



Sustainable Sciences Institute

2019 ANNUAL REPORT



Message from SSI's President

As we approach the end of the year, I reflect upon the great strides we have made over the twenty years since SSI was founded, not only in the realm of scientific capacity building and discovery, but in the partners and friends we have made along the way. So much progress, and still so much to be done in the field of global public health! Despite the challenges, I feel great excitement and optimism for the decade to come. I thank you deeply for your continued support of SSI and global health.

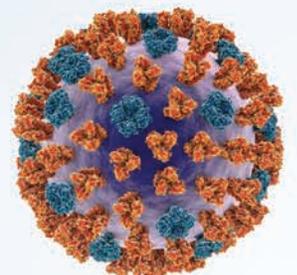


Eva Harris, SSI Founder and President

New Research Grant!

This year, in partnership with St. Jude Children's Hospital and The University of Michigan, SSI has been awarded a new research grant, entitled "*Dissection of Influenza Vaccination and Infection for Childhood Immunity (DIVINCI)*" led by Dr. Aubree Gordon, SSI's Influenza Program Coordinator and lead researcher.

Continuing our long-time collaboration and partnership with the Nicaraguan Ministry of Health (MOH), SSI will be conducting a cohort study to investigate the development of influenza immunity in infants and children. This project will be based on a group of children in Managua, Nicaragua, with the study headquartered at the Health Center Sócrates Flores Vivas (HCSFV) in District II of Managua, and at the Nicaraguan National Virology Laboratory. Influenza viruses from respiratory samples during acute infection will be analyzed, and blood samples will be collected from influenza cases and vaccinees, as well as annually, to examine the effects of immune imprinting on influenza immunity. This study should inform the design of next-generation and universal influenza vaccines.



SSI Spotlight: Jose Victor Zambrana

Tell us about your childhood, where were you born?

I was born in Nicaragua in 1991, a year after the peace agreement that ended ten years of civil war. I grew up in times of collective rehabilitation, but also saw disparities, racial inequalities, and differences in living conditions all around me. I always had an insatiable curiosity about the natural world. My family experienced a lack of financial security growing up, but my father believed that education was integral to the development of all his children. Studying in private schools as a child with few resources shaped my character immensely because I developed humility, simplicity, and most importantly, a deep gratitude towards my family.

How long you have worked with Sustainable Sciences Institute in Nicaragua? What is an important finding that stems from your research?

I came in contact with SSI in 2011 when I was a college student at the Universidad Nacional Autonoma de Nicaragua (UNAN). I did a practicum in the National Virology Laboratory and SSI's Virology program, both headed by Dr. Angel Balmaseda, and was subsequently hired as an entry-level technician at SSI. I loved working there, because it is one of the few places in Nicaragua performing active biomedical research. I developed my thesis, an evaluation of serological tests for HIV, which ended up influencing the diagnostic algorithm for HIV and the national purchase of reagents in Nicaragua that year. Since 2014, my amazing team and I at SSI have worked on the serological diagnosis, development, and evaluation of in-house serological tests for arboviruses, such as dengue, chikungunya, and Zika, that have been applied to research and surveillance at the national level. In 2016, I realized we needed to update our data analysis to incorporate more modern statistical and epidemiological tools. Therefore, I taught myself the R programming language, with which I learned basic data and statistical analysis. Utilizing this new tool, in tandem with a scientific-writing course offered by SSI, I was able to co-author 4 scientific papers on Zika, including a co-first authorship with a doctoral student at UC Berkeley on the prevalence and risk factors of the enormous Zika epidemic in Managua, which improved our understanding of Zika more generally.

How did you arrive at UC Berkeley? What is your current focus there?

I desired to gain new knowledge regarding state-of-the-art epidemiological and statistical methods, so I applied to the competitive UC Berkeley Gilead Fellowship for the Advancement of Global Public Health to obtain an MPH in Epidemiology at UC Berkeley. I overcame many hardships, including teaching myself English in just a few short years en route to being awarded the fellowship. Now, I am here at UC Berkeley completing my Masters and gaining a deeper understanding of the disease patterns in Managua, through my own research and the Pediatric Dengue Cohort Study.

How do you see SSI's role in Nicaragua?

At SSI in Nicaragua, we develop sustainable strategies for prevention of mosquito-borne illnesses, through affordable diagnostic technologies and community mobilization. These initiatives make a big difference in our battle against, and understanding of, arboviruses in Nicaragua. SSI has been instrumental to my career, and the career of my peers, as it allows us to contribute to our communities with research that has an immediate public health impact within Nicaragua and is also very important to the international scientific community at large.



Jose Victor Zambrana

Program Highlights
2019

HAY
FRÍJOLAS HUEVOS

Nicaraguan Dengue Studies

In 2019, Nicaragua experienced the largest dengue epidemic in the country's history. Throughout the region, Guatemala, Honduras, and Nicaragua have all declared nationwide alerts to expedite the public health response to this epidemic. In the previous arbovirus transmission season (2018-2019), 10 cases of dengue virus type 2 (DENV2) were confirmed out of 549 suspected cases in our Pediatric Dengue Cohort Study (PDCS). As of the first week in December 2019, there have been 327 laboratory confirmed cases of DENV2 out of 896 suspected cases! In addition to these record rates of transmission, the PDCS had to adapt to new guidelines instituted by the Ministry of Health, on the management of suspected dengue cases. Health centers were instructed to create Febrile Attention Units (UAF) for the primary care of patients with warning signs, patients who would have been immediately transferred to the hospital in past years. This signified a dramatic shift in workflow for the study team's medical staff, as they were responsible for treating many more patients. Health Center personnel successfully managed to respond and adapt to this measure, even in the face of the unprecedented outbreak.

Our companion study, based at the National Pediatric Reference Hospital "La Mascota", was equally flooded with dengue cases this season. In addition to responding with quality medical care and saving lives during the mega-epidemic, our team continued to conduct our studies, which enabled real-time analysis of the epidemiological and immunological interactions between DENV and the closely related Zika virus (ZIKV). Addressing a major question in the field, the team found that prior DENV infection protects against symptomatic Zika, but that prior ZIKV infection is a risk factor for symptomatic DENV2 infections. Investigations are underway to more fully understand these intriguing observations, with important implications for both dengue and Zika vaccines.



Influenza Studies



Data from our ongoing influenza transmission studies are proving invaluable for characterizing correlates of protection to influenza as well as factors affecting the durability of the immune response. For instance, our Household Influenza Transmission Study provided the first evidence that influenza stalk antibodies, a potential target for universal influenza vaccines, protect people from influenza infection. We further found that pre-existing neuraminidase antibodies shorten the duration of influenza disease including reducing shedding which supports that neuraminidase should be included as a target in

next-generation influenza vaccines. This year, we also expanded our work on Respiratory Syncytial Virus (RSV), a respiratory virus that has an extremely high burden of severe disease in infants and young children. Using data from our Nicaraguan Birth Cohort Study, we documented a very high burden of disease and found that RSV was responsible for 25% of the acute illness deaths in infants that occurred in the cohort. Given the incredibly high burden of RSV we found in our population and the lack of accessible preventative and treatment measures available for RSV, we plan to expand our work on RSV in the coming year to contribute to efforts to produce an RSV vaccine for infants and young children and to support decision-making once an RSV vaccine is available.

Community Engagement



SSI's community mobilization programs have proven that communities themselves have the ability to combat mosquito-borne illness through key messaging and empowerment. SSI and our partner AMOS Health and Hope continue to work with health brigades in multiple districts of Managua, to mobilize communities afflicted by mosquito borne diseases.

Our strategy uses evidence-based communication to influence social behavioral change and relies on the self-determination and resilience of the communities affected to fight against the *Aedes aegypti* mosquito. Over fifteen years of data and successful interventions through programs such as Camino Verde, DengueChat, and CareGroups have proven that communities themselves can reduce their risk for mosquito-borne diseases, without relying on outside intervention or the use of toxic chemicals and insecticides. Through the work of SSI's Executive Director, Josefina Coloma, these programs are being replicated in other countries, including Paraguay, Colombia, and Mexico. We are excited by the progress and the promise of mobilized communities inventing their own solutions!



Scientific Capacity Building



*Maria Elena Peñaranda
SSI Scientific Director*

In 2018, SSI established a three-year partnership with SENACYT (Secretaria Nacional de Ciencia, Tecnologia e Innovacion) to promote the development of science, technology and innovation within Panama. In the second year of this program, we implemented five capacity-building initiatives in Panama City and the adjacent region of Darién. Among these were a manuscript-writing workshop, three proposal-writing tutorials (aimed at health science researchers and returning scholarship recipients), and a comprehensive laboratory workshop on arboviral disease diagnosis, with laboratory technicians responsible for the detection of dengue, Zika and chikungunya virus infections in Panama City.

For the first time, SSI conducted a proposal-writing workshop in Darién, the southern region between Panama and Colombia. Also known as the 'Darién Gap', this region consists of a remote forest where there are no roads that adjoin the North and South American continents. Among the 23 participants, 20 were women belonging to different indigenous groups within the region. Their proposals dealt with topics concerning clean water, recycling, and sanitation as well as conservation of their history, rituals and way of living.

Additionally, this year SSI implemented a cost-effective new modality for proposal-writing tutorials. Over the course of two days, we offered one-hour tutorials to individual groups of researchers applying for the SENACYT grant cycle. We met one-on-one with ten different researchers to discuss their proposal and offered targeted feedback on each of the projects. From the ten projects reviewed, five were selected and four received funding from SENACYT.

We Need Your Support!

Just as the scientists and public health workers that we empower rely on us, we rely on your support to continue our important mission. Your donation will go directly towards providing the training and research supplies urgently needed by our partners the world over.

Solving global health crises requires us to think and act globally. The best way to fight disease outbreaks is to equip local scientists, health professionals, and communities to face their challenges head on. Your support helps us to build such a world.

Donate via mail or online at:

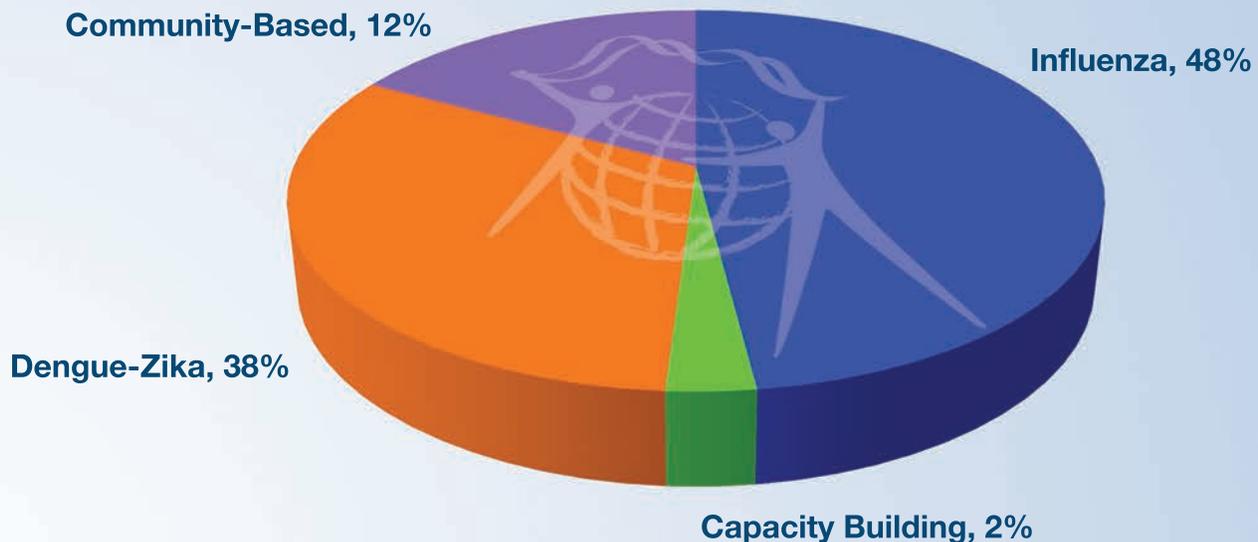
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Our programs are funded by grants from government agencies, private institutions, and generous contributions from individual donors

TOTAL 2019 BUDGET: \$2,739,112



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Josefina Coloma, Executive Director
Maria Elena Penaranda, Scientific Director
Marlon Buitrago, Senior Accountant
Kenny Ou, Accounting Assistant
Mary Masland, Grants Manager
Frank Steier, Office Administrator

SSI Nicaragua

Angel Balmaseda, Director of Virology
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Contact Us

Sustainable Sciences Institute
870 Market Street, Suite 764 San Francisco, CA 94102
415-772-0939
admin@sustainableciences.org

