satellite construction and rocket launching. NAST also runs inclusive programs, such as artificial intelligence (AI) training for the visually impaired, helping differently-abled individuals build confidence and technical skills. A significant achievement in Nepal's growing space research sector is the CubeSat Design and Training Program for engineering students, marking a milestone in the country's venture into space science and satellite technology.

Promotion and Popularization of STI

NAST actively promotes science and technology through a variety of public engagement and educational programs. These efforts, spearheaded by NAST's Promotion Division, aim to cultivate a scientific mindset across all sectors of the society through key initiatives such as:

Science Awareness and Education: NAST conducts district-level Science Fairs, encouraging student involvement with the theme: "Science Education is Amusing, Not a Burden". It targets not only scientists but also the general public and school students, helping demystify scientific principles.

Science Journalism Training: Annual training for aspiring journalists enhances the quality and authenticity of science reporting, reinforcing the importance of accurate public communication on scientific topics.

Digital Access and Literacy: In collaboration with the Government of Korea, NAST has established an **Information Access Centre** (IAC) at its Technology Building and a mobile IAC bus, an ICT-equipped vehicle that travels across Nepal to provide digital literacy and cyber-security trainings, especially in underserved areas.

Audio-Visual Communication: NAST produces documentaries, interviews, and event coverage through its in-house audio/visual team and studio. These resources are broadcast via Nepal Television and Kantipur FM, and shared through social media platforms, significantly enhancing public access and interest in science.

Library and Digitization Efforts: The NAST Central Library plays a central role in S&T promotion, leading efforts to network S&T libraries nation wide. The Electronic Information Documentation Centre (EDIC) furthers the digitization of scientific resources, improving accessibility for researchers and technologists.

Through these diverse programs, NAST continues to bridge gaps in science literacy, promote digital inclusion, and foster a scientifically informed society in Nepal.

Publications

NAST has been publishing the **Nepal Journal of Science and Technology (NJST)** since 1992. NJST is a peer-reviewed, open-access, multidisciplinary journal published biannually, and featuring scholarly articles in both natural and applied sciences. In addition to NJST, NAST also publishes **"Bigyan Lekhmala"**, a science book written in simple Nepali language that presents informative articles on various science and technology topics for the general public. NAST also releases a monthly newsletter, **the NAST-Monthly**, which provides updates and highlights of activities and events conducted by the Academy each month. Another significant initiative in the publication is the **Who is Who Directory**, a database of individuals in Nepal who have acquired PhD degrees. A digital version of the directory has been made available online, allowing for quick and easy updates. NAST plans to release a printed edition of the directory every five years. Additionally, NAST regularly publishes a variety of other materials, including project and program reports, Annual progress reports, Research and innovation reports. These publications aim to document, disseminate, and promote scientific progress and innovation within Nepal and beyond.

NAST's Support for Research, Innovation and Scientific Excellence

NAST in collaboration with the Kathmandu Valley Development Authority (KVDA) has launched the **Urban Ecosystem-based Adaptation (EbA) Research Grants**. These grants are open to researchers at various levels, including those pursuing PhD, Master's and Bachelor's degrees, as well as independent research practitioners, who are affiliated with academic or professional research institutions**. Innovation Grants** are given to the best proposals that demonstrate practical and impactful innovations. **Young Scientist Research Grant** is awarded to encourage young scientists through dedicated funding opportunities for outstanding research proposals. Conference and Collaboration Support is provided by NAST for partial travel support to enable researchers to participate in international conferences. Financial assistance is also available for professional societies to organize scientific events and conferences. A portion of NAST's funding is reserved to promote Collaborative Research Efforts, fostering partnerships between institutions and disciplines. Through these initiatives, NAST aims to empower researchers, promote scientific innovation, and build a robust research ecosystem in Nepal.

Recognition and Awards

NAST honors outstanding contributions to science and technology through various awards.

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SN	Award	SN	Award
1	Science and Technology Academy Award	11	Outstanding Student Award
2	Nature Conservation Award	12	Dayananda Bajracharya Research Award
3	Vice Chancellor National Innovation Award	13	Phanindra Prasad Nyaupane Research Award
4	Science Award	14	Mohan Dhwaj Basnet Pragya Award
5	Technology Award	15	Bhuvaneshwar Technology Award
6	Youth Science and Technology Award	16	Jit Bahadur Nakarmi Metal Technology Award
7	Women in Science and Technology Award	17	Kaji–Indra Katuwal Agriculture Award
8	Science and Technology Promotion Award	18	NRN Science and Technology Award
9	Science and Technology Journalism Award	19	Hama Balkrishna Shrestha Engineering Award
10	Science Teacher Award		

The **Lifetime Achievement Award** is conferred on five scientists who have made significant, long-term contributions to the advancement of science in Nepal.

NAST-Specialized Research Labs

NAST has expanded its services across all seven provinces of Nepal, as defined by the country's federal constitution. This expansion ensures that the Academy's programs and resources are accessible nationwide, from the Far East to the Far West. To support this effort, NAST has established provincial laboratories strategically located in each region, taking into careful consideration the unique natural resources and scientific priorities of each province. These regional labs enhance the Academy's ability to conduct localized research, promote resource-based innovation, and address region-specific challenges through science and technology. This move reflects NAST's commitment to inclusive scientific development and its vision of fostering balanced regional growth through the application of science and technology.

SN	Province	District	Specialized lab.
1	Koshi	Dharan	Agricultural and Food Technology
2	Madesh	Bardibas	Chure Conservation a and Development
3	Bagmati	Chitwan	Urban Development and Environment
4	Gandaki	Pokhara	Mountain Green Economy
5	Lumbini	Dang	Traditional Technology
6	Karnali	Surkhet	Information and Communication Technology
7	Sudurpachim	Mahendranagar	Research in Herbal Medicine

Recent Partnership and MoU

NAST continues to strengthen its role in advancing science and technology through strategic partnerships with national and international organizations. These collaborations focus on fostering research, innovation, training, and knowledge sharing across diverse scientific domains. These collaborations reflect NAST's commitment to inter-institutional synergy, applied research, and sustainable development, reinforcing its mission to advance science and technology.

On January 24, 2025, NAST formalized an agreement with **Suryodaya Municipality** to establish and operate Nepal's first Tea Testing, Promotion, and Research Centre in Kanyam, Ilam. This initiative is expected to support scientific research and innovation in Nepal's tea industry, promoting quality standards, market competitiveness, and sustainable agricultural practices.

On February 3, 2025, NAST signed a Memorandum of Understanding (MoU) with the **National Trust for Nature Conservation (NTNC), Nepal**, to establish a collaborative framework for academic and research initiatives. The partnership emphasizes multidisciplinary programs in biodiversity, climate change science, research, training, and knowledge exchange, aiming to address critical environmental challenges through scientific cooperation.

On February 18, 2025, NAST signed a MoU with the **Council of Scientific and Industrial Research (CSIR), India**, marking a significant milestone in regional scientific collaboration. The agreement seeks to promote joint efforts in scientific research, technology development, and industrial innovation, enhancing knowledge exchange and capacity building between the two institutions.

Similarly, NAST has signed a Memorandum of Understanding with Dhulikhel Municipality, Kavre, in October, 2024 to import and install low maintenance water purification unit to provide drinkable water to the local communities of Dhulikhel-2, with Gauradaha Municipality, Jhapa in August, 2024 to enhance the use of innovative technology for the farmers in order to increase the agricultural produce along with avians, with Kathmandu Valley Development Authority (KVDA), Kathmandu in June, 2024 to effectively implement the urban Eba project, and with Suryodaya Municipality, Ilam in January, 2025 to operate a lab to measure the quality of Nepali tea and to research and promote the Nepali tea, to mention a few in the fiscal year 2024/25.

To put it in the nutshell, NAST supports in formulating the science and technology policies in the country creating the ecosystem for research, recognizes the best performing scientists and researchers of many fields across the country, conducts in-house research fostering the youth to engage in scientific and technological researches, and creates noble areas and platforms for research in the country via national and international collaborations with its limited resources.

Science, Technology & Innovation News

ARTIFICIAL INTELLIGENCE / HEALTH

AI-powered brain device allows paralysed man to control robotic arm

The human user and AI have shared autonomy and constantly interact to complete tasks.

A man with partial paralysis was able to operate a robotic arm when he used a non-invasive brain device partially controlled by artificial intelligence (AI), a study reports. The AI-enabled device also allowed the man to perform screen-based tasks four times better than when he used the device on its own.

Brain–computer interfaces (BCIs) capture electrical signals from the brain, then analyse them to determine what the person wants to do and translate the signals into commands. Some BCIs are surgically implanted and record signals directly from the brain, which typically makes them more accurate than non-invasive devices that are attached to the scalp.

Jonathan Kao, who studies AI and BCIs at the University of California, Los Angeles, and his colleagues wanted to improve the performance of non-invasive BCIs. The results of their work are published in *Nature Machine Intelligence* this week.

First, the team tested its BCI by tasking four people — one with paralysis and three without — with moving a computer cursor to a particular spot on a screen. All four were able to complete the task the majority of the time.

When the authors added an AI co-pilot to the device, the participants completed the task more quickly and had a higher success rate. The device with the co-pilot doesn't need to decode as much brain activity because the AI can infer what the user wants to do, says Kao. “These co-pilots are essentially collaborating with the BCI user and trying to infer the goals that the BCI user is wishing to achieve, and then helps to complete those actions,” he adds.

The researchers also trained an AI co-pilot to control a robotic arm. The participants were required to use the robotic arm to pick up coloured blocks and move them to marked spots on a table. The person with paralysis could not complete the task using the conventional, non-invasive BCI, but was successful 93% of the time using the BCI with an AI co-pilot. Those without paralysis also completed the task more quickly when using the co-pilot.

www.nature.com, September 02, 2025

HEALTH

WHO recommends injectable lenacapavir for HIV prevention

Major new policy updates announced at the IAS 2025 conference

The World Health Organization (WHO) released new guidelines recommending the use of injectable lenacapavir (LEN) twice a year as an additional pre-exposure prophylaxis (PrEP) option for HIV prevention, in a landmark policy action that could help reshape the global HIV response. The guidelines are being issued at the 13th International AIDS Society Conference (IAS 2025) on HIV Science, in Kigali, Rwanda.

LEN, the first twice-yearly injectable PrEP product, offers a highly effective, long-acting alternative to daily oral pills and other shorter-acting options. With just two doses per year, LEN is a transformative step forward in protecting people at risk of HIV – particularly those who face challenges with daily adherence, stigma, or access to health care.

“While an HIV vaccine remains elusive, lenacapavir is the next best thing: a long-acting antiretroviral shown in trials to prevent almost all HIV infections among those at risk," said Dr Tedros Adhanom Ghebreyesus, WHO Director-General. “The launch of WHO's new guidelines, alongside the FDA's recent approval, marks a critical step forward in expanding access to this powerful tool. WHO is committed to working with countries and partners to ensure this innovation reaches communities as quickly and safely as possible.”

The new guidelines come at a critical moment as HIV prevention efforts stagnate with 1.3 million new HIV infections occurring in 2024 – with disproportionate impact among key and priority populations, including sex workers, men who have sex with men, transgender people, people who inject drugs, people in prisons, and children and adolescents. WHO's recommendation on LEN signals a decisive move to expand and diversify HIV prevention, giving people more options to take control over their health with choices that fit their lives.

As part of these guidelines, WHO has recommended a public health approach to HIV testing using HIV rapid tests to support delivery of long-acting injectable PrEP, including LEN and cabotegravir (CAB-LA). The simplified testing recommendation removes a major access barrier by eliminating complex, costly procedures and enabling community-based delivery of long-acting PrEP through pharmacies, clinics, and tele-health.

www.who.int, July 14, 2025

Lithium deficiency and the onset of Alzheimer's disease

The earliest molecular changes in Alzheimer's disease (AD) are poorly understood. Here researchers show that endogenous lithium (Li) is dynamically regulated in the brain and contributes to cognitive preservation during ageing. Of the metals analysed, Li was the only one that was significantly reduced in the brain in individuals with mild cognitive impairment (MCI), a precursor to AD. Li bioavailability was further reduced in AD by amyloid sequestration. Study explored the role of endogenous Li in the brain by depleting it from the diet of wild-type and AD mouse models. Reducing endogenous cortical Li by approximately 50%

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markedly increased the deposition of amyloid-β and the accumulation of phospho-tau, and led to pro-inflammatory microglial activation, the loss of synapses, axons and myelin, and accelerated cognitive decline. These effects were mediated, at least in part, through activation of the kinase GSK3β. Single-nucleus RNA-seq showed that Li deficiency gives rise to changes in multiple brain cell types that overlap with transcriptome changes in AD. Replacement therapy with lithium orotate, which is a Li salt with reduced amyloid binding, prevents pathological changes and memory loss in AD mouse models and ageing wild-type mice. These findings reveal physiological effects of endogenous Li in the brain and indicate that disruption of Li homeostasis may be an early event in the pathogenesis of AD. Li replacement with amyloid-evading salts is a potential approach to the prevention and treatment of AD.

www.nature.com , August 06,2025

CHEMICAL MACHINE LEARNING

New machine-learning application to help researchers predict chemical properties

ChemXploreML makes advanced chemical predictions easier and faster — without requiring deep programming skills.

MIT researchers developed ChemXploreML, a new desktop application that provides an automated and user-friendly approach to predicting molecular properties using machine learning, making advanced machine-learning methods accessible to chemists without requiring extensive programming expertise.

One of the shared, fundamental goals of most chemistry researchers is the need to predict a molecule's properties, such as its boiling or melting point. Once researchers can pinpoint that prediction, they're able to move forward with their work yielding discoveries that lead to medicines, materials, and more. Historically, however, the traditional methods of unveiling these predictions are associated with a significant cost expending time and wear and tear on equipment, in addition to funds.

There is a branch of artificial intelligence known as machine learning (ML). ML has lessened the burden of molecule property prediction to a degree, but the advanced tools that most effectively expedite the process by learning from existing data to make rapid predictions for new molecules require the user to have a significant level of programming expertise. This creates an accessibility barrier for many chemists, who may not have the significant computational proficiency required to navigate the prediction pipeline.

To alleviate this challenge, researchers in the McGuire Research Group at MIT have created ChemXploreML, a user-friendly desktop app that helps chemists make these critical predictions without requiring advanced programming skills. Freely available, easy to download, and functional on mainstream platforms, this app is also built to operate entirely offline, which helps keep research data proprietary. The exciting new technology is published in the Journal of Chemical Information and Modeling.

One specific hurdle in chemical machine learning is translating molecular structures into a numerical language that computers can understand. ChemXploreML automates this complex process with powerful, built-in "molecular embedders" that transform chemical structures into informative numerical vectors. Next, the software implements state-of-the-art algorithms to identify patterns and accurately predict molecular properties like boiling and melting points, all through an intuitive, interactive graphical interface.

"The goal of ChemXploreML is to democratize the use of machine learning in the chemical sciences," says Aravindh Nivas Marimuthu, a postdoc in the McGuire Group and lead author of the article. "By creating an intuitive, powerful, and offline-capable desktop application, we are putting state-of-the-art predictive modeling directly into the hands of chemists, regardless of their programming background. This work not only accelerates the search for new drugs and materials by making the screening process faster and cheaper, but its flexible design also opens doors for future innovations."

ChemXploreML is designed to evolve over time, so as future techniques and algorithms are developed, they can be seamlessly integrated into the app, ensuring that researchers are always able to access and implement the most up-to-date methods. The application was tested on five key molecular properties of organic compounds melting point, boiling point, vapor pressure, critical temperature, and critical pressure — and achieved high accuracy scores of up to 93 percent for the critical temperature. The researchers also demonstrated that a new, more compact method of representing molecules (VICGAE) was nearly as accurate as standard methods, such as Mol2Vec, but was up to 10 times faster.

"We envision a future where any researcher can easily customize and apply machine learning to solve unique challenges, from developing sustainable materials to exploring the complex chemistry of interstellar space," says Marimuthu.

www.news.mit.edu, July 24, 2025

FOOD SAFETY AND QUALITY

MSU Researchers Develop Faster Methods for Detecting Viruses in Food, Water

Waiting for the results of water or food contamination tests can take days, but with two technologies developed at MSU, researchers can have results back in hours. These technologies can identify beach contaminations faster so that the public can be informed earlier. Reducing detection time means treatments can be given earlier to improve people's health

Waiting is the hardest part. Especially in the case of testing for water or food contamination, which can take days or even a week in some cases for the results, leaving the possibility that people have been unknowingly exposed. To address this issue, Michigan State University researchers have developed two innovative methods to test for bacteria and viruses in food and water that reduces this time from days to hours, offering real-time results in the field.

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"We know it's a problem," said Evangelyn Alocilja, professor in the Department of Biosystems and Agricultural Engineering in the College of Engineering. "The beach is closed today, but what about the people who went swimming before the test results came back?"Alocilja and her team have developed glycan-coated magnetic nanoparticles that are thinner than the width of a human hair to remove and identify microbial contaminants from food and water. Glycan is a sugar that attaches to the proteins that live on the surface of viruses and bacteria. Once the nanoparticles stick to the bacteria, a magnet is used to separate the particles and bacteria from the sample. Then, the contaminant is easily removed.

Once the contaminant is removed, the next step is identifying what kind of bacteria it is by using a biological sensor or biosensor that can detect living things. The biosensor uses gold nanoparticles that embed themselves in the DNA of the bacteria if the specific gene they are looking for is present. If the gold nanoparticles appear red, the target gene is present. If the gold nanoparticles change from red to blue, that means the nanoparticles have formed a clump and the target gene is absent. This testing method takes about 40 minutes, meaning that the user can identify bacteria in the water in two to four hours instead of one to two days. For example, salmonella, campylobacter and E. coli are transmitted through contaminated water and are the most common causes of foodborne illnesses in the U.S. and worldwide. Alocilja's nanoparticle-based biosensor technology can isolate these foodborne and waterborne bacteria in less than 30 minutes, extract the DNA in 20 minutes and detect the target gene in 40 minutes, saving time and money. Only a small amount of nanoparticles are needed to test the sample thanks to the glycan-coated magnetic nanoparticle technology. For example, to test one liter of water or 25 grams of food, only one milliliter of glycan-coated magnetic nanoparticles is needed. Alocilja hopes these inexpensive technologies costing 10 to 50 cents per test for the glycan-coated magnetic nanoparticles and less than $2 per test for the gold nanoparticle method will one day be used around the world to test water quality and be used to improve food safety. Recently, Alocilja and her team have been testing this integrated nanoparticle-based sample-to-result biosensor technology in the field to detect infectious and antimicrobial-resistant organisms, which can be used in health clinics and emergency rooms.

www.newswise.com, August 21, 2025

ARTIFICIAL INTELLIGENCE AND AUTOMOBILE-INDUSTRY

Research finds human limit to overseeing self-driving cars

New research answers one of the industry's biggest questions: how many self-driving cars can one human safely keep an eye on?

For years, experts have debated just how many driverless cars a single person can effectively supervise from a remote control centre, with estimates all over the map. Research from Coventry University has finally identified a "Goldilocks zone," showing that the sweet spot is between five and seven vehicles.

The findings are necessary for the safety and reliability of upcoming services like driverless buses, delivery vans, and robotaxis, where one operator will need to watch over a whole fleet of vehicles on set routes. This doesn't apply to private self-driving cars just yet; for those, a driver still needs to be in the car and ready to take the wheel. Published in "Computers in Human Behavior, the study makes it clear that getting the number right is a serious matter. Assigning too many or too few vehicles comes with life-threatening risks. The results offer a much-needed baseline for companies building the remote operation hubs that will act as the backbone for future transport, helping them boost efficiency, cut costs, and reduce the risk of accidents.

Researchers at Coventry University's Research Centre for Future Transport and Cities set up their experiment to avoid the confusion of past studies. They created a simulator that looked just like a future control room and had 24 experienced drivers take on the role of supervisors. Participants in the research study watched fleets of three, five, seven, and nine self-driving cars navigating a highly realistic "digital twin" of Coventry. Their instructions were simple: don't interfere with the driving, just watch. If something looked wrong, their job was to alert a separate standby driver to step in. While loading up an operator with nine cars might seem efficient, performance dropped off a cliff. At that level, supervisors missed or completely ignored over a third of the critical incidents that required a human's attention. Their average response time held steady at around 13 seconds – about how long it takes someone to properly size up a situation before acting – but their overall awareness and decision-making suffered badly. More surprising was the discovery that being underloaded is also a problem. When operators only had three vehicles to watch, many became bored and started to micromanage, intervening far too often when the system was working just fine. "With 3 I felt my attention wandering as there wasn't so much to focus on," one participant said. Another simply called it "dull".

The sweet spot, according to the research, was supervising between five and seven self-driving cars. Here, operators found the perfect balance. They were alert and quick to react but didn't feel overwhelmed. Clear information from the cars helped them make good decisions, though they noted that too many text messages became a distraction. The researchers believe that other ways of delivering information, like audio or voice alerts, could be a great solution. Professor Stewart Birrell, Director of the Research Centre for Future Transport and Cities, said: "We're proud to have provided insights that could support the safe rollout of connected and automated vehicles. This study was essential for understanding what remote supervision might look like in the real world. We found that five vehicles are enough to keep operations efficient without overwhelming the human operator. "Having this knowledge and insight is critical if we want these systems to work in busy places like cities, where one person might need to keep an eye on several vehicles at once." This research is already being put into practice through the government-funded SCALE project, which is set to deploy remote control systems for self-driving cars in Solihull.

www.iottechnews.com, September 1, 2025

ENERGY & GREEN TECHNOLOGY

Battery made from natural materials could replace conventional lithium-ion batteries

What if the next battery you buy was made from the same kinds of ingredients found in your body? That's the idea behind a

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breakthrough battery material made from natural, biodegradable components. It's so natural, it could even be consumed as food.

A team of researchers at Texas A&M University, including Distinguished Professor of Chemistry Dr. Karen Wooley and Professor of Chemical Engineering Dr. Jodie Lutkenhaus, has developed a biodegradable battery using natural polymers. The findings are published in the Proceedings of the National Academy of Sciences. Wooley's research group in the College of Arts and Sciences has spent the past 15 years shifting toward natural products for the construction of sustainable and degradable plastics materials. Lutkenhaus, associate dean for research in the College of Engineering, has been using organic materials to design a better battery. She suggested collaboration to combine Wooley's naturally sourced polymers with her battery expertise.

"We've long been interested in safer, more flexible battery materials," said Lutkenhaus. "When Dr. Wooley's lab began developing these naturally sourced polymers, it opened the door to something entirely new—a battery that could perform well and also disappear safely when it's no longer needed."

A battery made from vitamin B2 and amino acids

The new material is made from two key ingredients found in nature: riboflavin, also known as vitamin B2, and L-glutamic acid, an amino acid that helps build proteins in the body.

"Those components were identified by Dr. Shih-Guo Li, Ph.D., who began his dissertation research five years ago with the intention of enhancing the content of bio-renewable building blocks for organic polymer battery construction," Wooley said. "He then developed synthetic methods to connect the molecular building blocks into chain-like structures called polypeptides."

What makes this material special is that it's redox-active, which means it can gain and lose electrons. This is how batteries store and release energy. In this case, the riboflavin handles the energy, while the polypeptide provides structure and helps the material break down naturally. Unlike conventional lithium-ion batteries, which rely on metals and petrochemicals, this new material is derived entirely from renewable biological sources. It's designed to degrade safely when exposed to water or enzymes, making it a promising solution for reducing battery waste, especially in cases where batteries aren't properly recycled.

"Although there are significant efforts to recycle batteries, in cases where batteries are not actively collected and processed for recycling, they should be capable of undergoing breakdown naturally and with release of non-toxic degradation products," Wooley said.

In lab tests, the material showed its suitability as an anode, the part of a battery that stores electrons. The material was shown to be non-toxic to fibroblast cells, a type of cell found in connective tissue.

www.techxplore.com, September 24, 2025

SPACE

Unlocking space biology: A novel microgravity bioreactor for on-orbit research

This groundbreaking research reveals how a new microgravity bioreactor could revolutionise experiments in space.

As humanity sets its sights on long-duration space missions to destinations like Mars and the Moon, a fundamental challenge emerges: understanding how biological systems respond to the harsh, alien environment of space. Our ability to establish sustainable lunar bases, successfully send astronauts to Mars, and even explore beyond depends critically on deciphering these biological shifts. Currently, much of our space biology research relies on indirect or limited methods. There's a pressing need for *in-situ*, real-time investigation to truly understand how life adapts, or struggles, off-world.Our novel microgravity bioreactor offers a groundbreaking solution to these limitations. This device has been developed within the project ALCYONE, funded by the EU under the Horizon Europe program, and coordinated by the School of Aerospace Engineering of Sapienza University of Rome. Its core purpose is to enable complex biological experiments directly within the space environment, providing a controlled and sustained platform for research that was previously impossible. This innovative technology is incredibly important because it opens doors to significant advancements in a deeper understanding of human health in microgravity and high radiation conditions.

Space environment challenges

Microgravity – or more accurately, weightlessness – is the condition in which the effects of gravity are greatly reduced. This occurs when an object is in continuous free fall, such as during orbital flight or in open space. This profound absence of the constant gravitational pull we experience on Earth has far-reaching and often detrimental effects on biological systems. At the cellular level, microgravity influences fundamental processes such as gene expression, cell differentiation, and intercellular communication. On the other hand, the effect of radiation on living cells in space is a paramount concern for human space exploration, especially as missions extend beyond Earth's protective magnetosphere towards the Moon and Mars. Unlike terrestrial radiation, space radiation consists of highly energetic particles, primarily Galactic Cosmic Rays (GCRs) and Solar Particle Events (SPEs), which can penetrate spacecraft shielding and living tissues. These types of ionising radiation cause damage at the molecular level, most critically to DNA. This damage can lead to harmful biological effects.

ALCYONE technology: A space-ready bioreactor

Traditional ground-based simulations often introduce undesirable stress on biological samples and can only approximate a real space condition, not even a complete one. Furthermore, it is currently not possible to recreate on the ground the complex radiation environment encountered in space. It is precisely this 'gap' between terrestrial simulations and real space conditions that our microgravity bioreactor aims to bridge. By being designed for *in-situ* operation directly in space, our bioreactor provides a sustained and genuine microgravity and radiation environment for biological samples, free from the misleading factors of shear stress, partial gravity effects, and the need for constant reorientation inherent in ground-based systems. On the contrary, direct

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access to the space environment allows for unprecedented opportunities to observe, manipulate and understand biological processes as they truly unfold off-world, offering a more accurate and reliable platform for cutting-edge space biology research.

One of the most important technologies that pushed the innovation of the ALCYONE project is the integration of thin-film sensors and actuators onto the same substrates that constitute the micro-incubator, making it a 'real' lab-on-chip device that does not require external laboratory instrumentation for handling the local environmental conditions as well as for monitoring the status of the incubated biological samples. Integrated environmental controls utilise a miniature thin-film metallic heater for each incubation chamber and dedicated ultra-sensitive hydrogenated amorphous silicon (a-Si:H) temperature sensors to maintain precise temperature levels.

Furthermore, the bioreactor boasts impressive modularity and versatility. Its adaptable microfluidic chamber design allows for the accommodation of various cell types, including mammalian cells, yeast and microbial cultures, along with different experimental setups, enabling a broad spectrum of research. While operating *in-situ* in true microgravity, the internal fluid dynamics within the bioreactor are optimised through precisely engineered microchannel geometries and passive flow control techniques. This ensures uniform nutrient distribution and waste removal around the samples, preventing unintended shear forces or nutrient gradients that could mimic partial gravity effects, thereby guaranteeing consistent and authentic microgravity exposure to the cells.

www.innovationnewsnetwork.com, September 22, 2025

SCIENCE, TECHNOLOGY AND SOCIETY

Columbia Basin: Data-driven tools for smarter Integrated Pest Management (IPM)

A long-established potato pest-monitoring network in the Columbia Basin is providing historical data and in-the-field "truth-testing" for a new internet-based Potato Decision Aid System. These programs can inform efforts to establish and enhance pest monitoring networks in other crops. The entomologists had already trialed and compared monitoring techniques, arriving at the best methodology for monitoring each pest. Ensuring sound methodology across a pest-monitoring network is essential to producing decision-worthy data, Carrie Wohleb, Washington State University Extension (WSU) regional vegetable crops specialist says Extension scientists partnered with WSU researchers to identify best practices for monitoring new pests. Sound methodology also provides useful, high-integrity data. "Because we monitor the same way year after year, we can identify patterns with greater confidence", Wohleb notes.

Growing the network

About 10 years ago, data accumulating from the network got the attention of Dave Crowder, a WSU entomologist. By combining insect population data with temperature data from 300 weather stations in Washington State, Crowder and colleagues could produce interpolated "heat maps".

"We take all of the monitoring data about where the bugs are currently and then produce interpolations across the whole landscape about where bug densities are and where areas that have high, medium, and low risk are," Crowder explains.

The weekly *Potato Alerts* report had been showing dots on a map to indicate pest counts. The heat maps that the WSU entomologists developed provided a better visual picture of pest pressure. By eliminating the dots, the heat maps were also less field-specific. That sat well with growers concerned about anonymity.

Funding and industry support

From the network's beginning, Washington's potato industry saw the value of the data collected—and was willing to offer financial support. Building support from those who most benefit from a pest-monitoring network is essential to a network's longevity. "You should really identify early on how you're going to fund and support these systems", advises Crowder. "Lots of researchers develop useful models for crop pests, but then there can be a gap in making the model useful to growers."

Communication

Since the potato pest-monitoring network began, WSU Extension scientists have adapted to different communication preferences—and changing communication technologies and features. The network first reported pest-monitoring results on a website. Weekly emails the second year developed into *Potato Alerts*. That weekly newsletter became the network's main communication channel, growing to reach more than 900 readers in the Pacific Northwest. More recently, with the beginning of a Potato DAS, growers can receive more specific text and email alerts.

Growers in the Columbia Basin can access up-to-date pest-monitoring information in a variety of formats: website, email, and text alerts. Successful networks should have a way to gather feedback and evaluation from users.

Users may prefer to receive the information in different formats. Some people like to read text; others want a more visual representation. "One of the strengths as we've shifted to the Decision Aid System alongside the *Potato Alerts* is that we can offer both text and visual", says Wohleb. "People have different learning styles and preferences for how to receive information".

The technology used in the Potato DAS also offers promise for other geographies. A Specialty Crop Research Initiative grant is funding testing of a similar potato decision aid platform in other major production areas with research partners in Colorado, Maine, Michigan, New York, and Wisconsin.

www.sciencesocieties.org, August 28, 2025

Brief News

WHO declares Nepal free of rubella

The World Health Organization (WHO) on August 18, 2025 has announced that Nepal has eliminated rubella as a public health problem, marking a major milestone for maternal and child health in the region. Nepal is the first country in WHO's Southeast Asia Region to eliminate the highly contagious viral infection. "Nepal's success reflects the unwavering commitment of its leadership, persistent efforts of the healthcare workers and volunteers and unstinting support of engaged and informed communities, for a healthy start for babies and a future free of rubella disease," said Catharina Boehme, Officer-In-Charge of WHO in Southeast Asia. Health experts warn that measles, with its high transmissibility, often signals wider immunity gaps, underlining the need for continued progress towards the global Immunization Agenda 2030

www.downtoearth.org.in, August 19, 2025

Mediterranean Heat wave shocks with 8 degree C warming

Mediterranean Heat wave shocks with 8 degree C above the normal for July in some parts of Europe, informed by Jeff Berardelli, chief meteorologist and climate specialist from US through a social media platform . The near surface temperature in the continent have a heat dome that developed in June increased the temperature drastically over the Mediterranean Sea- just in the beginning of summer season in Europe. Some 2,300 people were reported to have died due to heat related cause till early July . By mid –July, even in inland regions of Spain and the UK experienced extreme temperature alerts. The heat trend across the countries is likely to continue, with seasonal forecasts for July-August-September quarter indicating over 70 per cent probability of above normal average temperature in much of Europe , according o Copernicus Climate Change Services

www.downtoearth.org.in, July 11, 2025

AI breakthrough finds life-saving insights in everyday blood work

Study shows routine blood samples may give doctors early insights into injury severity and patient survival after spinal cord damage.AI-powered analysis of routine blood tests can reveal hidden patterns that predict recovery and survival after spinal cord injuries. This breakthrough could make life-saving predictions affordable and accessible in hospitals worldwide. Routine blood samples, such as those taken daily at any hospital and tracked over time, could help predict the severity of an injury and even provide insights into mortality after spinal cord damage, according to a study by Dr. Abel Torres Espín, a professor in Waterloo's School of Public Health Sciences. The research team utilized advanced analytics and machine learning, a type of artificial intelligence, to assess whether routine blood tests could serve as early warning signs for spinal cord injury patient outcomes. "This foundational work can open new possibilities in clinical practice, allowing for better-informed decisions about treatment priorities and resource allocation in critical care settings for many physical injuries" Dr. Abel Torres Espín.

www.sciencedaily.com, September 23, 2025

Diabetes Drug has Anti-Ageing Effect on Chromosomes

A drug prescribed to people with type-2 diabetes can do more than just lowering blood sugar- it also helps to slow cellular ageing, according to a clinical trial. The drug henagliflozin helps the body to flush out excess glucose in the urine. The drug also promotes weight loss. Jie Zhang and his colleagues at the First Affiliated Hospital of Nanchang University in China tested the anti-ageing effects of henagliflozin in 142 people with type 2 diabetes. The team measured the length of telomeres protective DNA sequences on the ends of chromosomes that shorten with age-in participants white blood cells. After 26 weeks of this regimen, about 90%of participants in the henagliflozin group had significantly longer telomeres than at baseline , compared with nearly 66% of those in the placebo group. This observation by the researchers points to an effect of henagliflozin on anti-ageing.

Nature, Volume 645, pg 287, September 11, 2025

A modified hot glue gun can mend broken bones

Bones can repair themselves after small injuries, but if there is a void and the space needs to be filled with either graft or an artificial plug , the process requires preplanning and time for the surgery.-To solve the problem , Jung Seung Lee at Sungkyunkwan University in South Korea have developed a system that can be applied instantly in any trauma surgery. They modified a hot glue gun by reducing the temperature at which it operates from 100 C to around 60 C. They also made a material that acts as a bilogical glue-A mixture of hydroxypatite which makes up 59 per cent of the volume of normal human bones and a biodegradable thermoplastic called polycaprolactone. Surgeons can use the hot glue gun to fill bone voids in a matter of minutes during surgery , and bone cells are then able to span the gap and repair the injury over time. The researchers also found they could incorporate vancomycin and gentamicin, two antibacterial compounds , into filament to reduce the potential for infection. The drugs are released slowly and diffuse directly onto the surgical site over several weeks.

New Scientist, pg 11, September 13, 2025

A baby benefits from personalized gene editing in the clinic

An infant with an inherited life-threatening metabolic condition has responded to a tailored therapy that uses the gene-editing tool CRISPR to correct a specific mutation. Scientists have used a genome-editing technique called base editing to correct a mutation in a baby who had been diagnosed with a rare genetic disease. The bespoke therapy, in which the treatment was delivered through lipid nano particles, was developed in record time, as reported by Musunuru et al. through research work published in the journal TheNew England Journal of Medicine.

www.nature.com , August 19, 2025

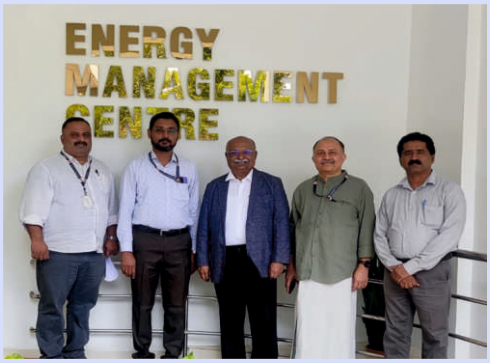
Easy on the Eyes: Specs Adjust at the touch of a Button

Researchers have devised a way to electronically switch the strength of a pair of glasses so that bifocal wearer can avoid the pesky head tilt needed to refocus their vision from near to far. Yi-Hsin Lin at the National Yang ming Chiao Tung University in Taiwan and her colleagues in their research by using lenses made of liquid crystals , which mobile phone screens use to turn light into images. The lenses can zoom in or out in response to changes in an electric field generated by battery powered electronics in the frames. With a gentle touch to the right temple, or arm of the glasses, users can retune their vision to focus on objects near or far . The researchers say the new technology has potential for mass production and might be especially useful for virtual- reality headsets.

Nature Volume 645, pg 287, September 11, 2025

Meetings and Visits of Director General, NAM S&T Centre

Meeting with Dr. R. Harikumar, Director, Energy Management Centre (EMC), Thiruvananthapuram, Kerala



Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre, New Delhi visited the Energy Management Centre, Ministry of Power, Govt. of Kerala, Thiruvananthapuram, Kerala during September 8-10, 2025 to participate in the International Workshop on "**Energy Efficiency, Conservation and Transition for Achieving Net Zero and Sustainable Development Goals**". During the visit, Dr. Bandopadhyay had wide ranging discussions with Dr. Harikumar, Director, EMC; Mr. Dinesh Kumar A. N., Joint Director, EMC; Mr. B.V. Subhash Babu, Registrar and other senior colleagues aimed at enhancing S&T collaborations with EMC and other partners regarding the Energy Sector and Climate Change related issues. During the meeting Mr. Sunil Kumar, Accounts Manager, NAM S&T Centre was also present.

Dr. Harikumar expressed keen interest in expanding the collaboration with the NAM S&T Centre. Dr. Bandopadhyay also suggested that NAM S&T Centre and EMC may enter into a Memorandum of Understanding (MoU) highlighting areas of future collaboration such as organizing scientific events on Energy, Climate Change, Net Zero and associated topics; joint publication of Books/Monographs and Fact Files and any other areas of mutual interest. Dr. Harikumar has agreed for signing a MoU and also for collaboration in the aforesaid areas. It was also agreed that the proposed MoU may be signed during the first week of February 2026 during the International Energy Festival of Kerala (IEFK).

It was also agreed that EMC and NAM S&T Centre will organize a Joint Workshop every alternate year just before the IEFK event starting February 2027. In addition, EMC has also agreed to prepare two Fact Files during 2026 preferably on – (1) Best Practices in Energy Conservation in the Global South; and (2) Technological Innovations in Energy Management for achieving Sustainable Development Goals.

Meeting with Prof. Dr. Hariyono, Rector, Universitas Negeri, Malang, Indonesia

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre, New Delhi visited Malang, East Java, Indonesia during September 22-25, 2025 to attend the International Training Workshop on "**STI Policy: Artificial Intelligence for Climate Learning Futures**" jointly organised by the International Science, Technology and Innovation Centre for South-South Cooperation under the auspices of UNESCO (ISTIC), Kuala Lumpur, Malaysia; Universitas Negeri Malang (UM), Indonesia and the NAM S&T Centre, New Delhi. During the visit Dr. Bandopadhyay had the opportunity to meet and discuss with Prof. Dr. Hariyono, Rector, UM, Malang; Prof. Markus Diantoro, Head of Research Centre and Community Engagement, UM and other senior University officials. During the discussion, possibilities of identifying areas of S&T collaboration between UM and the NAM S&T Centre were explored.

Dr. Bandopadhyay proposed to Prof. Markus that a joint Post Doctoral Fellowship offered by UM and the NAM S&T Centre and hosted by UM may be considered. The areas that are of interest to UM are related to UN Sustainable Development Goals-2030 namely SDG-2 (Zero Hunger); SDG-3 (Good Health and Well Being); SDG-4 (Quality Education); SDG-7 (Affordable and Clean Energy); SDG-8 (Decent Work and Economic Growth); SDG-12 (Responsible Consumption and Production) and SDG-17 (Partnership for the Goals). Based on the discussions and subsequent online meetings, UM and the NAM S&T Centre have already started working on developing **"Joint Post-Doctoral Fellowship Guidelines"** for taking this initiative forward.

In addition, the NAM S&T Centre will facilitate publication of an edited book on "STI Policy: Artificial Intelligence for Climate Learning Futures" based on the papers submitted by the presenters during the aforementioned event and other invited papers from subject experts.

(Contd. from Page 16 - Fellowship Reports.....)

Joint NAM S&T Centre – JSS AHER, Mysuru, India Fellowship Programme – 2024

Research Completion Report of Dr. Meera Jhoti Somanah Bhugowandeen, Senior Lecturer, University of Technology, Port Louis, Mauritius

Supervisor: Dr. Subbarao, Professor, Dept. of Biochemistry, JSS Medical College, **India**

Research Title: ***Investigation of the Polyphenolic Content and Antioxidant Activity of a Fermented and Non-Fermented Carica papaya Pulp Extract***

Mounting evidence demonstrating the implication of free radical-induced oxidative stress as the etiology of inflammation-induced diseases has sparked interest into natural sources of antioxidants that can be used as a practical and cheap approach to disease management in high-risk individuals.

This study, conducted under the 2024 Joint NAM S&T Centre–JSS AHER Mysuru Fellowship, although preliminarily aimed to gauge the use of yeast-based fermentation as a potential means of transforming local food produce into functional health foods, at the same time valorising the potential of a local variety of papaya. A comparison was conducted with a commercially available fermented papaya preparation (Immun'Age®) and fresh ripe papaya pulp.

Findings showed that fermentation boosted total phenol content almost 5-times (fermented: 2.574 mg GAE/100g FW vs. non-fermented: 0.480 mg GAE/100g FW), but both samples showed weak to non-detectable quercetin equivalents. Yeast fermentation rendered the glucose content almost 6 time superior to its non-fermented counterpart (fermented: 1034.537 g/100g FW vs. non-fermented: 174.276 g/100g FW). 2,2-diphenylpicryl-1-hydrazyl (DPPH) radical scavenging activity showed dose-dependent activity, where ethanolic extracts of ripe non-fermented papaya pulp were slightly superior to fermented extract (27.7% vs. 20.62%;) at highest concentration 500 mg/ml. Moreover, both extracts at 10 mg/ml exhibited BSA denaturation inhibitory capacity of 86%.

A Pearson's correlation analysis suggested the potency of both extracts of papaya to be strongly dictated by their total phenol content. Chromatographic analysis confirmed structural changes in both sugar and phenolic content post-fermentation.

Joint NAM S&T Centre – JSS AHER, Mysuru, India Fellowship Programme – 2025

Research Completion Report of Ms. Agustin Herliatika, M.Sc., Researcher, Research Centre for Animal Husbandry, National Research and Innovation Agency (BRIN), Indonesia

Supervisor: Dr. Ann Catherine Archer, Assistant Professor, Department of Microbiology, School of Life Sciences, JSS Academy of Higher Education and Research (JSS-AHER), Mysuru, Karnataka, India

Research Title: ***Effect of Starch and Direct Fed Microbial (DFM) Inclusion on Sheep's Rumen Microbial Characteristic: In-Vitro Study***

The six-week research under the Joint NAM S&T Centre – JSS AHER, Mysuru, India Fellowship Programme, 2025, investigated the impact of starch and microbial inclusion on microbial rumen ecology, feed efficiency and enteric methane emissions.

The microbial rumen ecology was identified using Next-Generation Sequencing (NGS). The feed efficiency was observed in true digestibility and short-chain fatty acids (SCFA) profile. The enteric methane emission was predicted using SCFA.

The sheep's rumen fluid collected from the slaughterhouse in Bannimantap, Mysuru,

(Contd. on page 18)

India, was used as the main microbiome source, and Indonesian local grass and Indian local grass were used as the control diet in the treatments. In addition, three microbiome inclusions (*Bacillus Subtilis*, *Bacillus Licheniformis*, and *Lactobacillus Plantarum*) and one starch source (*Coryphautan*) were used as feed modification factors.

Results of the study revealed that the inclusion of starch in Indonesian local grass improved the feed utility in sheep, while the addition of *Lactobacillus Plantarum* in Indian grass increased the true digestibility of the grass.

Research Completion Report of Mrs. Nur Syafiqah Farhanah, Ph.D. Scholar, Department of Chemical Engineering and Process, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Selangor, Malaysia

Supervisor: Dr. Siddesha J M, Assistant Professor, Division of Biochemistry, School of Life Sciences, JSS AHER, Mysuru, Karnataka, India

Research Title: ***Antibacterial and Phenytoin Drug Release Studies from Greenly Synthesized of Zinc Oxide using Syzygium cumini Leaf Peel Extract Nanocarrier***

This study, conducted under the 2025 Joint NAM S&T Centre–JSS AHER Mysuru Fellowship, holds potential to be a contribution to Sustainable Development Goal 3 (SDG-3), which is promoting healthy lives and well-being for all.

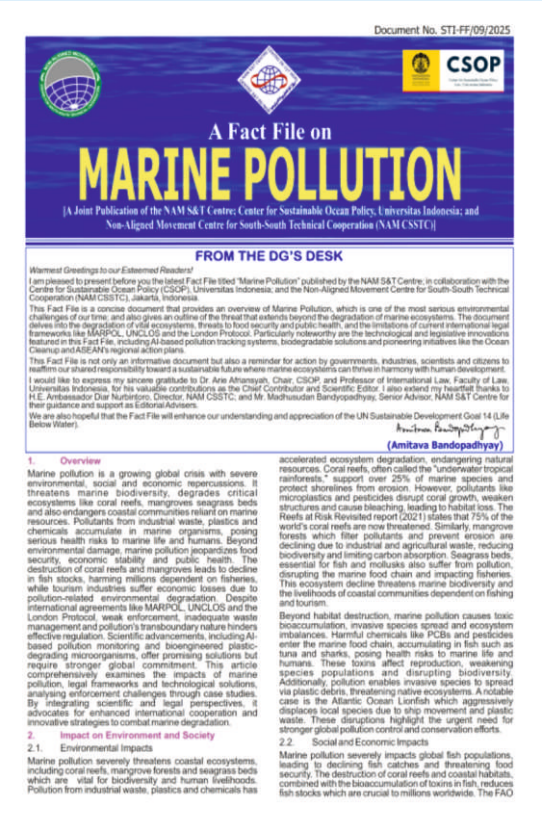
One of the most concerning complications during the wound healing process is bacterial infection. When an injury occurs, the damaged skin becomes highly vulnerable to microbial infections caused by *Staphylococcus aureus (S.aureus*) and *Klebsiella pneumoniae* (*K.pneumoniae*), which caused delay in the wound healing process. Recently, few studies have reported that phenytoin (PHT), a repositioned drug, had shown a significant potential as a therapeutic agent for diabetic wound healing. However, despite extensive research and clinical trials, the cytotoxicity of PHT for human use remains controversial that may cause adverse effects on the cardiovascular and nervous systems, making it hazardous to human health. Thus, encapsulation of PHT within a controlled drug delivery system, such as nanoparticles, offers a promising strategy to minimize off-target toxicity while enhancing therapeutic efficacy

In the current research, PHT was encapsulated in a drug delivery system made of green- synthesized zinc oxide nanoparticles (ZnO NPs) with *Syzygium cumini* (SC) leaf peel extract as the biogenic mediator. The physicochemical and biological characteristics of the resultant nano-carriers were rigorously tested. Structural confirmation of the NPs was conducted through Fourier Transform Infrared Spectroscopy (FTIR), while Dynamic Light Scattering (DLS) analysis provided hydrodynamic sizes within the range of 50.79–372.8 nm and zeta potential values between –19.78 and –27.81 mV. Encapsulation efficiency (EE%) of PHT-ZnO NPs/SC at mass ratios of 1:2.5 and 1:5.0 was determined to be 99.90% and 99.86%, respectively. Drug release profile revealed that PHT-ZnO NPs/SC (1:5.0) released higher cumulative drug release than PHT- ZnO NPs/SC (1:2.5) in 48 hours. Antibacterial analysis revealed that the minimum inhibitory concentration (MIC) of PHT-ZnO NPs/SC (1:5.0) against *S. aureus* and *K. pneumoniae* was 50µg/mL. In addition, disc diffusion assays revealed that the best antibacterial activity was displayed by the PHT-ZnO NPs/SC (1:5.0) formulation as indicated by an optimum zone of inhibition (ZOI) value compared to other formulations. Improved performance of this formulation can be explained by its smaller particle size, controlled drug release profile, and the incorporation of bioactive constituents from SC extract, which may provide more hydrogen bonding interactions with bacterial proteins to enhance antimicrobial activity.

In summary, PHT-ZnO NPs/SC (1:5.0) exhibited slightly better antibacterial effect than the other synthesized nanoparticles, making it the most efficient antibacterial agent used in this study. However, closer examination of their cytotoxicity, stability, and wound healing activity is a prerequisite to verify safety and therapeutic efficacy.

FACT FILE

Fact File: Marine Pollution



Document No. STI-FF/09/2025

CSOP

A Fact File on

MARINE POLLUTION

[A Joint Publication of the NAM S&T Centre; Center for Sustainable Ocean Policy, Universitas Indonesia; and Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC)]

FROM THE DG'S DESK

Warmest Greetings to our Esteemed Readers!

I am pleased to present before you the latest Fact File titled "Marine Pollution" published by the NAM S&T Centre; in collaboration with the Centre for Sustainable Ocean Policy (CSOP), Universitas Indonesia; and the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC), Jakarta, Indonesia.

This Fact File is a concise document that provides an overview of Marine Pollution, which is one of the most serious environmental challenges of our time; and also gives an outline of the threat that extends beyond the degradation of marine ecosystems. The document delves into the degradation of vital ecosystems, threats to food security and public health, and the limitations of current international legal frameworks like MARPOL, UNCLOS and the London Protocol. Particularly noteworthy are the technological and legislative innovations featured in this Fact File, including AI-based pollution tracking systems, biodegradable solutions and pioneering initiatives like the Ocean Cleanup and ASEAN's regional action plans.

This Fact File is not only an informative document but also a reminder for action by governments, industries, scientists and citizens to reaffirm our shared responsibility toward a sustainable future where marine ecosystems can thrive in harmony with human development.

I would like to express my sincere gratitude to Dr. Arie Afriansyah, Chair, CSOP, and Professor of International Law, Faculty of Law, Universitas Indonesia, for his valuable contributions as the Chief Contributor and Scientific Editor. I also extend my heartfelt thanks to H.E. Ambassador Diar Nurbintoro, Director, NAM CSSTC; and Mr. Madhusudan Bandyopadhyay, Senior Advisor, NAM S&T Centre for their guidance and support as Editorial Advisers.

We are also hopeful that the Fact File will enhance our understanding and appreciation of the UN Sustainable Development Goal 14 (Life Below Water).

(Amitava Bandopadhyay)

1. Overview

Marine pollution is a growing global crisis with severe environmental, social and economic repercussions. It threatens marine biodiversity, degrades critical ecosystems like coral reefs, mangroves seagrass beds and also endangers coastal communities reliant on marine resources. Pollutants from industrial waste, plastics and chemicals accumulate in marine organisms, posing serious health risks to marine life and humans. Beyond environmental damage, marine pollution jeopardizes food security, economic stability and public health. The destruction of coral reefs and mangroves leads to decline in fish stocks, harming millions dependent on fisheries, while tourism industries suffer economic losses due to pollution-related environmental degradation. Despite international agreements like MARPOL, UNCLOS and the London Protocol, weak enforcement, inadequate waste management and pollution's transboundary nature hinders effective regulation. Scientific advancements, including AI-based pollution monitoring and bioengineered plastic-degrading microorganisms, offer promising solutions but require stronger global commitment. This article comprehensively examines the impacts of marine pollution, legal frameworks and technological solutions, analysing enforcement challenges through case studies. By integrating scientific and legal perspectives, it advocates for enhanced international cooperation and innovative strategies to combat marine degradation.

2. Impact on Environment and Society

2.1. Environmental Impacts

Marine pollution severely threatens coastal ecosystems, including coral reefs, mangrove forests and seagrass beds which are vital for biodiversity and human livelihoods. Pollution from industrial waste, plastics and chemicals has accelerated ecosystem degradation, endangering natural resources. Coral reefs, often called the "underwater tropical rainforests," support over 25% of marine species and protect shorelines from erosion. However, pollutants like microplastics and pesticides disrupt coral growth, weaken structures and cause bleaching, leading to habitat loss. The Reefs at Risk Revisited report (2021) states that 75% of the world's coral reefs are now threatened. Similarly, mangrove forests which filter pollutants and prevent erosion are declining due to industrial and agricultural waste, reducing biodiversity and limiting carbon absorption. Seagrass beds, essential for fish and molluscs also suffer from pollution, disrupting the marine food chain and impacting fisheries. This ecosystem decline threatens marine biodiversity and the livelihoods of coastal communities dependent on fishing and tourism.

Beyond habitat destruction, marine pollution causes toxic bioaccumulation, invasive species spread and ecosystem imbalances. Harmful chemicals like PCBs and pesticides enter the marine food chain, accumulating in fish such as tuna and sharks, posing health risks to marine life and humans. These toxins affect reproduction, weakening species populations and disrupting biodiversity. Additionally, pollution enables invasive species to spread via plastic debris, threatening native ecosystems. A notable case is the Atlantic Ocean Lionfish which aggressively displaces local species due to ship movement and plastic waste. These disruptions highlight the urgent need for stronger global pollution control and conservation efforts.

2.2. Social and Economic Impacts

Marine pollution severely impacts global fish populations, leading to declining fish catches and threatening food security. The destruction of coral reefs and coastal habitats, combined with the bioaccumulation of toxins in fish, reduces fish stocks which are crucial to millions worldwide. The FAO

Marine pollution has emerged as one of the most pressing environmental crises of our time, posing profound ecological, social and economic challenges. It threatens marine biodiversity, degrades vital ecosystems such as coral reefs, mangroves and seagrass beds, and endangers millions of people who depend on marine resources for their livelihoods. Industrial waste, plastics and chemical pollutants accumulate in marine organisms, leading to toxic bioaccumulation, species decline and serious health risks for humans. Beyond its environmental impact, marine pollution undermines food security, disrupts fisheries, damages tourism industries and increases public health costs worldwide.

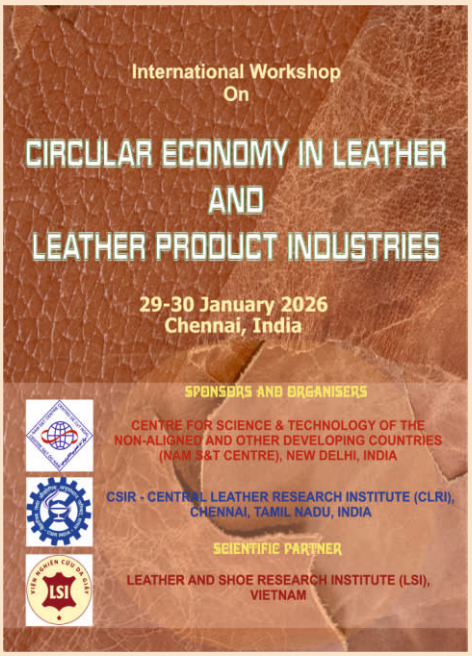
Despite the existence of various international frameworks their enforcement remains weak due to jurisdictional complexities, inadequate waste management systems, and the trans-boundary nature of marine pollution. However, recent scientific and technological advances—such as AI-based pollution monitoring, bioengineered plastic-degrading microorganisms and large-scale cleanup initiatives offer promising new tools for global mitigation.

Recognizing the urgency of this issue, the NAM S&T Centre, in collaboration with the Centre for Sustainable Ocean Policy (CSOP), Universitas Indonesia, and the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC), Jakarta, Indonesia**,** has released its ninth **Fact File** titled "**Marine Pollution**". This Fact File provides a comprehensive overview of the causes, consequences and solutions to marine pollution, examining both environmental and socio-economic dimensions. It also evaluates international legal frameworks and presents innovative scientific and policy responses, highlighting success stories such as Kenya's plastic bag ban, Indonesia's National Action Plan on Marine Debris, and ASEAN's regional initiatives. The document underscores the shared global responsibility to safeguard marine ecosystems and aligns with the United Nations Sustainable Development Goal 14 (Life below Water), promoting a sustainable future where oceans can thrive alongside human progress.

The Fact File has been conceptualized and edited by Dr. Arie Afriansyah, Chair, CSOP, and Professor of International Law, Faculty of Law, Universitas Indonesia, Indonesia. H.E. Ambassador Diar Nurbintoro, Director, NAM CSSTC, Indonesia and Mr. Madhusudan Bandyopadhyay, Senior Advisor, NAM S&T Centre, India served as Editorial Advisers.

Centre Announces

International Workshop on
CIRCULAR ECONOMY IN LEATHER AND LEATHER PRODUCT INDUSTRIES
January 29-30, 2026
Chennai, India



Global leather industry encompassing leather, footwear and leather garments, holds a significant position in international trade and manufacturing. Leather is valued for its durability, aesthetic appeal and versatility, making it a key raw material for various end-use sectors including fashion, automotive, furniture and accessories. Countries such as India, China, Italy, Vietnam and Brazil are among the top producers and exporters, contributing significantly to the global supply of leather and leather products. The sector plays a crucial role in employment generation, particularly in developing economies where micro, small and medium enterprises (MSMEs) dominate the value chain.

Despite its economic importance, the leather industry faces increasing scrutiny due to its environmental footprint. Traditional leather processing methods consume large volumes of water, chemicals and energy, and also generate significant amounts of solid and liquid waste containing hazardous substances such as chromium, sulfides and organic matter. Additionally, leather off-cuts, trimmings and defective products are often discarded without adequate valorization.

As global markets and consumers shift towards environmentally safe products and practices, there is a pressing need for the leather and leather product industries to adopt sustainable and circular models. A "Circular Economy" approach seeks to redesign production and consumption systems to keep materials in use for as long as possible, minimize waste and regenerate natural systems.

Considering the importance of the above mentioned issues, **the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India**; and **CSIR-Central Leather Research Institute (CLRI), Chennai, India** is jointly organizing an International Workshop on **"Circular Economy in Leather and Leather Product Industries"** during **29 - 30 January 2026** in **Chennai, India**. The **Leather and Shoe Research Institute (LSI), Hanoi, Vietnam** will participate as **a Scientific Partner**, bringing its extensive expertise in sustainable leather processing and footwear manufacturing to support the goals of the Workshop.

The Workshop Programme has been primarily designed for scientists, technologists, researchers, academicians, industry representatives and policymakers working in the relevant areas of leather, leather products, footwear and footwear components.

Experts and scientists desirous of participating in the Workshop, except those from India, should submit their application ***electronically*** directly to the **NAM S&T Centre (namstcentre@gmail.com)**, latest by **November 28, 2025.**

Applicants from India should, however, submit their requests to the CSIR - Central Leather Research Institute, Chennai (Tamil Nadu), India.

For further details, please visit Centre's Website: www.namstct.org

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