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LJI-led team wins top Nucleate honors for virus vaccine development proposal

San Diego scientists work with business experts to advance dengue and Zika virus vaccine strategy

LA JOLLA, CA—A San Diego team, led by scientists at La Jolla Institute for Immunology (LJI), has won the top prizes in the [Nucleate Activator](#) competition. Out of 1,000 initial competitors, the LJI team advanced to the final four teams and swept all the prizes they entered for. Their winning research proposal outlines how scientists could stop dengue virus and Zika virus by developing sophisticated vaccines that activate both B cells and T cells.

Nucleate is a student-led, non-profit organization dedicated to empowering early-stage, life-science startups and emerging biotech leaders. The Nucleate Activator program connects early career researchers with MBA students and entrepreneurs interested in supporting potential biotech startups.

By communicating the need for dengue and Zika vaccines—and their approach to make those vaccines a reality—the LJI-led team won Nucleate's Alnylam Pharmaceuticals for Scientific Excellence Award; the Genentech Award for Justice, Diversity, Equity, and Inclusion; and the MilliporeSigma Award for Global Impact.

"We were humbled by the jury's reaction," says LJI Postdoctoral Fellow Rúbens Alves, Ph.D. "Our project was recognized as having real potential, and our team has received support from people who really care."

Alves led the team through the nearly year-long competition process and was thrilled to see the LJI/UC San Diego team advance to the final pitch round. His team members were LJI Instructor Annie Elong Ngono, Ph.D., UC San Diego M.B.A. candidate Angus Wu, and UC San Diego M.D.-M.S. candidate Victoria Smith. LJI Professor Sujana Shrestha, Ph.D., served as team mentor.

For the competition, participants were required to develop a plan for a potential biotech startup where they were the co-founders. The team chose "Toga Therapeutics" as their start-up name (after the Togavirus family of pathogens, which the self-amplifying RNA machinery comes from), and developed their company pitch as they advanced through the competition and met with Nucleate mentors.

Toga's pitch builds on nearly two decades of critical research in the Shresta Laboratory. Shresta studies the interaction between flaviviruses, such as dengue, Zika, and Japanese encephalitis, and the immune system. This research has shed light on the importance of a "balanced" immune response that harnesses both antibody-producing B cells to prevent infection and T cells to clear infected cells and regulate the body's inflammatory response.

As Alves points out, previous dengue vaccine candidates have failed because of the broad range of types of dengue virus. Without comprehensive immunity against all dengue "serotypes," vaccinated patients can get actually "primed" for more severe infections, a very counterproductive and possibly dangerous outcome. Dengue virus and Zika virus overlap in many regions of the world, and Shresta has shown that Zika virus infection or vaccine-induced immune response may also precipitate severe dengue. This means vaccines need to address both pathogens.

To solve this problem, the Toga team proposed a strategy to engineer a safe and effective immune system response using self-amplifying RNA (based on the Togavirus family member-based vaccine platform) to produce stable antigens at a low cost.

In fact, Elong Ngono says this kind of RNA-based platform holds promise because it is versatile. Researchers could produce antigens against flaviviruses and potentially many other viral families. Toga's approach to vaccine antigen production could even lead to new types of cancer immunotherapies.

As the researchers developed their Nucleate pitch, they relied on Wu and Smith's business expertise to show how this research approach could be financially viable. Through Nucleate, they also connected with a team of professional research and business mentors who helped refine their vision. The LJI Business Development staff also worked with the team to strengthen their pitch.

On May 17, 2023, the Toga team delivered their polished pitch at Nucleate's San Diego Bio and Eco West Activator Final Pitch showcase. The Toga team had their eye on three prizes, and they hoped to earn just one of them. Instead, the judges unanimously awarded the team all three of the prizes they had entered for.

"We've really made people aware that we need a dengue and Zika vaccine," says Elong Ngono. "Working with Nucleate made it possible for people to understand our research and know how to help."

The team now hopes to build on the business expertise they gained through the Nucleate Activator program and spin-off Toga's strategy into an actual biotech start-up.

Alves says the Genentech Award for Justice, Diversity, Equity, and Inclusion holds special significance for him. Alves is from Brazil and is from the first generation in his family to go to college. In fact most of the Toga team grew up outside the United States, in Nepal, France, Taiwan, and Cameroon.

"We say that from diversity comes strength," says Alves. "Different parts of the world have different problems, but we really believe in the same vision: vaccines for all."

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