In 2009, I was enjoying my first biology course when a pandemic gripped my city. The fear of viruses, hearing people coughing uncontrollably, witnessing the unmitigated suffering of influenza – all made a dramatic impression on me. Ironically, as I later began to study viruses, my dread as a young boy was replaced by an unflagging respect and dedication to their research. With the opportunity of attaining my Ph.D. alongside the exceptional virologists at Yale, I hope to contribute to the prevention and eradication of future viral pandemics.

I began performing virology research with Professor Laura Trejo as an undergraduate student at Universidad Autonoma de Nuevo Leon (UANL) in 2014. I spent 4 years in Dr. Trejo's laboratory investigating how extracts from Mexican seaweeds inhibited measles virus (MeV) replication. We purified the extracts, I tested them through different combinations against MeV and identified their composition through HPLC. After rigorous experiments, we discovered that these algae contained a high concentration of polysaccharides and polyphenols that had a potent antiviral and virucidal effect. This work resulted in two research publications on which I am a second-author and a co-author.

Ultimately, my love for viruses fully awakened in summer of 2016, when I worked in Stephen Goff's lab at Columbia University. His passion for research and mentoring made me realize just how much I want to follow his path. After my research proposal, I started to work on the design of CRISPR/Cas9 knockout cell lines for the genes Mnat1, Eif3l, Amotl1 and Cops5 – and their effect on different viruses. With Dr. Goff's permission, I continued the project at UANL. Under the mentorship of Dr. Trejo, I became the first student at UANL to work with CRISPR/Cas9.

To deepen my knowledge in virology, I worked the following summer with Dr. Manuel Llano from the University of Texas at El Paso. I investigated the role of the LEDGINS drug in HIV replication. By using confocal microscopy, I observed that LEDGINS was interacting with the HIV integrase. Simultaneously, Dr. Llano invited me to co-author and publish a scientific review titled "Defining Pharmacological Targets by Analysis of Virus-Host Protein Interactions". With this unique opportunity, I learned the entire process of a scientific publication.

I returned to Dr. Steve Goff's lab at Columbia in 2018. I discovered that Mnat1 knockout, which is a cofactor of CDK kinase, decreased Zika and dengue virus replication. My research in this second internship involved bioinformatic analyses of sequenced genomes of Mason-Pfizer monkey virus and, by using the pLVX lentiviral vector, the restoration of Mnat1 in the knockout cell line. In the end, restoration of Mnat1 restored virus replication. The Mnat1 project served as my undergraduate dissertation and we are now actively trying to publish this work.

Since I am a first-generation student, finances have been a big obstacle. But thanks to hard work, I was awarded a Postgraduate Research Associate position at Yale University. Here, Dr. Brett Lindenbach encouraged me to reinvent the way of investigating the mechanism of flavivirus NS1-2A protein processing, which has challenged virologists for many years. By using a reverse genetics system for yellow fever virus, I formally demonstrated that NS1-2A processing is essential in virus replication. Then, we were curious to know if the yellow fever virus could replicate independently of the normal NS1-2A processing mechanism. I tackled this question by introducing the EMCV-IRES and a signal peptide between NS1-2A to obtain the NS1 and NS2A proteins independently

processed. Interestingly, these mutants were not able to replicate, suggesting that the uncleaved NS1-2A precursor also plays an essential role in viral replication.

Simultaneously, to elucidate the requirements for NS1-2A processing, I constructed a panel of NS2A truncations. By using a specific Gaussia luciferase reporter fused to NS1-2A viral proteins, we showed which regions of NS2A are vital for this cleavage. However, the main goal of this project is to discover the protease involved in this mechanism. By using the same reporter system, I also demonstrated that the protease RHBDD1 can restore NS1-2A defective cleavage in several flaviviruses, which implies this a protease involved in this mechanism. I gave oral presentations at the American Society for Virology meeting (ASV2019) and the Mexican Congress of Virology, and we are excited to submit a paper detailing our research soon.

I also gained mentoring experience during my undergraduate years in the molecular virology course. My role was to teach students several virology techniques. I also gave lectures about CRISPR/Cas9 and its application to virology. The teaching experience - fostering personal and professional growth - was incredibly fulfilling, and I believe Yale is a great home to improve my skills as a mentor with its Poorvu Center for Teaching and Learning.

My goal is to lead a state-of-the-art virology research group focused on understanding the mechanisms underlying viral replication and developing novel methods to inhibit them. Attaining my Ph.D. in microbiology will be a crucial step towards achieving this objective.

With these goals in mind, the interdisciplinary BBS Program in Microbiology at Yale University is precisely the type of environment I am looking to train in. Yale is teeming with outstanding virologists such as Dr. Lindenbach, with whom I have been working for more than a year. His research directly aligns with my desire to understand how RNA viruses replicate. Further, Dr. Ho and Dr. Mothes have extensive expertise in retroviruses. I am interested in their research of retroviral *in vivo* imaging and single-cell analysis, respectively. With a better understanding of retrovirus replication, we can improve the technologies to treat HIV. The work of Dr. Iwasaki is also compelling. Specifically, I would like to contribute to her research on mechanisms of immunity against RNA viruses. This will allow me to prevent pandemics like the one I experienced in my youth.

Virology is a field where one must be open-minded to learning and change, just as viruses themselves evolve and adapt to their hosts. I believe the rich virology research at Yale will keep me growing as the scientist and virologist I want to become.