

Statement of Research Achievements:

Multiple inventions from Vemula's lab have potential to make societal impact. Several recognitions were received to appreciate the impact of translational technologies that were developed at Vemula's lab.

Anti-pesticide technology to protect farmers

Farmers are the backbone of India, and providing "first-in-class" technologies to protect their health from pesticide-induced lethality is an impactful contribution to society. The farmers spray pesticides in the field without having any protection, which leads to severe exposure through skin and inhalation. Such exposure leads to severe neurotoxicity, loss vision, paralysis and death in case of high dose exposure. Therefore, to solve this unmet need, Vemula's lab at inStem has developed a nucleophilic polymer-based topical hydrogel, which can be applied to the skin like a cream. This cream chemically deactivates pesticides through nucleophile-mediated hydrolysis to prevent pesticide-induced toxicity and mortality, *in vivo*.

To recognise the impact of this technology the following awards were given:

DBT-Product, Process, Technology Development and Commercialization Award 2020 (by the Department of Biotechnology, Govt of India)

GYTI-SRISTI-BIRAC Award-2019 (Gandhian Young Technological Innovation Award by Biotechnology Industry Research Assistance Council)

Anti-viral (Germicidal Fabric) technology to prevent infections

Recently, Vemula lab has developed "***Germicidal Fabric (G99+ antiviral)***" technology which led to the launch of antiviral masks and apparel in the market. During the recent pandemic, wearing mask has become inevitable. While most PPEs currently in use provide a physical barrier, they do not deactivate the virus, hence they accumulate on the fabric. Therefore, Vemula lab has done fundamental science to develop novel antiviral molecules, which can be covalently attached to the fabric to generate antiviral masks. Vemula's group intensified development of the germicidal coating in April of 2020, as part of the national effort, led by the Department of Biotechnology, and Aatmanirbhar Bharat effort by Govt. of India, towards the current COVID-19 pandemic. Hence, based on this technology he founded a startup company, Color Threads and partnered with Van Heusen and commercialized the G99+ antiviral masks and apparel in November 2020.

To recognise the impact of this technology the following award was received:

National Biotechnology Innovation Award 2023

Notably, Vemula is one of 50 researchers, worldwide, who featured in an article by the journal *Nature Biotechnology* articulating, outstanding questions and developing technologies in his area of research (*Voices of Biotech* 2016) (www.nature.com/nbt/journal/v34/n3/full/nbt.3502.html).

Here some of the examples are given to demonstrate Vemula's ability to develop deep science-based technologies to solve unmet clinical needs and his efforts to translate those technologies into the market through establishing science-entrepreneurship programs.

Science for Society

1. Prophylactic technologies to prevent pesticide-induced neuro-muscular dysfunction and mortality in Indian farmers: Based on these technologies, he founded a company, ***Sepio Health Pvt. Ltd, (Bangalore, India)***, which will be conducting human studies in the near future.
2. Novel blood bag technology to enhance the quality and shelf-life of stored blood: Based on this technology, he founded a company, ***CaptureBio Pvt. Ltd. (Bangalore, India)***, for further developing novel blood bags to test in the clinic.
3. Small-molecular potential drugs for repairing barrier dysfunction, in vivo. Vemula lab has developed small-molecular potential drugs for the treatment of epithelial and endothelial barrier dysfunction-associated diseases such as IBDs. Based on this technology, Vemula formed a company, ***Artus Therapeutics (Boston, USA)***, for further developing pipeline and taking these molecules into the clinical stage.
4. Germicidal Fabric technology based antiviral masks and apparels: Based on this technology, a startup company, ***Color Threads Pvt. Ltd. (Tiruppur, India)*** has been formed, and products were launched in the market.
5. Microneedle-based device for painless drug delivery: Vemula lab in collaboration with engineers has developed a device for delivering drugs in a painless manner. Specifically, using this device insulin can be administered in a painless manner, and more importantly it can completely prevent repeated injections-associated fibrotic tissue and adipose tissue formation. Based on this technology, Vemula co-founded a startup company, ***NeeDel Innovations Pvt. Ltd. (Bangalore, India)***, to further develop and commercialize the technology.