



Sustainable  
Sciences  
Institute

# 2020 Annual Report

**SSI Responds  
to COVID-19**





# A message from our President and our Executive Director



President, Dr. Eva Harris, Ph.D



Executive Director, Dr. Josefina Coloma, Ph.D

What a year 2020 has been! The global COVID-19 pandemic has decisively underscored the importance of robust public health systems and on-site capacities to detect and respond to emerging infections. SSI's work has never been more relevant! We strive to continue providing scientific communities in partner countries with improved capacities to confront the current health crisis and those that will come in the future. This year, we have faced many challenges but have also witnessed the resilience and innovative spirit of those working on the front lines as we support them accelerating and sharing diagnostics, advancing relevant research and implementing best practices for care. To those who have dedicated this year to saving lives and working tirelessly towards a better future

## Thank You!

## COVID-19 Response in Nicaragua

In Nicaragua, SSI responded quickly to the news of the COVID-19 pandemic as we braced for an outbreak. By late January, we were already set up with primers and protocols for PCR testing in Managua, as well as with antigens and protocols in place to run ELISA assays to detect anti-SARS-CoV-2 antibodies. We also supplied many of SSI's partner countries with the receptor binding domain (RBD) of the spike protein of the SARS-CoV-2 virus, allowing them to get their antibody testing systems off the ground early and opening the pathway for contact tracing as well as other important outbreak preventive measures.

In addition, we conducted a study led by Dr. Angel Balmaseda, SSI's Nicaraguan Virology Program Director, of a COVID-19 outbreak that occurred within the National Diagnostics and Reference Center. Further, we were awarded COVID-19 NIH research supplements to our existing influenza household and cohort studies, as well as dengue grants. SSI's unique position of running a long-term cohort study allows us to look back in time to understand if and how pre-existing antibody and T-cell responses to seasonal human coronaviruses may protect children from disease when infected with SARS-CoV-2. The household study allows us to investigate more general trends of asymptomatic infections as well as questions regarding shedding, serial interval of infections, and potential reinfections.





# COVID-19 Response in Ecuador

In Ecuador, our Executive Director, Josefina Coloma and SSI partnered with Fondo PorTodos (<https://www.portodos.ec/en/>), a private trust created to support communities during the COVID-19 crisis, to transfer low-cost ELISA assays for the detection of SARS-CoV-2 antibodies. This assay, developed by Florian Krammer at Mt. Sinai School of Medicine and the antigens used for the ELISA were donated to SSI and Ecuador by an initiative funded by Open Philanthropy and led by Dr. Aubree Gordon, SSI's Influenza Program director, at the University of Michigan (<https://tinyurl.com/yxtb75gk>). PorTodos and SSI transferred the technology and 65,000 assays to 11 universities and research centers in Ecuador to be used in COVID studies.



In addition, 200,000 additional ELISA assays were donated for a national seroprevalence study to be performed in collaboration with the National Secretariat of Risk Prevention and the Ministry of Health. This model of partnerships between the private sector, academia, civil society and the government has been key to surmounting many challenges posed by the pandemic in Ecuador and can serve as a model for other countries.

SSI and Ecodess field study personnel in Ecuador became a lifeline to remote communities by delivering food aid to over 3000 families funded by Por Todos Trust.





# New Global Pandemic Preparedness Consortium: A2CARES

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This year, SSI became a member of the CREID (Centers for Research in Emerging Infectious Diseases) network. This new NIH-sponsored consortium of 10 Centers across the globe, selected via a highly competitive review process, will help us better prepare for disease outbreaks. Our Center, led by SSI's President Dr. Eva Harris and Executive Director Dr. Josefina Coloma, based at the University of California, Berkeley, is named the Asian-American Center for Arbovirus Research and Enhanced Surveillance (A2CARES). A2CARES comprises partners in Nicaragua, Ecuador, Sri Lanka and the United States, with the overarching goal of developing an interconnected, harmonized network of clinical and laboratory sites to provide the foundation for research programs, compare arboviral diseases across geographic regions, develop and implement cutting-edge molecular and serological testing methods, and respond efficiently and effectively to new disease outbreaks.



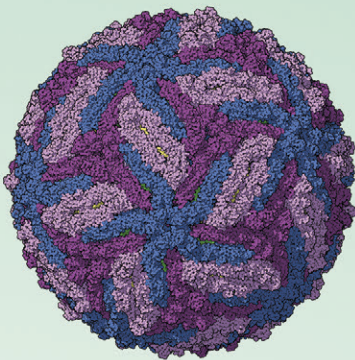
Asian-American  
Centers for  
Arbovirus  
Research and  
Enhanced  
Surveillance

We will utilize standardized hospital studies and community-based cohorts across these three countries to characterize and compare human arboviral illnesses in urban and rural sites and develop sustainable infrastructure to rapidly respond to epidemics, complemented by outbreak investigation, surveillance of non-human primates, and vector incrimination. The A2CARES Consortium will provide valuable new tools and knowledge that will be enable us to study emerging and endemic infectious diseases far into the future.





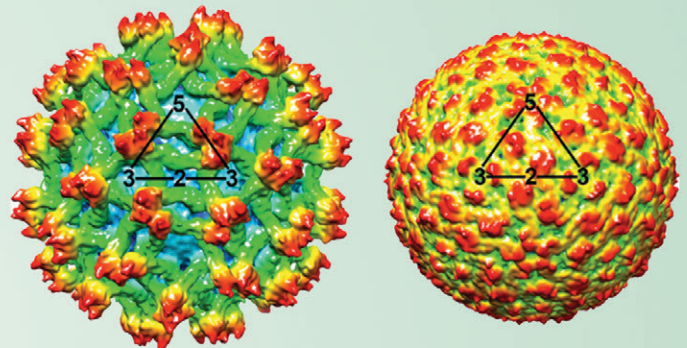
# Dengue/Zika Paper Published in *Science*



On August 28, 2020, our new paper was published in *Science*, “*Zika virus infection enhances future risk of severe dengue disease*” (Katzelnick et al.), which highlights the complex immune interactions among Zika virus (ZIKV) and the four different dengue virus serotypes (DENV1-4). The study of these interactions has far-reaching implications for our understanding of dengue and Zika and potential vaccines and highlights the importance of following infection history over long periods of time.

In this paper, a terrific collaboration between our teams in Nicaragua and UC Berkeley, we took advantage of our unique long-standing cohort and hospital-based studies in Managua and showed that prior ZIKV infection and cross-reactive anti-DENV antibodies after a ZIKV infection increase the risk of a subsequent symptomatic DENV2 infection, as well as enhancing disease severity. In contrast, prior DENV infection and anti-DENV antibodies are protective of symptomatic ZIKV infection! We also showed that similar asymmetries exist among the DENV serotypes. An important implication is that if Zika vaccines induce cross-reactive DENV antibodies such as those observed after natural ZIKV infection, they could increase risk of subsequent symptomatic and severe dengue disease; however, approaches can and are being taken by ZIKV vaccine developers to avoid inducing antibody-dependent enhancement. Our findings also show why it is important to analyze correlates of protection and risk for dengue caused by specific serotypes separately.

We continue to learn more as we delve deeper into unraveling the complex virological and immunological interactions of DENV serotypes and ZIKV in the Nicaraguan pediatric cohort study.





# SSI Spotlight: Fausto Bustos

Tell us about your life and upbringing, how did you get into epidemiology?

It's kind of a crazy story. I was born in San Diego, but grew up in Tijuana across the border in Mexico. As I did my elementary and high school education in the US, I crossed the border twice each day for 14 years -- over 5,000 times! I went on to do my undergraduate at Stanford in Political Science and Human Biology, which was my first encounter with research. I found public health to be a great fit, as it was at the intersection of my interests in public policy and medicine. Next I did an internship at the State Department's Office of International Health and Biodefense, which was an amazing nexus of many different public health topics. We answered questions such as, "If we want to reduce the burden of neglected tropical disease, how do we actually do that from the government's perspective." It felt very empowering and practical to be a part of public health in action, especially implemented through the policy lens. I then got my Master's in Epidemiology at Harvard. For my PhD, Berkeley was my first choice; once there, I connected with Eva Harris and she told me, "If you want to join my lab you need two things: you need to learn biology and you need to know Spanish" -- which I did! Thanks to the skills I learned from my PhD experience, I'm now the Program Manager and the Director of Epidemiology and Statistics at SSI.



Tell us about your research, what have you been working on, both before and during the COVID-19 pandemic?

My research sits firmly at the intersection of infectious disease, epidemiology and biostatistics, with a focus on interdisciplinary methods. For the past four years, my studies have centered on dengue, Zika and chikungunya viruses viewed through three unique lenses: epidemiological, clinical, and spatiotemporal. I use a highly computational approach to understand how these outbreaks spread over space and time. Right now, my other major project is to try to understand the clinical differences between dengue, Zika and chikungunya as diseases. In many places affected by these diseases, you would be lucky to have even an IgM ELISA for dengue. From my data, I am trying to help those who don't have the diagnostic capacity that we have at SSI. I aim to pull the human story out of the science and data: "What does this mean for the average patient? What does this person in this neighborhood need to do to protect themselves, which may be different from someone in a different time or place." Not just science for the sake of science.

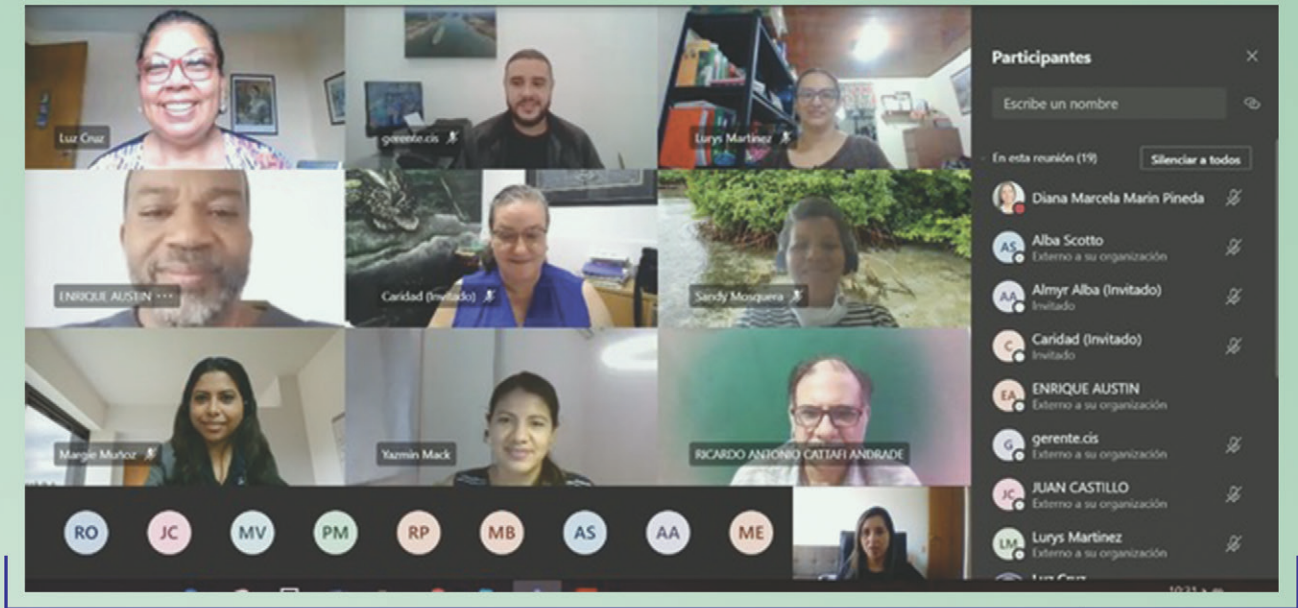
In April of 2020, I was finishing my PhD, when I realized that I needed to take action on COVID-19. I had the unique experience of spending the last four years of my life dealing with the Zika pandemic, and I could apply many of the skills I had developed to COVID-19. During the craziest time for me academically, I dropped it all to start working for the California Department of Public Health. I was given access to the California data on COVID-19 surveillance and modeling, and my job was to calculate the doubling time for the cases, which would be a part of the governor's briefing the next day. My job was also to present the data in a way that did not require several years of statistics education to understand. When California would implement the mandates, I would inform the counties, who in turn would tell doctors and other front-line health officials, "here is where you're likely to end up in terms of COVID-19 cases." At the state level, this allowed us to start to identify which specific communities needed the most help.

How do you feel public health could be improved more generally?

A lot of the challenge is educating the public. We can do fancy stats and studies and we can produce a vaccine, but if there is vaccine hesitancy then it's not super helpful. If the public doesn't trust you on masks or social distancing, it doesn't matter what the policies are, they aren't going to go anywhere. I wish we had less people saying, "These are the latest COVID case numbers" and instead asking people, "What can I do to convince you of the benefit of vaccines?" When we discuss public health, a lot of the intention and the money is focused on the 'health' portion, but the 'public' is right there as well. I would like public health to place a much stronger emphasis on science communication. It blows my mind that in 8 years of graduate education in public health, I never had a class on effectively communicating with the public, whether in times of crises or not. As the COVID-19 experience has shown, we need to make things easier to understand for a public that doesn't have the technical expertise to make sense of a lot of the numbers. And lastly, we need to be more transparent with the public about what we know, what we don't know, and how ongoing research could bring about practical, scientific discoveries. That's why I love SSI so much -- it is committed to building real partnerships with local communities, not only to conduct research, but to improve lives by sharing the benefits of research with others.



# Capacity Building



SSI's Capacity Building Program equips local scientists with the tools and training necessary to advance their own research, empowering them to solve the unique public health challenges that afflict their communities.

SSI Online  
Proposal  
Writing  
Workshop

This year, we have supplied laboratory reagents to Nicaragua, Ecuador, and Bhutan for the successful diagnosis of COVID-19, and we are in the process of assisting our collaborators in Quetzaltenango, Guatemala, to obtain the equipment and reagents to diagnose COVID-19 and other infectious diseases such as dengue, Zika and human papilloma virus. The success of the Guatemala initiative could not have been possible without the valuable help of instructor and collaborator Dr. Jesse Waggoner from Emory University and Dr. Janet Ikeda, the director of the Asociación de Investigación, Desarrollo y Educación Integral (IDEI) in Quetzaltenango.

In 2020, SSI adapted our training workshops to the conditions presented by the COVID-19 pandemic. As in-person instruction was no longer permissible, we adapted to successfully implement multidisciplinary virtual training workshops in Panamá and are planning more online workshops for 2021 in Brazil, Panamá, Honduras and other countries around the globe.



The virtual proposal writing workshop we conducted in Panamá trained 21 scientists to write articles for publication in peer-reviewed journals on a variety of topics such as women's empowerment, children with HIV and resistance to therapy, nutrition for native communities, and improvement of rice culture, among others. Our instructors held lectures in the morning, and one-on-one tutoring sessions were scheduled in the afternoons, giving individual attention to each participant. We observed that this new virtual modality was at times more effective than in-person instruction, as the participants were better focused on their work, there was faster turnover of reviews, and rapid progress of writing and data analysis. While more focused and direct, we also cut down on the cost of travel and accommodations for the instructors, broadening our reach and allowing participants from all over Panamá to attend from their own homes. The new modality of virtual teaching will enable us to reach many more participants in the future and expand our reach to more of the world's scientific community, with current plans to teach in Bhutan, Mozambique, Madagascar and with many more of our collaborators in Latin America.



# We Need Your Support!

As the world grapples with the deadly COVID-19 pandemic, SSI's mission of a sustainable future for global health becomes even more important.

Your charitable contribution directly supports scientists and public health communities of limited resources with the vital supplies needed to conduct relevant research of the SARS-CoV-2 virus and equips them to combat COVID-19, as well as better prepare their sites for future outbreaks. Thank you for supporting our mission and helping local researchers and public health systems where they are needed most.

Donate via mail or online at:

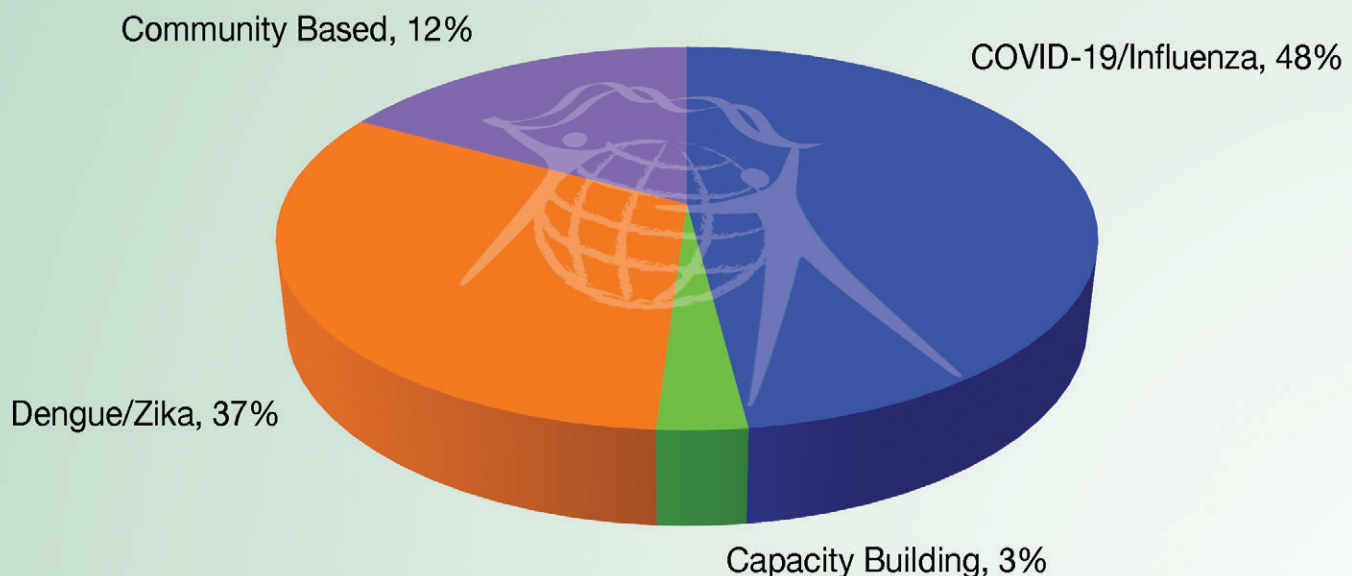
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Our programs are funded by grants from government agencies, private institutions, and generous contributions from individual donors.





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## **Contact Us**

**Sustainable Sciences Institute**  
870 Market Street, Suite 764 San Francisco, CA 94102  
415-772-0939  
[admin@sustainablesciences.org](mailto:admin@sustainablesciences.org)