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AIM brings innovations from labs to hospitals and masses

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A transnational approach to translational research



Human body like the Space is an endless frontier made even more complex by the irreversibility of life by the arrow of time. Similar to the mystery of origin of the Universe some problems in the human body are so complex, for example, the problem of qualia or the Hard problem of consciousness– “why any physical state is conscious rather than nonconscious” that it has given the league of neuroscientists, philosophers and empiricists a perpetual “Whereof one cannot speak, thereof one must be silent” or the Upanishadic “Neti Neti” limbo.

Another such outlier among the mysteries of nature which has currently eclipsed the developmental goals of poor and rich countries alike is an infinitesimally small virus, rather a particular strain of coronavirus that ordinarily causes the common cold. Evolutionary biologists are still to figure out whether to classify viruses as living or dead or something in between; whether they are a rare anomaly of nature or the first and the most abundant form of cellular organization in Universe. Human genome that is made up of 5-10% of viral DNA tells us that we have been at the receiving end of countless virus attacks throughout our evolutionary history but scientists are now coming to terms with the fact that viruses may have played a very important role in our evolution e.g. in the development of female placenta which essentially helped us establish at the top of the food chain. In the far future scientists envision using viruses in development of nanomachines, cancer killing cyborgs and advanced geriatric care.

Globalization and extensive deforestation have caused a lot of pathogens of animal origin to adapt and infect humans, and viruses are so adaptable that they have started developing increasingly stealthy mechanisms to remain undetected by human immune system. The initial strains of SARS-CoV-2 had developed mutations with respect to SARS-CoV-1 that allows it to first replicate silently in the upper respiratory tracts of patients for first few days and spread by respiratory droplets before showing any detectable symptoms. With widespread transmission viruses accumulate more mutations and the current strains are becoming more infectious, virulent and stealthy due to changes in its spike protein and genetic material. The only way Covid 19 outbreak is going to end is when enough people have developed immunity (by a combination of innate, adaptive and passive immunity) through infection or vaccination against the prevalent and most virulent strains. A good vaccine along with other treatment options like repurposed drugs, plasma therapy, antibody mixtures, antivirals, immunomodulators and other adjunctive therapies are the tools we are using to tide over the pandemic.

We hardly give a second thought while taking any OTC (over the counter) medication for our minor ailments but we will be very surprised to know that most modern medications under Allopathy and for that matter any other system of medicine work like black boxes. In a few cases we know the chemical composition or the active chemical groups in the medicine but how they interact with thousands of receptors in human body giving rise to a cascade of effects finally resulting in the alleviation of the symptom troubling us is a problem that is too hard to figure out with the current level of technological advances in a complex living system. So all clinical research on medicines work on the principle of cause and effect, trying to maximize desirable effects while trying to minimize the undesirable side effects. Novel drug discovery process starts with thousands of trial compound collections which are then reduced to hundreds of lead compounds by high throughput screening to finally identify few novel drug candidates by secondary assays which may or may not pass four phases of clinical trials to get apex drug authority approvals; the whole exercise costing a billion dollars. Like the olden wars for spice, the big silent wars are now for averting hospice.

Vaccines differ from drugs in that they are always biological products and larger, more complex requiring special cold storage conditions up to -50 degrees. These special storage conditions create logistical nightmare for their global distribution and administration from their source of production. An ideal vaccine is defined in terms of its safety profile, cost, efficacy, need for booster doses, thermal stability and mode of administration. Many pharmaceutical companies have specialized vaccine verticals and they may choose any of the methods to generate a vaccine depending on their expertise like attenuated or inactivated viruses, recombinant- DNA vaccines, RNA vaccines, subunit – virus protein, sugars or other structural components from the virus.

Translational Medicine is a bench to bedside approach to medical research that tries to better translate the results of laboratory studies or clinical research to be used for better clinical prognostics and facilitate better clinical outcomes. There is a clear disconnect between academia, medical training and research, and medical practice; most of the medical colleges and research centres are not tied up with hospitals because of the highly commercial nature of medical practice in our country. The primary reason for this state of affairs of medical education is the high costs involved in it compared to the average household income of the middle class.

In response to the pandemic COVID-19, Atal Innovation Mission (AIM), NITI Aayog was entrusted to identify promising startups that can offer innovative solutions to address the current crisis by Government of India Inter-Ministerial Working Group. This working group is also critically supported by industry bodies like CII, NASSCOM, UNDP and TiE who are committed to tackling COVID-19. This resulted in identification and industry-connect opportunities for 1,000+ COVID-19 related startups and startups working in different categories such as equipments, hygiene and also those working on

awareness and sensitization campaigns.

These startups are now actively helping the Government to tackle covid-19. AIM is also leveraging the strength of Indian academic research and translational resources of its AICs at CCMB and C-CAMP to boost research translation and commercialization in the medical field focussing on Covid 19 research in the current scenario supported by other AICs like 91springboard, Andhra Pradesh MedTech Zone, AIC -Pinnacle etc. Atal Incubator Centres and Established Incubator Centres under AIM have played an instrumental role in controlling the emerging Covid 19 scenario in the country and are expected to further raise the bar in coming times.

EIC-CCAMP started a nationwide search for innovations that were ready to be deployed immediately or in the near future to curb the COVID-19 outbreak. EIC 91Sprinboard has launched a community repository of resources supported by AIM and updated in real time for solving COVID 19 challenges. AIC-Pinnacle in partnership with Garage48 organised an online hackathon, inviting Non-Medical Solutions from the Quarantined Minds of Young India against COVID-19. Andhra Pradesh MedTech Zone has been providing support for large scale manufacturing of ventilators, PCR based & serology based COVID diagnostic kits through proposals. AMTZ in its efforts to pace in curbing shortage of ventilators and other COVID-19 targeted products, have developed TECHRx APP to help all innovators, startups and manufacturers to connect with Electronic Spares, Components and Machinery suppliers.

AIC -SMUTBI team were able to design and 3D print the mask as an intervention to the acute shortage of mask in initial covid 19 surge. The mask can be converted to N95 standards with the filters being replaced with 0.3 microns fibre/materials. Atal Incubation Centre- Rambhau Mhalgi Prabodhini has launched I-CAN (India Co-Win Action Network) initiative in collaboration with Connecting Dreams Foundation (CDF) to help underprivileged communities that have been hardest hit due COVID-19. It is a unique movement to combat the pandemic through an online platform that connects those help seekers and help givers. In addition to this numerous AIM startups and Atal tinkering lab innovators have come up with solutions such as AI enabled diagnostic decision-making support for pulmonary diseases, telemedicine and case management platforms and other innovations in the field of Drug Discovery, Biotherapeutics, Devices & Diagnostics and Bioinformatics & Computational Biology.

In medicine many of the old doctrines get progressively invalidated but it happens at a meticulously slow rate, the most recent is that fMRi that is used to scan any sort of brain activity in relation to various diseases like Alzheimer's to Sleep apnea is at best a false representative of the blood flow in the brain. This new research finding has invalidated the previous research of hundreds of neuroscientists who had designed their studies on the basis of fMRi. Patents, intellectual property, innovation in translational medicine and big pharmaceutical industries needs to be well coordinated to bring about this change at a quicker pace. To meet the country's growing healthcare needs cost effective and high quality preclinical and clinical research needs to be facilitated by core stakeholders and augmented by product development support services. Interaction with enterprises, particularly SMEs involved in new technology innovation can facilitate translation of scientific know-how into viable products. A network of Centres of Excellence (CoE) in clinical research through partnerships with leading institutions conducting clinical trials in India needs to be developed and synergized. Providing comprehensive and sustained training in clinical research through these CoEs in order to build a cadre of world class investigators capable of conducting clinical trials for regulatory submissions will fast track drug development and clinical research in the India.

Developing a vaccine is an inordinately tough task limited by time and capacity, a safe and effective vaccine often requires more than a decade to be licensed and used globally, and requires more than $ 500 million in capital. To give some perspective an average molecular biology doctorate student spends 100+ man hours and 1000 slides to complete a five year study. Multiple vaccine platforms are in development, and enrolment in a clinical trial with different candidate vaccines will become centralized with a translational medicine platform. Clinical endpoints of various trials should be normalized as much as possible so that relative efficacy can be determined clearly. The Effectiveness criteria for Covid 19 vaccines are going to be prevention of infection, reduction in mortality or reduction in severe hospitalizations.

After vaccination the studies that need to be conducted are the degree of prevention of infections and reinfections, the most effective dose and the length of protective immunity. Other studies that needs to be conducted are the need for the booster doses and the effects of the booster doses. Our body does not develop a long term immunity from the conventional coronavirus. A genetic/family history screening may be required for those predisposed to ailments like Multi organ Inflammatory syndrome and a thorough analysis of auto immune disease spectrum. The populations in developed countries with high mortality rates and comorbidity rates will be very reluctant to try a new vaccine but in India the onus for this rests with the Government and the medical fraternity. Storage of some vaccines developed by biopharmaceutical companies require -80 degrees of storage, a logistical nightmare for global distribution but Serum Institute of India has been able to locally manufacture 50 million doses a month of Oxford-AstraZeneca vaccine by modifying weakened version of chimpanzee adenovirus. Vaccines developed by SII can be stored at 2-8 degrees which more suitable for impending hot summer in the country. UN has applauded Indian vaccine efforts and India has been able to export 2 million doses to Brazil and 1 million

doses to Canada as a friendly gesture. No wonder India is called the pharmacy of the World and it also produces 60% vaccines of the total vaccines of the World and 80% vaccines imported in USA are from India.

A centralized review board facilitated by a Translational platform will be well equipped to achieve this objective and tackle emerging Covid 19 scenario and future vaccination efforts in India. A combination of vaccines is a dangerous concoction and the clinical studies attempting to study the comorbid side effects of more than two vaccines have never been attempted but to tackle the increasing complex nature of pandemics and epidemics it needs to be attempted and India is possibly the only country in the World that has the capability to take on this herculean task.

Other flagship interventions by AIM which have already made a huge impact are:

- AIM-ICDK Water innovation challenge - AIM, NITI Aayog has partnered with Innovation Center Denmark (ICDK), Denmark Embassy in India and the Denmark Technical University (DTU) to identify Innovative & next-gen solutions to solve proposed challenges in collaboration with corporate and public partners. The initiative engages young talent from leading universities and innovation hubs to come up with technology driven innovative solutions for effective water management for digital water management solutions, solutions for monitoring and prevention of leakage in city water supply, wastewater management across rural/agri belts and urban settlements, rainwater harvesting in rural and urban settlements.
- India Australia Circular Economy Hackathon (I-ACE) - a joint effort by AIM, NITI Aayog, Government of India and Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia to enable the students and startups/MSMEs of both the nations in fostering innovative solutions for the development of a circular economy across the food system value chain with the aim of increasing the long-term health and resilience of our planet, through innovative technology solutions.
- AIM, NITI Aayog in collaboration with United Nations Development Programme (UNDP) India has launched Youth Co:Lab which aims at accelerating social entrepreneurship and innovation in young India recognizing young people as critical drivers of sustainable development. Through Youth Co:Lab, young entrepreneurs and innovators will get a chance to connect with governments, mentors, incubators and investors, who will help equip them with entrepreneurial skills.
- AIM-PRIME - AIM, NITI Aayog has launched AIM-PRIME (Program for Researchers on Innovations, Market-Readiness & Entrepreneurship), an initiative to promote and support science-based deep-tech startups & ventures across India through hands-on practical insights and mentoring from experts and mentors who have been nurturing science-based deep-tech startups in global innovation hotspots as well as in India. Beneficiaries get access to in-depth learning via a comprehensive lecture series, curated video library, live team projects, exercises, and project-specific mentoring and plenty of peer-to-peer learning opportunities.
- AIM iCREST - Incubator Capabilities enhancement for a Robust Ecosystem for high performing Startups – launched in collaboration with Bill & Melinda Gates Foundation and Wadhwani Foundation –providing global expertise and showcase proven best practices to the incubator networks. It enables incubators and their teams to gain deep insights about incubation and acceleration and learn about best practices of about 200 incubators and accelerators globally.

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