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FROM THE DG'S DESK

Warmest Greetings!!

Hope all is well with you, your families and other colleagues.

As we all are aware, all of us are going through an unprecedented medical emergency and socio-economic disruption due to the outbreak of the "COVID-19 Pandemic". We are hopeful that the global S&T capabilities of scientists and technologists will soon result into sustainable solutions to this problem by developing effective vaccines, drugs and other treatment protocols. However, we at the NAM S&T Centre are trying to do as best as we can to maintain professional interactions and exchange of information electronically with our Focal Points and the scientific community in our Member Countries as well as other developing countries.

I am happy to inform all of you that our esteemed Member Country, the Kingdom of Cambodia has ratified the Statute of the Centre in April 2020. I hope that other Members which have not yet ratified the Statute will complete the process very soon.

The readers may recall our report published in the October – December 2019 issue of this Newsletter on the International Training Course on "Science, Technology & Innovation (STI) Diplomacy" that was organised by the NAM S&T Centre in partnership with the Department of Science & Innovation (DSI), South Africa and the Academy of Science of South Africa (ASSAf) in November – December 2019 in Pretoria. The DSI has now circulated a Pretoria Statement/Recommendations for South-South Cooperation on STI Diplomacy which was prepared with consensus of all the participants of the Course. The document proclaims a common vision of STI Diplomacy in the future, emphasises the benefits STI can bring in tackling the common challenges of the Global South and outlines the principles needed to foster STI Diplomacy worldwide. A copy of the document has been published in this issue for its wider dissemination.

We have also included three invited scientific articles in this issue on Technopreneurship, Science Communication and Marine Science Research & Ocean Governance.

The Centre has proposed to publish a series of Monographs on various S&T topics that are of immediate concern for the developing countries. The first ever such Monograph would be on Lightning Protection titled "Lightning: Understanding Science, Engineering and Economic Implications for Developing Countries" which has been edited by Dr. Chandima Gomes, Professor, University of the Witwatersrand, South Africa. Eminent experts from Bangladesh, Brazil, France, Germany, India, Mexico, South Africa, Sweden and USA have contributed 12 chapters on various themes including lightning science research, protection of buildings and structures and power systems, lightning detection and warning, etc. I am happy to mention that the Centre has signed an agreement with the reputed publishing house, Springer Nature, Singapore, which has agreed to publish this Monograph that is expected to be brought out in printed form by December 2020.

The Centre welcomes Amity Foundation for Science, Technology & Innovation Alliances (AFSTIA), NOIDA, India and CSIR-National Metallurgical Laboratory (CSIR-NML), Jamshedpur, India as new Members of the NAM S&T - Industry Network.

During the last quarter, the Centre has published one book titled "Drug Development from Natural Resources: Scope and Challenges" which has been edited by Dr. SubbaRao V. Madhunapantula of India.

Due to lockdown and restrictions on international travel during the current Corona Virus crisis, the Centre is currently not in a position to organise scientific events in different countries as was done earlier. However, we are exploring the possibilities to organize our programmes through video conferencing in collaboration with our Member Countries. The Centre has announced the organisation of an International Conference on "Climate Change Adaptations in Dryland Agriculture in Semi-Arid Areas" (in Virtual-Mode) during 21 - 23 July 2020, jointly with Great Zimbabwe University, Masvingo, Zimbabwe and the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Developments, Zimbabwe.

In addition, an International Training Program on "Lightning Protection: Defence Against the Killer from the Blue" will also be organised in virtual-mode by the Centre jointly with the Center of Excellence on High Voltage Engineering, University of the Witwatersrand, South Africa on 26 August 2020. We are also trying to organise other Conferences / Workshops and Training Programmes through Virtual Mode during the Corona Virus crisis. We will request your whole hearted cooperation, support and participation in these virtual events during the upcoming months.

Stay Safe and Happy Reading!!

Amitava Bandopadhyay

(Amitava Bandopadhyay)
Director General

Centre Welcomes

Amity Foundation for Science, Technology & Innovation Alliances (AFSTIA), NOIDA, India as a New Member of the NAM S&T - Industry Network

The NAM S&T Centre warmly welcomes the Amity Foundation for Science, Technology & Innovation Alliances (AFSTIA) (www.amity.edu), NOIDA, India as an esteemed Member of the NAM S&T - Industry Network.

The Amity Group of Educational Institutions is a leading Private Education Group. Amity Group of Educational Institutions has already established 10 Universities, 150+ Institutions, 25 Schools & Preschools with more than 150,000 students covering an area of over 1000 Acres in India and abroad including United Kingdom (London), United States of America (New York), UAE (Abu Dhabi), Singapore, South Africa, Mauritius, China, Romania, The Netherlands (Amsterdam) and Uzbekistan.

Amity's focus on path-breaking research and innovations in Science & Technology, a globally benchmarked infrastructure and innovative teaching have resulted in Amity Universities emerging among the most sought-after education destinations. It figures in top 3% of the world universities in QS and Times Higher Education (THE) rankings and has been given A+ grade by the Indian National Assessment and Accreditation Council (NAAC).

Amity Science, Technology & Innovation Foundation (ASTIF) is the umbrella body of the Amity Education Group for promoting and facilitating research and innovation in science, technology and innovation in all Amity universities. In this Knowledge Era, Amity University has emerged as a Research & Innovation Driven University. Amity has undertaken over 350 projects funded by leading government and non-government organizations and international funding agencies such as MoEF, DST, CSIR, DBT, ICMR, ICAR, DRDO, Bill & Melinda Gates Foundation, Leverhulme Trust of UK and USAID. State of the art research infrastructures have been created, both through Government funded and S&T departments as well as through Amity resources. Amity is an innovation oriented group of educational institutions and has so far filed about 1250 patents. The Scientists and Researchers of Amity University pursue research activities tirelessly, and publish their work in reputed, peer-reviewed refereed journals with high impact factor. Amity researchers have published over 20,000 research publications such as research papers, articles, books/ chapters in journals such as Cell, Lancet, ACS, Oxford Journals, Nature Publishing group, RSC Advances, Taylor & Francis, Springer, Elsevier, Wiley Publishing etc. Amity faculty have developed over 2000 case studies which have been referred by leading institutions such as Harvard, MIT, Oxford, Stanford, etc.

Some of the technologies which have been transferred recently to Industries include Rootonics: a plant root fungus which has close to 'magical' benefits for Crops, Biodegradable Plastic, Milk Adulteration Detection Kit, Photocatalytic Wastewater Treatment of Textile and Dyeing Industry, Nanomaterials for Dye Removal in Water, Iodine Based Finger Print Powder for Developing Latent Fingerprint, LPG Sensor, Herbal Mosquito Repellent, Rechargeable Fly Ash Battery and Herbal Colors.

The University has also made concerted efforts to strengthen Research & Innovation activities as evidenced by the Amity Innovation Incubator supported by DST, DST-Technology Enabling Center (TEC), NRDC-Amity Innovation Facilitation Centre, Amity Center for Entrepreneurship Development, etc.

Centre Welcomes

CSIR-National Metallurgical Laboratory, Jamshedpur, India as a New Member of the NAM S&T - Industry Network

The NAM S&T Centre warmly welcomes the CSIR-National Metallurgical Laboratory, Jamshedpur, India, as an esteemed Member of the NAM S&T - Industry Network.

CSIR-National Metallurgical Laboratory (CSIR-NML) (www.nmlindia.org) is a premier Indian research organisation dedicated to various facets of Minerals, Metals and Materials – science, technology, industrial services and human resource development. Since inception, CSIR-NML has diversified its research areas ranging from extractive metallurgy, alloy development and import substitution, refractory material development, corrosion studies, mathematical and physical modeling of metallurgical processes, mineral research, advanced materials and materials tailoring, integrity evaluation of critical industrial components, surface engineering and cleaner and sustainable metals production. The Laboratory has made notable contributions in the areas of mineral beneficiation and agglomeration, ferrous and nonferrous metallurgy, alloy development and processing, materials science & engineering and, resource conservation & environment. A historical accounts of past achievements (1950-2010) of CSIR-NML is painted in the Diamond Jubilee commemorative volume 'la vintage metallurgie: 60 years of marriage of science to industry' (http://eprints.nmlindia.org/4360/).

CSIR-NML continues to play a vital role in the quest of the country towards scientific and technological leadership and providing scientific solutions to the industries in the areas of minerals, metals and materials. CSIR-NML is also carrying out major activities for creating awareness among the common masses on issues relating to health, environment, rural technology and sustainable development. With a strong and committed staff having a wide-spectrum of expertise and modern facilities, CSIR-NML has completed 70 glorious years of existence and still endeavours to move ahead to meet the challenges of the global economy and reach greater heights.

The Laboratory has kept pace with changing research scenarios and needs of the country. In the last few years, greater emphasis is given to industry sponsored research and, alignment with government program; namely, Make in India; Innovate in India; Strategic Sector Needs; Swatch Bharat; Societal and Skill India, etc. The activities of the Laboratory touch upon several major sectors relevant to the growth of India, including iron and steel, power and energy, oil and gas, automotive, railways, strategic, societal, and others.

CSIR-NML envisions becoming a self-reliant, self-sufficient R&D laboratory by continuing to provide feasible and sustainable solutions to the industries in the areas of metals, minerals and minerals. The laboratory strives to recreate its niche in the areas relevant for empowering the evolving India via catering to the needs of modern India.

THE PRETORIA STATEMENT/RECOMMENDATIONS FOR SOUTH-SOUTH COOPERATION ON STI DIPLOMACY

December 2019

PREAMBLE

Worldviews are increasingly becoming harmonious in the belief that science, technology and innovation (STI) diplomacy is flourishing as the main mechanism towards the improvement of infrastructure, enhancing education systems, addressing health challenges and a myriad of other developmental factors facing countries. This projection has progressed increasingly from emphasis and focus on the internationalisation of science towards the internationalisation of STI. Consequently, knowledge driven innovation is upscaling gradually as a growth factor in economies in the developed world. The challenges that confront the Global South (developing world) are transboundary, international, or global in context and requires the application of STI diplomacy to alleviate societal challenges.

In the last decade, STI diplomacy has gained a lot of traction in the Global South. These countries advocate for a new perspective on STI diplomacy, one that reflects their diverse histories and different developmental needs. Evidently, STI diplomacy is embedded into many countries' foreign policies and international relations because scientific cooperation benefits both the technical and political interactions between nations. In the age of the global knowledge economy, STI diplomacy has become an important vehicle for strengthening South-South relations. Moreover, the Global South needs to deepen the pursuit of scientific collaboration, joint generation of knowledge, and the use of innovative technology for socio-economic benefits. Various/multiple in-country, regional and worldwide policy documents critically outline a greater need for effective engagements and partnerships between scientists, policymakers and diplomats to attain set goals.

INTRODUCTION

The South African Department of Science and Innovation (DSI) and the Academy of Science of South Africa (ASSAf) partnered with the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre) to host a training course on STI Diplomacy. As a result of fruitful discussions during the workshop, this *"PRETORIA RECOMMENDATIONS FOR SOUTH-SOUTH COOPERATION ON STI DIPLOMACY"* was established by a group of high-level experts who participated in the workshop. It proclaims a common vision of STI Diplomacy in the future, emphasises the benefits STI can bring in tackling the common global south challenges and outlines the principles needed to foster STI Diplomacy worldwide.

OBJECTIVES

The training course, in the context of this recommendation framework, sought to build bridges between science, technology and innovation practices, national and regional interests, as well as global south challenges. Working together, the purpose is:

- to provide practical measures on the utilisation of STI Diplomacy as an international scientific cooperation tool and policy instrument for the attainment of the United Nations' Sustainable Development Goals;
- to ensure the inclusion of STI diplomacy at the intersection of governance and civil society engagement;
- to build strong South-South cross-border networks to promote collaborative efforts for the next generation of STI diplomats in the global south wherein they will share and disseminate information, reach consensus on STI issues impacting their countries; and
- most importantly, encouraging the interface of STI diplomacy with global south foreign policies and national interest.

BENEFITS OF COLLABORATIVE SOUTH-SOUTH STI DIPLOMACY EFFORTS

- Jointly building competitive knowledge economies to accommodate the varying innovation systems in various countries and sharing lessons learnt by countries who have good systems (policies, governance support structures and strategies on STI) in place by hosting of/attending workshops or seminars and sharing information;

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- Ease of access to research and innovative infrastructures through twinning or exchange programmes;
- Establishing networks to generate ideas for technology development initiatives and global innovation value chains.

Conclusively, the STI Diplomacy Training Course participants recommend that the Global South should maximise efforts towards the strengthening of STI policies, initiatives, programmes and increased investments, aimed at the advancement of scientific cooperation. Researchers, scientists, innovators and entrepreneurs are at the centre of influencing global trends through competitive thinking and collaboration and deserves strong support. Evidence-based policies will create better conditions for STI collaboration and an increase in successful regional, national and foreign policy agendas. The partakers also advocate that in-country policies on STI in the Global South must be sharpened to enable science advice to influence the amendments of foreign policies that directly speak to how countries engage beyond their borders. There is great value for the citizens of our countries and opportunities for inclusion and impact results. The aforementioned recommendations were inferred and written by:

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Role of Technopreneurship in Achieving Sustainable Development Goals in Developing Countries

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In September 2015, the United Nations General Assembly launched the 2030 Agenda for Sustainability. The 2030 Agenda is a universal plan to preserve the planet, achieve prosperity and eradicate extreme poverty. Agenda 2030 demands cooperation of all countries and stakeholders to implement this plan successfully. Approval of the agenda by the General Assembly represents a commitment of all Members to work side by side in order to reduce poverty, heal and secure the earth. The agenda defined the Sustainable Development Goals (SDGs). Those goals address the global challenges we are facing e.g. poverty, inequality, climate changes environmental degradation, peace and justice. The UN has summarized these targets into 17 goals. All the 17 goals are interconnected and serve each other.

The United Nations (UN) is focusing on entrepreneurship as part of its endeavor of economic empowerment to achieve the SDGs and encourage young people to start their own business and create new job opportunities. Youth in most developing countries represents 15-20% of the population.[2] Encouraging entrepreneurship is considered an effective opportunity[1] to address unemployment, economic empowerment and sustainable socio-economic development, especially among the youth and women. The development of entrepreneurship was accelerated and advanced by the technological developments that offer novel alternatives to performing services and developing products, more efficiently and competitively. The innovation ecosystem ensures that people receive the necessary support for the development, implementation and commercialization of their ideas. In turn, this will be reflected on the success rate of entrepreneurs and hence, improvement of the economy in developing countries and a smooth transition into the era of knowledge-based economy.

Technopreneurship

Nowadays, the developments in science, technology and innovation is considered a fundamental competence for economic growth and wealth enlargement. It is important to determine the best way to harness and exploit knowledge and innovation. The accelerated progress of technology became an essential part of our lives. The emergence of technological innovations has opened up to new opportunities and challenges to a nation's economic development.[3]

The emergence of technology and the innovations, it brought, has opened up new opportunities and challenges into businesses. In this regard, technological adoption and advancement act as a channel to expand and accelerate the businesses as well as the people. Lalkaka defined technological innovation as the process that drives a concept towards a marketable product or service. This holds true as it contributes towards raising productivity and competitiveness.[4]

The term “Technopreneurship” was created from both words: “technology” and “entrepreneurship”. It describes what you acquire, when you merge entrepreneurship and technology. This is a process of using advances produced by science and knowledge to create innovations that can serve different aspects of our life. Technopreneurship requires creative and competent minds. Technopreneurship is a new model of entrepreneurship. It encompasses a coming together of people who are intelligent, driven, creative, tech-savvy, passionate and have a desire for calculated risk. By contrary entrepreneurship is seldom a one-man show – the success of technopreneurship depends on how well the team functions together. For a technopreneur, it is not as much about the money as it is about the verification that the 'idea' is a worthy one and that it works. The idea needs to work for the greater common good – it doesn't need to be a worldwide blockbuster. For this reason, Technopreneurship is an expensive exercise and technopreneurs need to work payless until their ideas become commercially feasible.

It is not often easy, and they have to persist, lead and motivate their team, raise funds, pitch their idea and get them to join forces. It is here that their past work experience and network becomes extremely useful. Quite often, technopreneurship starts with the customer experience and works backward to arrive at the technology and use it to provide a solution that is agreeable to customers. A technopreneur always learns and develops, innovates and disrupts the workings of other people. Today, if you don't have the Facebook or WhatsApp on your cell phone, people would think of you as an “Alien”.

Elon Musk is an example of the perfect role model of technopreneur, who is visionary, invests a lot to prove his concepts, use technology to change the life we are living for a better tomorrow. He owns a string of companies, which are well known of being disruptive to multiple industries. He is very inspiring to millions of youth around the world.

Policy Measures to Support Technopreneurship

Technopreneurship can be the magic wand, which is capable of changing life in the developing countries. Therefore, we must strive to boost technopreneurship. Promoting innovation and entrepreneurship should be a major concern for policymaker. Governments should play a role for encouragement of technopreneur. The support may be direct or indirect. Indirect support can be in the form of endorsing favorable regulations, legalizations and policies to create enabling ecosystem for technopreneurship and direct support through providing risk capital. One of the fundamental needs for successful technopreneurship is infrastructures.[5] Injecting risk capital is pivotal for technopreneurship, yet enormous involvements will lead to dependency on governmental assistance and hence weakness of the start-ups and affects its sustainability. Hence, any governmental aid for technopreneurship should be carefully designed to support technology development. One of the crucial factors for the success of technopreneurship is the need for the technology it provides by business firms. Technical experience alone is not enough, entrepreneurial skills and creativity training should be provided to technopreneurs.

There are additional policy measures that can augment the influence of technopreneurship to sustainable development.

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These measures will aid scaling up of their products and services through public private partnership or other innovative business models. In many of the developing countries there are regulatory obstacles, which hinder the technopreneurs from engagement in business. Therefore, policymakers must set a regulatory framework and adequate legalizations, which enhance the business environment for technopreneurs. Access to finance is critical for supporting innovation, providing necessary infrastructures e.g. incubators, accelerators. These types of programs will catalyze the development of sustainable business models.

Exchange of technology and innovation can nurture the technopreneurship. This will facilitate the exchange of good practices and magnify the impact of innovation, when they diffuse. Governments in developing countries may support the market demand to strengthen the utilization of innovations and promote its employment in the different sectors. Stakeholders in private sector should be involved for efficient use of innovation. Improving the awareness and expanding networks promote technopreneurship among different categories such as youth, women and other disadvantaged groups. Public and private partnerships promote effective dialogue between the different groups and will enable decision makers to implement better strategies for technopreneurship.

Technopreneurship Education and Sustainable Development

It is essential to guarantee that women, youth and other disadvantaged groups have fair access to education and relevant skills development trainings, which are mandatory to gain the desired competencies. There must be investment in education and training to improve the quality of student and allow them to get the in-demand skills. Curricula should be improved to focus on these skills needed for technopreneurship. Capacity building of the institutions to able to provide the relevant skills, mentoring and support for technopreneurs.

There is a huge shortage of entrepreneurship education and training in developing countries in contrast to western countries. Also, the research focus on environmental sustainability and innovation is not much, as there are no incentives for innovation. Instead researchers strive to publish and not to innovate.[6] There should be institutional reform and radical change in assessment of excellence in academia and scientific research to encourage searchers to engage more in eloquent research. It is advised to design the technopreneurial training in a way to connect with sustainable development to increase the awareness and open minds for learners in this area.[7] To enhance the sustainability, we need to foster the collaboration in areas related to the sustainable development goals through technopreneurship activities.[8] One of the challenges to efficient technopreneurship training in developing countries is shortage of adequate funding as well as qualified trainers. Using the poor traditional teaching methods decrease the quality of such technopreneurship training and hence its impact.

Potential Technologies

There are different technologies, which are expected to make big differences in our day-to-day life. Artificial intelligence, machine learning, augmented reality and virtual reality, blockchain technology, the Internet of Thing (IoT), 3D printing cloud computing, digital analytics and big data. These represent cutting-edge technologies and there a lot of work on-going to employee these technologies in different applications.

Conclusions

For successful technopreneurship, we need to think big, but we must start small. Ensure that we have smart strategies. We should not shame from failure, but we need to be persistent. Our asset is our team, we should engage younger staff and target younger customers. Ambitious technopreneurs must be satisfactorily outfitted with technical and business skills. We must work on our skills and benefit from the available quality trainings and aspire for continuous learning. Relevant, reliable, and competitive technologies are pre-requisite for a successful technology transfer.

The policies for developing technologies should be appropriately directed and their research and development capacity should be continuously upgraded. Hence, they will be able to create relevant technologies, which always suit user's needs, are technically reliable and cost-effectively competitive. Also, the business enterprises need to improve their absorbing capacity of new technologies. The technopreneurship will not only just fulfill the technological demand but it will improve the economy as a whole. It will be viable and be a major contributing factor to the realization of indigenous technologies to social and economic developments and will serve to achieve the sustainable development goals.

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Communicating Science – Changing Paradigms in the Pandemic

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The genre of science communication was perhaps put to its severest test in the recent times as the novel Coronavirus pandemic rolled in, swiftly spreading to more than 200 countries. The highly contagious disease has infected more than 6.5 million people worldwide and caused more than 3.8 lakh fatalities.

Although coronaviruses, also responsible for the common cold, have been studied and investigated for long, the 'novel' coronavirus, given the name SARS-CoV-2, is a new virus about which very little was known when it first struck in the beginning of this year. The speed and scale of spread of the disease caused by the novel coronavirus, COVID-19, was something never before witnessed in one's lifetime. In fact, in living memory no other event has led to most of the world shutting itself down under lockdowns and those that didn't suffered heavy casualties. It was this initial mystery about the virus and the mechanism by which it went on a rampage that created a scary situation worldwide.

While eventually reports and features on health came to be the most sought after, the initial 'information vacuum' led to widespread flow of misinformation that swept through predominantly social media channels. A host of unverified videos and unscientific health advices were being forwarded widely. These ranged from conspiracy theories that dubbed the virus a biological weapon to calling on people to keep the throat moist, take overdoses of vitamin C and avoid cold or preserved food and drinks for 90 days to keep the disease away. Fake videos and photos of several coronavirus victims lying dead in the streets of Wuhan in China have been shown to be false. When hand sanitization with 60% alcohol was promoted, rumours spread like wildfire that drinking absolute alcohol, or industrial alcohol, could easily kill the virus leading to the death of many people. And, of course, those peddling home remedies had a field day with garlic, turmeric and several unsubstantiated and untried concoctions being touted as sure-shot remedies against COVID-19.

The scale of this misinformation was mind-boggling prompting even the World Health Organisation (WHO) to call it an 'infodemic'. While WHO itself decided to post such myths and misinformation and debunk them on its website, several social media networks too started taking active steps to address false information about the coronavirus on their sites. For instance, Facebook employed fact checkers to review information about the coronavirus and even went to the extent of removing “false claims or conspiracy theories”. It also notified individuals trying to share information that had been flagged as false. With the number of tweets about the coronavirus reaching well over 15 million in four weeks, Twitter launched a prompt appearing when users searched for the coronavirus encouraging them to use official channels – the World Health Organization or Centres for Disease Control – for information. For coronavirus searches, YouTube said it was showing previews of text-based news articles and also promoting videos on it from credible sources. Reddit put a banner at the top of its home page directing users to authoritative resources about the outbreak. Google also started displaying information from the WHO about the virus in search results. While never before had such a concerted worldwide effort been made to combat the outbreak of a deadly virus, it was perhaps for the first time that organizations woke up to the menace of misinformation and the harm they could engender and also actively made efforts to counter the flood of misinformation on social media platforms.

Not all was gloomy though. An encouraging trend has also been observed these past few months. Medical research has made it to prime time news, boosting health reporting, over and above crime and political reporting, perhaps for the first time. Not only are audiences tuning into news networks for updates on news about the novel coronavirus, conversations on social media networks are also geared around talking about new drugs and vaccines being discovered. This could be an opportune moment to strengthen and promote health reporting and communication worldwide.

However, the skills and expertise of the health reporters and communicators has also been severely challenged during the course of the pandemic. The intriguing nature of the new virus and an evolving understanding of its sinister workings over time have seen many answers to several questions getting modified or corrected over time as new research results become known. For instance, while initially it was believed that putting on masks had no benefits, at a later point it emerged that masks could considerably check the spread of the virus among the populations.

But even today there are no clear answers to many issues and questions. While research results vary, opinions of experts too are divided. For instance, how long the lockdowns should be implemented or why some places in the world are witnessing high fatalities while others are not. Then, there are questions pertaining to immunity. How do you boost your immunity? Is high immunity enough to protect one against the effects of COVID-19? Will recovery from an infection confer lasting immunity? How long would such an immunity sustain? Can one get infected a second time? How long a run will this virus enjoy? How soon is it expected to go away? With the genome of the various strains being sequenced and investigations into the mechanism of working and effects of the virus still in progress in innumerable laboratories around the world, answers to many questions are still evolving, posing a major challenge for science communicators, writers and reporters.

Communicating uncertainties and risks is always a challenge. Apart from the need to exercise due diligence with respect to the available knowledge and information, it also calls for a whole lot of responsibility and sensitivity on the part of the communicator. An incidence based in Italy can be cited in this regard. When a committee of geologists was asked to investigate frequent tremors in a town called L'Aquila, after initial investigations they came up with a cryptic message for the townspeople to go home, relax and sip a glass of wine. The next day, however, the town was struck with a large earthquake in which more than 300 people lost their lives. The townspeople filed a case for manslaughter against the scientists, which of course was later set aside. However, the point was about responsible communication. Risk communication calls on scientists

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and communicators to share their expertise and communicate relevant information to help people make informed choices, rather than being casual in the manner they communicate with the public. The issue here perhaps is more about effective and sensitive risk communication than anything else. In fact, risk communication is a critically important part of overall risk management. It shapes public perception and defines people's responses when a disaster strikes.

Engagement with the public is a complex process. Communication of an idea, concept or scientific development does not just demand sufficient information and knowledge, it also demands enough sensitivity towards and understanding of the audiences. Besides, it is not just enough to dump information on to the audiences. It is also the responsibility of the communicator to provoke the audiences to reason, question and assess before accepting the information that has been presented. Once that happens, the increasing menace of fake news, misinformation and unscientific messages can be checked to a great extent.

The pandemic is not just a learning experience and a lesson in communicating evolving science and uncertainties but also in informing policy in times of uncertainties.

Incorporating Social-Ecological Systems Thinking in Marine Science Research and Ocean Governance

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The marine and coastal environment offers economic, social, health and cultural opportunities to human society but it also faces many challenges that require integrated management. Oceans support humans through a provision of food, seabed mineral resources, offshore energy developments and shipping opportunities, as well as marine and coastal based recreation. However, human activities such as climate change, pollution, habitat modification and overfishing pose serious threats to the above-mentioned marine ecosystem services. Addressing these issues can raise confusion and conflicts between scientific researchers, economists, policy makers and marine resource users due to the complex nature of the environment and the challenges faced. This complexity stems from the multiple-scaled interactions and feedback found within the social and ecological systems of this area (see Fig. 1). Berkes and Folke (1998) presented the inevitable link and integration between the social and ecological systems. The authors described a delineation between the two as artificial and arbitrary (Berkes & Folke, 1998). Thus, the need for an interdisciplinary approach to address the complex social-ecological issues in the marine and coastal environment.

There are some key ideas that benefit marine social-ecological system research for management (Charles, 2018). First is a set of values that underpin interdisciplinary ocean research. That is building consensus, prioritising the health and safety of ecosystems and communities, respect for human rights, and ecological sustainability to mention a few. Charles (2018) lists the idea of a systems approach to issues evident in the environment and setting biological, social and economic objectives when addressing the problems. Another idea is the collection of sufficient and problem-relevant data that can be converted into indicators to inform decisions in integrating marine policies.

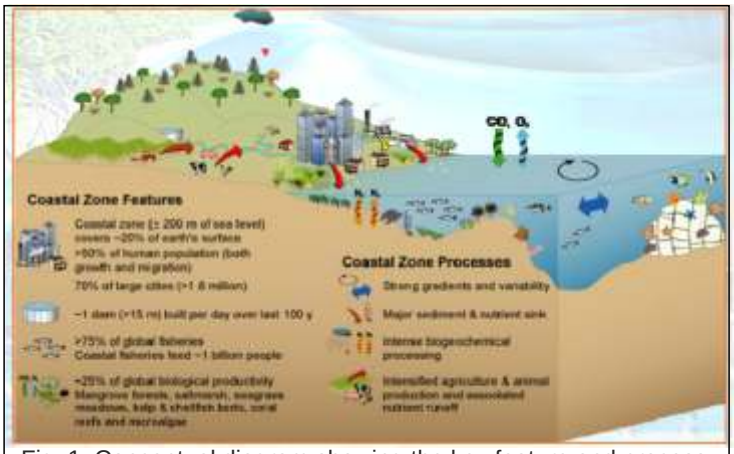

Fig. 1: Conceptual diagram showing the key feature and process in the coastal zones (taken from Le Tissier et al., n.d)

Such ideas have seen the adoption of the United Nations (UN) Sustainable Development Goals recognising the need for the inclusion of environmental goals and targets (e.g. SDG 13, 14 and 15) along with the social components such as poverty and hunger reduction, economic growth and technological development; the adoption of the UN Ocean Sciences Decade (2021-2030) recognising the oceans as integral to human well-being and providing a framework for a diverse array of stakeholders to participate; and the development of the Blue Economy concept to help frame the development of the oceans in a sustainable (both economically and environmentally), equitable and inclusive manner. These developments call for new ways of systems thinking and management methods.

There have been substantial advances in our understanding of integrated environmental management approaches. The consideration of a full array of interaction within an ecosystem, including humans, instead of the isolated consideration of a single species or issue is one of the commonly accepted environmental management approaches called the Ecosystem-Based Management (EBM) (Long et al., 2015). It is argued that EBM could help to build resilience of social and ecological ecosystems to environmental change (Ruckleshaus et al., 2008). Frameworks linking the social and ecological systems (SES) have been made for specific purposes such as the fisheries management (Charles, 2001), traditional management (Berkes et al., 2003), and analysis of sustainability of SES (Ostrom, 2009) and community conservation (Berkes et al., 2016).

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The wide-ranging issues and scales (as suggested by the SES frameworks) at which the EBM approach can be applied shows that finding a solution to problems faced by the oceans can be a complex and adventurous task.

Against this background, it is clear that EBM can be used even in the case of climate change and variability problems such as sea-level rise, coastal flooding, increased frequency and intensity of extreme events, and changes in marine ecosystems. These problems affect economies and livelihoods at all biophysical and social scales. Consequently, a social-ecological system would need to be clearly defined in terms of 1) the problem to be addressed, 2) the stakeholders involved 3) and the scales at which the problem will be addressed. This article will define a coastal social-ecological system under pressure of climate change and variability to demonstrate how EBM may be applied.

Ecosystem-Based Management Approach in Small-scales Fisheries

Climate change and variability can have a significant impact on marine ecosystems functions and structures. In turn, the fisheries livelihood would be affected. To define a social-ecological system for a hypothetical case study, the problem to be addressed would be the ecosystem impact of increased Sea Surface Temperature (SST). The stakeholders involved to find a solution to this problem would be the scientific researchers, small-scale fishers, and government representatives mandated to manage the fisheries resources. While navigating the implementation of the EBM to find solutions to this complex problem, a strong emphasis is placed on the role of society in the process. Charles (2014) suggests that the human dimension needs to be visible at all the implementation stages of the EBM; that is the inducing, influencing and supporting stages of the process.

The need for engagements and conversations among the stakeholders in these stages is inevitable as solutions to this problem need to go beyond the fish but also consider the livelihoods of those who are dependent on the marine resources and the sustainability of this social-ecological system. In a similar study, Duba (2020) explored climate change and variability in South Africa from the perspective of a local fisheries community, as well as from the scientist's perspective. Marine resource users in fishing communities along the coast of South Africa often show long term dependence on the neighbouring ocean, in this case going back at least three generations. This community provided long term, rich, detailed, and contextualized environmental knowledge from their daily interactions with the sea. The results from the study revealed the impacts of climate change in marine ecosystems from the socio-economic, governance and ecological dimensions. Moreover, the fishers showed willingness to collaborate with scientific experts for research and management of the marine ecosystem as long as their socio-economic well-being is not compromised. These findings could serve as a crucial base for society to influence the EBM process through an establishment of trade-offs such as closure of the most threatened species and diversifying their fisheries in the region. In this way, an environment for the ecosystem to cope with the threat is enabled, allowing the possibility that the structure and the function of the ecosystem would be maintained.

While EBM is not the only management approach, it does allow for broad stakeholder engagement and scaling-up to provide an integrated approach to managing our marine spaces. As highlighted in the case study (and ongoing international initiatives) different voices need to be included in the decision-making processes and this approach provides a mechanism for the inclusion of the lived realities of the local communities.

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Science, Technology & Innovation News

SPACE TECHNOLOGY

Magnetic Field Force New Perspective on Milky Way Galaxy's Black Hole

Observations from Stratospheric Observatory for Infrared Astronomy (SOFIA) indicate that the magnetic field near our galaxy's core is strong enough to control the material moving around the black hole, even in the presence of the black hole's enormous gravitational forces.

The research, presented on June 3, 2020 at a meeting of the American Astronomical Society, could help answer longstanding mysteries about why our black hole is relatively quiet compared to others, and why the formation of new stars in our galaxy's core is lower than expected.

Using its newest infrared instrument to study celestial dust grains, which align perpendicular to magnetic field lines, SOFIA was able to produce detailed maps of our galactic center, showing the behaviour of these otherwise invisible magnetic fields around the black hole.

"There are still aspects of our galaxy's black hole that we can't explain with gravity alone," said Joan Schmelz, Director at the Universities Space Research Association in Columbia, Maryland and Senior Science Advisor, SOFIA. "Magnetic fields may be able to help solve these mysteries."

Scientists have often relied on gravity to explain their results because measuring celestial magnetic fields is extremely challenging. But the data from SOFIA now compel scientists to consider their role. We know that magnetic fields in the Earth's magnetosphere protect us from high-energy particles coming from the Sun. They also control the plasma of the solar atmosphere, called the corona, where they create dramatic loops and powerful flares.

SOFIA found that the magnetic field near the galactic center may be strong enough to control matter in a way that's similar to the solar corona.

Studying magnetic fields in the far reaches of the galaxy and beyond requires remote observations by telescopes like SOFIA. Flying at an altitude of 45,000 feet, above 99% of the Earth's water vapour, SOFIA is able to capture a unique view of the infrared universe, while landing after each flight so that it can be upgraded with the latest technology. For this result, SOFIA used the High-resolution Airborne Wideband Camera-Plus, or HAWC+ instrument, which was built at NASA's Jet Propulsion Laboratory in Pasadena, California, to study magnetic fields.

Source: www.nasa.gov

PUBLIC HEALTHCARE

Reverse Transcription Polymerase Chain Reaction (RT-PCR)

Real time RT–PCR is a nuclear-derived method for detecting the presence of specific genetic material in any pathogen, including a virus. Originally, the method used radioactive isotope markers to detect targeted genetic materials, but subsequent refining has led to the replacement of isotopic labelling with special markers, most frequently fluorescent dyes. This technique allows scientists to see the results almost immediately while the process is still ongoing, whereas conventional RT–PCR only provides results at the end of the process.

Real time RT–PCR is one of the most widely used laboratory methods for detecting the COVID-19 virus. While many countries have used real time RT–PCR for diagnosing other diseases, such as Ebola virus and Zika virus, many need support in adapting this method for the COVID-19 virus, as well as in increasing their national testing capacities.

To understand this, it's important to understand what is Virus. A virus is a microscopic package of genetic material surrounded by a molecular envelope. This genetic material can be either deoxyribonucleic acid (DNA) or ribonucleic acid (RNA). DNA is a two-strand molecule that is found in all organisms, such as animals, plants and viruses, and which holds the genetic code, or blueprint, for how these organisms are made and develop, while an RNA is generally a one-strand molecule that copies, transcribes and transmits parts of the genetic code to proteins so that they can synthetize and carry out functions that keep organisms alive and developing. Different variations of RNA are responsible for copying, transcribing and transmitting.

Some viruses such as the coronavirus (SARS-CoV-2), which causes COVID-19, only contain RNA, which means that they rely on infiltrating healthy cells to multiply and survive. Once inside the cell, the virus uses its own genetic code — RNA in the case of the COVID-19 virus — to take control of and 'reprogramme' the cells, turning them into virus-making factories.

In order for a virus like the COVID-19 virus to be detected early in the body using real time RT–PCR, scientists need to convert the RNA to DNA. This is a process called 'reverse transcription'. They do this because only DNA can be copied — or amplified — which is a key part of the real time RT–PCR process for detecting viruses.

Scientists amplify a specific part of the transcribed viral DNA hundreds of thousands of times. Amplification is important so that, instead of trying to spot a minuscule amount of the virus among millions of strands of genetic information, scientists have a large enough quantity of the target sections of viral DNA to accurately confirm that the virus is present.

A sample is collected from the parts of the body where the COVID-19 virus gathers, such as a person's nose or throat. The sample is treated with several chemical solutions that remove substances such as proteins and fats and that extract only the RNA present in the sample. This extracted RNA is a mix of the person's own genetic material and, if present, the virus's RNA.

The RNA is reverse transcribed to DNA using a specific enzyme. Scientists then add additional short fragments of DNA that are complementary to specific parts of the transcribed viral DNA. If the virus is present in a sample, these fragments attach themselves to target sections of the viral DNA. Some of the added genetic fragments are used for building DNA strands during amplification, while the others are used for building the DNA and adding marker labels to the strands, which are then used to detect the virus.

The mixture is then placed in an RT–PCR machine. The machine cycles through temperatures that heat and cool the mixture to

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trigger specific chemical reactions that create new, identical copies of the target sections of viral DNA. The cycle is repeated over and over to continue copying the target sections of viral DNA. Each cycle doubles the previous number: two copies become four, four copies become eight, and so on. A standard real time RT–PCR set-up usually goes through 35 cycles, which means that, by the end of the process, around 35 billion new copies of the sections of viral DNA are created from each strand of the virus present in the sample.

As new copies of the viral DNA sections are built, the marker labels attach to the DNA strands and then release a fluorescent dye, which is measured by the machine's computer and presented in real time on the screen. The computer tracks the amount of fluorescence in the sample after each cycle. When a certain level of fluorescence is surpassed, this confirms that the virus is present. Scientists also monitor how many cycles it takes to reach this level in order to estimate the severity of the infection: the fewer the cycles, the more severe the viral infection is.

Source: www.iaea.org

Pulse Oximetry

Pulse Oximetry is a test used to measure the oxygen level (oxygen saturation) of the blood. It is an easy, painless measure of how well oxygen is being sent to parts of your body furthest from your heart, such as the arms and legs.

A clip-like device called a probe is placed on a body part, such as a finger or ear lobe. The probe uses light to measure how much oxygen is in the blood. This information helps the healthcare provider decide if a person needs extra oxygen.

Pulse Oximetry may be used to see if there is enough oxygen in the blood. This information is needed in many kinds of situations. It may be used:

- During or after surgery or procedures that use sedation
- To see how well lung medicines are working
- To check a person's ability to handle increased activity levels
- To see if a ventilator is needed to help with breathing, or to see how well it's working
- To check a person has moments when breathing stops during sleep (sleep apnea)

Pulse Oximetry is also used to check the health of a person with any condition that affects blood oxygen levels, such as: Heart Attack, Heart Failure, Chronic Obstructive Pulmonary Disease (COPD), Anemia, Lung Cancer, Asthma, Pneumonia

All procedures have some risks. The risks of this procedure may include:

- Incorrect reading if the probe falls off the earlobe, toe, or finger
- Skin irritation from adhesive on the probe

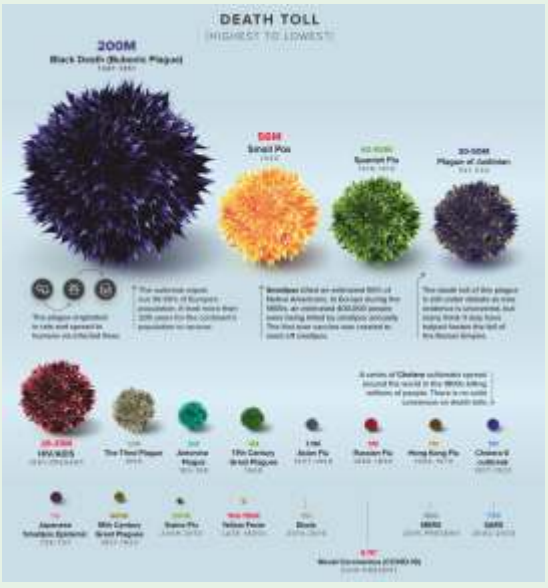
However, the way the procedure is done may vary. It depends on your condition and your healthcare provider's methods. In most cases, Pulse Oximetry will follow this process:

1. A clip-like device called a probe will be placed on your finger or earlobe. Or, a probe with sticky adhesive may be placed on your forehead or finger.
2. The probe may be left on for ongoing monitoring.
3. Or it may be used to take a single reading. The probe will be removed after the test

Source: www.hopkinsmedicine.org

Timeline of Pandemic

Disease and illnesses have plagued humanity since the earliest days, our mortal flaw. However, it was not until the marked shift to agrarian communities that the scale and spread of these diseases increased dramatically. Widespread trade created new opportunities for human and animal interactions that sped up such epidemics. Malaria, tuberculosis, leprosy, influenza, smallpox, and others first appeared during these early years. The more civilized humans became – with larger cities, more exotic trade routes, and increased contact with different populations of people, animals, and ecosystems – the more likely pandemics would occur. Here are some of the major pandemics that have occurred over years.



Source: ecosf.org

India Elected Chair of WHO's Executive Board

Dr Harsh Vardhan, Minister of Health and Family Welfare, India, was elected on 22nd May, 2020 as the Chair of World Health Organization's Executive Board.

WHO's Executive Board comprises 34 Members elected for three-year terms. The Chair of the Executive Board is elected by its Members on being nominated by the Regional Committees of the six WHO Regions, by rotation.

At the 72nd Regional Committee Session of WHO South-East Asia in September 2019, Member States had nominated India to be member of the WHO Executive Board from the Region to replace Sri Lanka whose term expired in May 2020 and also to lead 147th and 148th Sessions of the Executive Board as Chairperson. The other countries from WHO South-East Asia Region in the Executive Board are Bangladesh (2019-2022) and Indonesia (2018-2021).

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The main functions of the Board are to implement the decisions and policies of the Health Assembly, and advise and facilitate its work. The annual Board meeting is held in January when the members agree upon the agenda for the World Health Assembly and the resolutions to be considered by the Health Assembly. A second shorter meeting takes place in May, as a follow-up to the Health Assembly.

Dr Harsh Vardhan, who took over from Dr Hiroki Nakatani of Japan, would chair the 148th session of the Executive Board in January 2021. At the Executive Board meeting in May 2021, he will hand over to the next Chair from another WHO Region. However, he will continue to be a member of the Executive Board till 2023.

Source: www.who.int

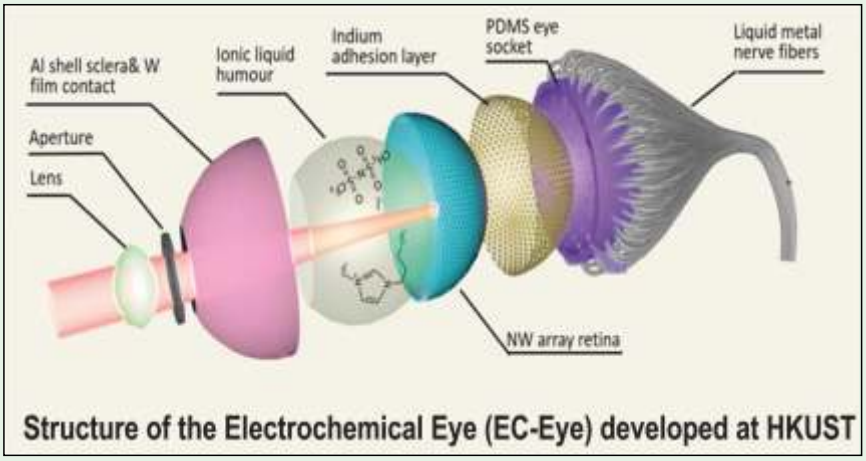
RESEARCH & DEVELOPMNENT

World's First Spherical Artificial Eye has 3D Retina

An international team led by scientists at the Hong Kong University of Science and Technology (HKUST) has recently developed the world's first 3D artificial eye with capabilities better than existing bionic eyes and in some cases, even exceed those of the human eyes, bringing vision to humanoid robots and new hope to patients with visual impairment.

The Electrochemical Eye (EC-Eye) developed at HKUST, not only replicates the structure of a natural eye for the first time, but may actually offer sharper vision than a human eye in the future, with extra functions such as the ability to detect infrared radiation in darkness.

The key feature allowing such breakthrough is a 3D artificial retina - made of an array of nanowire light sensors which mimic the photoreceptors in human retinas. Developed by Prof. FAN Zhiyong and Dr. GU Leilei from the Department of Electronic and Computer Engineering at HKUST, the team connected the nanowire light sensors to a bundle of liquid-metal wires serving as nerves behind the man-made hemispherical retina during the experiment, and successfully replicated the visual signal transmission to reflect what the eye sees onto the computer screen.



Structure of the Electrochemical Eye (EC-Eye) developed at HKUST

In the future, those nanowire light sensors could be directly connected to the nerves of the visually impaired patients. Unlike in a human eye where bundles of optic nerve fibers (for signal transmission) need to route through the retina via a pore - from the front side of the retina to the backside (thus creating a blind spot in human vision) before reaching the brain; the light sensors that now scatters across the entire man-made retina could each feed signals through its own liquid-metal wire at the back, thereby eliminating the blind spot issue as they do not have to route through a single spot.

Apart from that, as nanowires have even higher density than photoreceptors in human retina, the artificial retina can thus receive more light signals and potentially attain a higher image resolution than human retina – if the back contacts to individual nanowires are made in the future. With different materials used to boost the sensors' sensitivity and spectral range, the artificial eye may also achieve other functions such as night vision.

Source: www.sciencedaily.com

BLUE TECHNOLOGY

High Microplastic Concentration Found on Ocean Floor

Scientists have identified the highest levels of microplastics ever recorded on the seafloor. The contamination was found in sediments pulled from the bottom of the Mediterranean, near Italy.

The analysis, led by the University of Manchester, found up to 1.9 million plastic pieces per square metre. These items likely included fibres from clothing and other synthetic textiles, and tiny fragments from larger objects that had broken down over time. The researchers' investigations lead them to believe that microplastics (smaller than 1mm) are being concentrated in specific locations on the ocean floor by powerful bottom currents.

"These currents build what are called drift deposits; think of underwater sand dunes," explained Dr. Ian Kane, who fronted the international team.

"They can be tens of kilometers long and hundreds of metres high. They are among the largest sediment accumulations on Earth. They're made predominantly of very fine silt, so it's intuitive to expect microplastics will be found within them," he told BBC News. It's been calculated that something in the order of 4 to 12 million tonnes of plastic waste enter the oceans every year, mostly through rivers.

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Media headlines have focussed on the great aggregations of debris that float in gyres or wash up with the tides on coastlines. But this visible trash is thought to represent just 1% of the marine plastic budget. The exact whereabouts of the other 99% is unknown. Some of it has almost certainly been consumed by sea creatures, but perhaps the much larger proportion has fragmented and simply sunk.

Basically, the effort shown in against the coronavirus must now take on the scourge of ocean plastic pollution.

Source: www.bbc.com

CLIMATE CHANGE & LIGHTNING

Lightning Strikes in India

Lightning strikes kills 26 people in 8 districts mostly in North Bihar on 2nd July. The death toll included 6 people from rural Patna as well.

This was the third incident of the mass deaths due to lightning strikes in Bihar within a week. Earlier, 92 people were killed by a lightning strikes in 22 districts on 25th June. Later, 11 persons were killed by lightning strikes in 5 districts on 30th June.

Meanwhile, weathermen have cautioned people to remain alert with regard to lightning strikes expected over the next couple of days as well. Patna Meteorological Centre issued a yellow-coloured warning for thunderstorm along with lightning in all 38 districts. A yellow-coloured warning stipulates that authorities should be watchful for extreme weather conditions.

The thunderstorm along with the lightning have been attributed to combined impact of several weather factors in the region, including two trough lines along with the cyclonic circulations.

The daily weather bulletin issued by Patna Meteorological Centre on 2nd July stated that the monsoon through line was passing trough Ganganagar to Imphal across Patna. The rainfall in monsoon season normally hinges along the monsoon through line.

Another trough line - an elongated low pressure area was passing through East Uttar Pradesh to Vidarbha across East Madhya Pradesh.

Besides, a cyclonic circulation was situated over East Uttar Pradesh and neighborhood and another over south coastal Orissa and neighbourhood.

As a result of all such weather features the All India Weather Bulletin issued by the Indian Meteorological Department (IMD) on 2nd July stated that fairly wide spread to widespread rainfall activity with isolated heavy rainfall was expected over northeast and India comprising Bihar over the next five days.

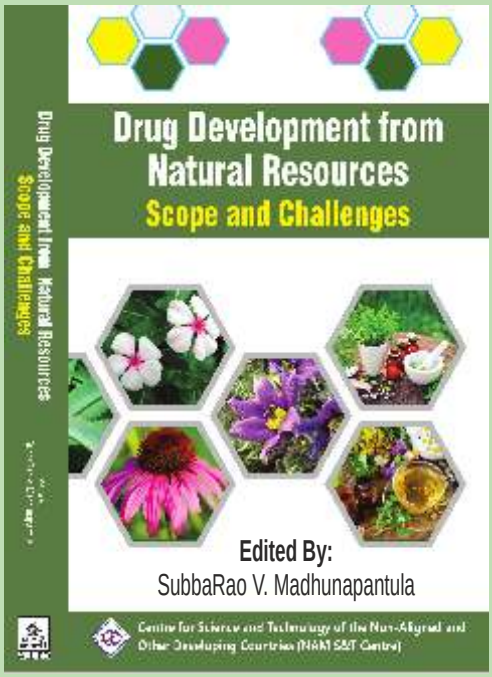
Source: www.livemint.com

Statute of NAM S&T Centre Ratified by Cambodia

The Kingdom of Cambodia joined the NAM S&T Centre as a Member in 2008. Since then, Cambodian scientists, experts and professionals have been actively participating in various activities of the Centre. Mr. Ven Keahak, Director General, General Department of Industry, Ministry of Industry, Science, Technology and Innovation is the Focal Point of the NAM S&T Centre in Cambodia.

According to Chapter - X, Article 28, the Statute of the NAM S&T Centre shall be subject to ratification, acceptance or approval by the signatory members. Instruments of ratification, acceptance or approval and instruments of accession shall be deposited with the Government of India.

In compliance of the above stipulation, the Royal Government of Cambodia has ratified the Statute of the NAM S&T Centre. The instrument of accession was signed on 13th April 2020 by Dr. Tung Ciny, Secretary of State, Ministry of Industry, Science, Technology and Innovation of the Kingdom of Cambodia; and the Chairman of National Committee of Science, Technology and Innovation for ASEAN Cooperation on behalf the Royal Government of Cambodia.



Price: INR 800 US$50

Drugs Develoment from Natural Resources
Scope and Challanges

Terrestrial and marine natural resources are of tremendous pharmaceutical potential but relatively considered as untapped sources of novel biologically active natural products. Potential natural products and their derivatives have been recognised from many years as therapeutic agents due to their unique structural and chemical diversity. This potential area needs to be explored and studied by the researchers, R&D agencies and concerned industries alike.

This book titled 'Drug Development from Natural Resources: Scope and Challenges' has been divided into two main sections. Section-I giving significant insights into Development of Health Beneficial Natural Products and Section 11 giving deep conceptual understanding of Medicinal Plants Research in Egypt, Vietnam, Nepal and Nigeria.

The book will be of immense use to medical professionals, pharmacists, allied healthcare professionals, taxonomists, biochemists, biotechnologists, bio informaticians, organic chemists, traditional healthcare professionals as well as pharmaceutical industries and others engaged in the field of drug discovery and development from natural resources.

Contents

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Centre Announces

International Training Program on

"LIGHTNING PROTECTION: DEFENCE AGAINST THE KILLER FROM THE BLUE"

(A VIRTUAL EVENT)

Lightning is a naturally occurring electric discharge caused by electromagnetic field imbalances between clouds and the ground, or within the clouds themselves. As a thundercloud (known as Cumulonimbus) matures, colliding particles of rain, ice or snow inside, separate charge with opposite polarity. Even though lightning is a spectacular phenomenon, it is dangerous. Lightning often causes death, injury and property damage, most commonly in tropical and subtropical areas where lightning ground flash density and populations are high. Unfortunately, in many such regions in the developing world safe shelters against lightning are not readily available.

In order to impart basic knowledge on various aspects of the lightning phenomenon to the scientists and professionals of the NAM and other developing countries, the Centre for Science & Technology of the Non-Aligned and Other Developing Countries **(NAM S&T Centre),** New Delhi, India jointly with the Center of Excellence on High Voltage Engineering, **University of the Witwatersrand,** Johannesburg, South Africa announces the organisation of an International Training Program on "**Lightning Protection: Defence Against the Killer from the Blue**" on **26th August 2020**. The event will be hosted by the Center of Excellence on High Voltage Engineering, University of the Witwatersrand and will be organized in Virtual Mode.

The Training Program intends to provide basic knowledge on the lightning as a scientific phenomenon, threats and risks to the human beings and living environment due to lightning, protection of buildings and equipment, lightning safety of underprivileged communities and low cost protection measures. The development of lightning protection and earthing related business models at SME level will also be discussed. For the non-profit-earning organizations, a briefing will be given on how to develop and sustain lightning safety education, advisory and research centers in developing countries giving examples of success and failure stories.

Applications from the young researchers, scientists, government officials and policy makers, and representatives from industry and non-government organizations - who are engaged in lightning science research and lightning protection programs are invited to participate in this Virtual Training Program.

For further details, please visit the NAM S&T Centre's Website (www.namstct.org)

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