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Adopting ‘Green Approach’ in Drug Discovery

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In the fast-changing global industrial arena, sustainability has become quite crucial. It is a critical issue across multiple industries; the healthcare and clinical research sectors are no exception. Hospitals and clinical facilities produce tonnes of waste alongside carbon emissions. Medical research consumes non-renewable resources at a staggering rate, which can have a long-term impact on the environment. Sustainable drug discovery and development is positioned as a key initiative in the long-drawn fight against climate change and reducing the detrimental impact on the environment, linked with the health and clinical industry. Let’s explore how India can nail this ‘green target’.

Integrating sustainable drug discovery practices enables more innovative and practical solutions that minimise the environmental impact. The demand for new medications and treatments will not decrease, which makes it crucial that the development process is responsible and eco-friendly. This will allow scientists to research and innovate treatments while also reducing the detriment to the environment which could lead to better health consequences in the long run.

Looking back at the past century, various industrial revolutions and developments have completely overlooked human health and environmental protection. Today, the environment is destroyed beyond repair and if proper corrective steps are not taken today we will for sure face the consequences of extreme climate change and struggle for survival in the future.

Prominent Environmentalist Sunderlal Bahuguna rightly said, “Development that destroys the environment is not development. True progress lies in preserving nature while meeting the needs of society.” Therefore it is now or never, not just for India but for the entire global community to come together and frame sustainable new drug discovery goals, prioritising environmental protection.

Healthcare and Environmental Impact

Undoubtedly, medical services are necessary for sustaining and saving human lives, However, the reality is that the healthcare industry has an impact on nature that can lead to eco-threats. In the US alone, the health sector is responsible for 8.5 per cent of national carbon emissions, both from regular operations and from energy, heating, cooling, and supply chain. Globally, hospitals use as much energy to cool their facilities as 110 coal power plants.

Moreover, billions of dollars worth of drugs are discarded due to improper packaging. Hospitals produce over 5 million tonnes of waste every year, of which, 25 per cent is some form of plastic. Plastics can be found in syringes, drug packages, surgical equipment, personal protective equipment, and more.

Strict Implementation of Sustainable Healthcare

Globally, the healthcare sector is responsible for 4.4 per cent of greenhouse gases. Besides reducing the direct effects of climate change on humans and the environment, mitigating the healthcare sector's negative impact could reduce the costs of care. As per the World Health Organization, the direct damage costs to health could reach about $2 to 4 billion a year by 2030. Hospitals and clinical production facilities being able to reduce their carbon footprints could drastically bring down costs associated with global health, according to Vial, a next-generation CRO from San Francisco, USA that delivers faster and radically cheaper trials through an end-to-end technology platform

Additionally, climate change has the potential to impact health in a variety of ways. For example, increasingly frequent and severe weather events lead to more food and water scarcity, vector-borne diseases, mental health issues, and medical emergencies. A decrease in air quality and food security could cause further health risks.

Environmental degradation could have a significant impact on the healthcare industry's ability to deliver safe and effective care worldwide. Issues such as hospital evacuations and power outages, medical supply shortages, and other disruptions, in turn, worsen the quality of care provided.

Reducing the carbon footprint of the medical industry could lead to dramatic improvements in overall human health, alongside notable social and economic benefits. "Greenifying" single-use plastics would also mean less plastic produced and discarded and could pave the way for more affordable alternatives.

Lastly, a shift in drug development to more sustainable and eco-friendly processes in both discovery and testing could minimise the environmental impact. **Dr Renu Swarup, former Secretary, the Department of Biotechnology, Government of India**, said, "As we advance in drug discovery, it is imperative to adopt green chemistry principles and sustainable manufacturing practices. By minimising waste, reducing energy consumption, and using eco-friendly solvents, we can ensure that the development of life-saving drugs does not come at the cost of environmental degradation."

Sustainable Drug Discovery

"Sustainability", partially translates to ethical and "green" practices. The pharmaceutical and biotech industries are beginning to shift towards these practices to reduce environmental stress on the planet. Dr Satish Reddy, Chairman, Dr. Reddy's Laboratories, said "Incorporating environmental stewardship into drug discovery requires a shift in mindset and investment in sustainable innovation. By prioritising green chemistry practices, optimising resource utilisation, and adopting renewable energy sources, we can minimise the environmental impact of pharmaceutical manufacturing and ensure a more sustainable future."

According to S&P Global ESG Scores calculated from the Corporate Sustainability Assessment (CSA) for the year 2024, out of 10,000 identified companies globally only less than 1000 companies have been selected for rankings to adhere to sustainability targets, among them around 10 companies have featured from India, while companies from smaller countries like Taiwan, Thailand, Japan, Republic of Korea, Italy, Spain, Germany, France and USA have fared far better.

New Drug Development

Now, turning the context of sustainability for India and its pharma, biotech, medtech and other aspects of allied healthcare sectors, the country stands at the dawn of a new era. Placed uniquely, with its skilled and well-educated professionals in Information Technology, Pharmaceuticals, Chemical Technology, Healthcare, Biopharmaceuticals, Biotechnology, and Engineering and with the advent of new age automation technologies like Artificial Intelligence (AI), Machine Learning (ML)

and Big Data Analytics, India could excel on par with the global leaders like Japan, China, USA and other leading European countries, in the arena of sustainable new drug discovery and provide solutions to complex healthcare challenges facing the global population.

Mastering the art of manufacturing quality branded generics; India has achieved the tag of 'Pharmacy of the world' by providing high-quality generic medicine to over 200 countries and with Indian pharmaceutical exports likely to touch $28 billion in 2023-24, registering 10.2 per cent growth, as per the Pharmaceuticals Export Promotion Council of India (Pharmexcil).

"As global leaders in drug discovery, Indian pharmaceutical companies have a responsibility to lead the way in environmental sustainability. By investing in green technologies, promoting recycling and waste reduction, and collaborating with stakeholders to develop eco-friendly solutions, we can mitigate the environmental footprint of drug development and contribute to a greener world," observed **Dr Deepak Parekh, Chairman, Indian Pharmaceutical Alliance.**

Due to a strong infrastructural base, India has the highest number of US FDA-compliant pharma plants outside of the USA. It is home to more than 3,000 pharma and biotech companies with a strong network of over 10,500 manufacturing facilities and a highly skilled resource pool.

Leading players in the Indian pharmaceutical, biotechnology and healthcare industry must look beyond their traditional mindset. From doing reverse engineering for manufacturing generics to copying the off-patented branded drugs, it is time to grasp the opportunity of new age technologies, venturing into sustainable new drug discovery regime by adopting Green Chemistry approaches, assessing ecological environment impact, and medical needs, utilise the modern age technology like AI and Big Data Analytics, and conduct clinical research works addressing the root cause of illness.

Healthcare expert **Sangeeta Reddy, Joint Managing Director, Apollo Hospitals Group** said, "Environmental protection must be integrated into the DNA of drug discovery processes. From green chemistry principles to sustainable packaging solutions, every aspect of pharmaceutical manufacturing should be designed with environmental sustainability in mind. By prioritising eco-friendly practices, the pharmaceutical industry can safeguard both human health and the planet."

Targeting R&D Prowess

Stressing the importance of collaborations to take on the challenges faced by the industry to bring sustainability aspect in the new drug discovery **Dr Sharvil Patel, Managing Director, Zydus Lifesciences Ltd** said, "I think the importance of collaboration between outstanding physicians and scientists within a conducive ecosystem is key for accelerating continuous progress in Research and Development that will pave way for new drug development era in India,"

Acknowledging the unfortunate reality that many companies face the need to reduce R&D efforts due to performance and market pressure, **Dr Ajit Shetty, Chairman, the Flemish Institute of Biotechnology and former Chairman, Janssen Pharmaceuticals**, noted that the situation is gradually changing and expressed confidence in India's potential to create a conducive sustainable ecosystem for innovation, with support from the government, regulatory bodies, risk funding, and other essential elements.

Expressing concerns as to how funding plays a vital role in devising a comprehensive sustainable R&D ecosystem, **G V Prasad, Managing Director and Co-Chairman of Dr. Reddy's Laboratories**, shared insights into research and development in new drug discovery. "Funding remains a major hurdle, not only for us but also for academia. While there are incubators in places like IEP, they're currently quite limited. Public health institutions must be strengthened. Unlike the National Institutes of Health (NIH) in the United States, there's no equivalent institution in India investing substantial capital in innovation. India can learn from countries like China, which have rapidly embraced innovation. Implementing programmes similar to China's Thousand Talents Programme could accelerate our efforts," said Prasad.

Appreciating the advanced R&D infrastructure facilities established in Genome Valley in Hyderabad, **Professor Alan Rowan, Director, the Australian Institute of Bioengineering and Nanotechnology (AIBN) at the University of Queensland,** emphasised that such facilities could be used for the rapid progress in cell biology and the remarkable advancements in genomics. "I'm particularly excited about the rapid progress in cell biology. Technologies like machine learning and spatial transomics are revolutionising our understanding of cellular kinetics. The mRNA revolution has enabled the development of protein vaccines, while AI is revolutionising radiotherapeutics. We have an incredible opportunity to leverage these technologies to create an end-to-end therapeutics pipeline," said Rowan.

While the integration of AI with R&D could open newer opportunities, AI's unparalleled data-harnessing abilities could allow it to be an invaluable tool for sustainable development. So the key might lie in the hands of the pharma companies on how to

implement AI for drug development in the most sustainable manner.

Notable Entities Working Towards Sustainability

Dr. Reddy's Laboratories has been a pioneer in implementing sustainable practices in pharmaceutical manufacturing. They have invested in green technologies, such as solvent recovery systems and energy-efficient processes, to minimise their environmental footprint. The company also focuses on waste reduction and recycling initiatives to ensure responsible stewardship of resources. Recently, they were awarded ‘Gold Medal' status by EcoVadis, the global sustainability ratings agency, for its score of 70 out of 100 in its scorecard for 2023.

Other leading Indian companies such as Biocon, Sun Pharma, Cipla, and Aurobindo have adopted green chemistry principles to develop eco-friendly processes and products. while Biocon emphasises the use of renewable energy sources and has implemented water conservation measures to reduce its environmental impact. Sun Pharma has invested in research and development of green technologies to minimise waste generation, and energy consumption and even promotes eco-friendly packaging solutions and implements recycling initiatives to reduce environmental pollution.

While these are some of the pharmaceutical companies in India taking baby steps and leading the way in embedding environmental protection in the process of making new drug discoveries, some of the global entities like Bayer, AstraZeneca, Torrent Pharma, Glenmark, etc, are also demonstrating their commitment to sustainable development and responsible business practices.

For instance, AstraZeneca leads the industry in sustainability with its Product Sustainability Index (PSI), evaluating environmental impacts and setting improvement plans. Siva Padmanabhan, Managing Director & Head, Global Innovation and Technology Centre, AstraZeneca highlights the company’s focus on Pharmaceuticals in the Environment (PIE) and responsible product stewardship. Sustainable practices are integrated throughout the product life cycle, with targets for API manufacturing emissions and environmental research. AstraZeneca's life cycle assessment (LCA) programme aligns with ISO standards. They've launched an Ecopharmacovigilance (EPV) dashboard and led the IMI PREMIER project, aiming to identify environmental risks earlier in drug development.

Meanwhile, Torrent Pharma's focus on reducing plastic usage and reusing hazardous waste aligns with its goal of minimising environmental impact. By recycling and reusing hazardous waste, the company significantly reduces waste and utilises it as an alternative fuel to conserve energy. Over 55 per cent of high-calorific value hazardous waste is diverted from incineration and processed in the cement industry. Additionally, Torrent Pharma explores the utilisation of canteen and biological waste for biogas generation, aiming to reduce landfill waste disposal by 20 per cent. These initiatives underscore the company's dedication to environmental responsibility and contribute to India's green agenda.

In parallel to Torrent Pharma's endeavours, Glenmark Pharma is actively adopting sustainable practices to safeguard crucial natural resources and mitigate environmental impact. Emphasising water management, Glenmark implements the 3R principle—Reduce, Reuse, Recycle—to curtail freshwater consumption by employing best practices and recycling treated wastewater for various purposes. Rain Water Harvesting (RWH) structures across multiple facilities further amplify water conservation efforts, replenishing 10 per cent of annual freshwater demand. Glenmark also employs wastewater treatment and recycling initiatives, such as the Zero Liquid Discharge (ZLD) approach in specific plants, retrieving high-quality water for reuse. These combined measures meet 38 per cent of the company's annual freshwater needs, underscoring its commitment to sustainability.

Furthermore, in Telangana, Re Sustainability Limited (ReSL) recently inaugurated its Zero Liquid Discharge (ZLD) Common Effluent Treatment Plant (CETP) in the TSIIC Pashamylaram industrial park in Hyderabad. The plant, developed on a DCO model with a total investment of Rs 55 crore, addresses critical environmental concerns by providing wastewater treatment services to pharmaceutical, bulk drug, and chemical manufacturing plants. Operating on a zero-liquid discharge model, the plant efficiently recycled wastewater for industrial reuse while managing solid waste sustainably. Supported by natural gas and solar power, the plant ensures zero emissions, exemplifying ReSL's commitment to responsible waste management and environmental stewardship.

Leading by Example

India must take on a pivotal role in preserving its precious natural resources. It is high time that industry leaders and government policymakers re-evaluate and optimise current practices while exploring new technologies. The pharma, biotech and healthcare companies must embed sustainable practices into R&D drug discovery programmes. Unless the

pharmaceutical sector in India adopts a holistic approach to devising a comprehensive, sustainable, and innovative drug discovery regime, its efforts to address the broader healthcare needs of the global population will remain incomplete.

Amguth Raju

(hyderabad@mmactiv.com)