TEXAS BIOMEDICAL RESEARCH INSTITUTE

2020 ANNUAL REPORT

SCIENCE IS THE HERO

TEXAS BIOMEDICAL RESEARCH INSTITUTE

HEALTH STARTS WITH SCIENCE

2020 ANNUAL REPORT

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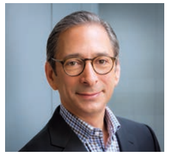

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INSIDE

SCIENCE IS THE HERO

THIS past year has been nothing short of spectacular. I use that term in its broadest sense to capture the weight and magnitude of the human experience in 2020. Together, as a global community, we have struggled economically, physically and emotionally to process a multitude of traumas from the pandemic to social injustice to economic uncertainty and more.

But, what I saw throughout 2020 was resilience, determination and progress. Our team, alongside scientists around the world, dug deep to find answers. They sacrificed time with family to seek solutions. They stretched their imaginations to consider new approaches. And, ultimately, they succeeded in bringing forth therapeutics and vaccines to the world in record time. You will read in their own words what their world was like last year.

I could not be prouder of the team at Texas Biomed for the Institute's role in the development of COVID-19 therapeutics and vaccines, but I am equally proud of the team for its continued commitment to good science, because as we have seen with COVID-19, good science wins.

We have known for years that the answer to global health lies with research, so we expedited the scientific process, but we did not circumvent the process. We stayed committed to our values of Teamwork, Integrity, Diversity, Excellence and Safety. This commitment was noticed by companies worldwide, which is why today under the leadership of our new VP for Business Development & Strategic Alliances we have more than $40 million in contract research booked and dozens of new partners. This attention also meant we could jumpstart our business development efforts and launch a new strategic innovations team to help foster collaboration with global companies.

This past year has allowed us to help educate and inform the public, and I am grateful for the opportunity we had to serve our community in this way. We want to serve the global community in the same way, and our new Vice President for Development is leading the charge to ensure our voice moves from local to global.

Our voices need to be loud, as we have also learned that science does not operate in a bubble. It is impacted by social injustice, public conflict and governmental discord. Our voices need to be heard through the cacophony of misinformation, and we need to be an advocate for change.

This year is my four-year anniversary at Texas Biomed, and while the Institute and the world have undergone seismic changes, what follows change is progress. It is clearer now than ever before that we are a global community, and infectious diseases across the world can impact us here at home. Now we know better so we can do better.

With your support, Texas Biomed helped change the course of the pandemic. Through the work we did and continue to do on diagnostics, therapies and vaccines, the world is beginning to reopen.

In my very first presentations to Texas Biomed in 2017, I began with a quote from Nelson Mandela where he says, "We can change the world and make it a better place. It is in your hands to make a difference."

Together, with you, science made a difference. Science is the hero.

Larry Schlesinger, MD
President and CEO

2020: A YEAR LIKE NO OTHER

ACCOUNTS OF LIFE AND SCIENCE DURING COVID-19

IN 2020, words that once graced the pages of science fiction novels became reality. In what felt like one day, businesses, restaurants, schools, playgrounds — all the places we live, work and visit — simply shut down. And, while we have so many essential workers to thank for their heroic efforts to get us through the past year and a half — healthcare workers, grocery workers, truck drivers, first responders and more — researchers and scientists led the way in providing both hope and a way out of the darkness.

Scientists were on TV every night helping citizens across the globe understand terms like social/physical distancing, transmission rate, flattening the curve, herd immunity, PPE and many others. Facing the pressure to deliver a reprieve in the form of a vaccine while also educating the public and continuing research into ongoing health crises, scientists also faced the same realities and lived with the same fears as everyone else. In the following five stories, we share personal accounts from scientists who were on the front lines of COVID-19 and other disease research to learn what it was like to work through 2020.

LAUNCHING A NEW, COLLABORATIVE PROGRAM INTO COVID-19

Jordi B. Torrelles, PhD, Professor, BSL-3 Program Director

The first time I heard about the new coronavirus I was in the Democratic Republic of the Congo. It was late January 2020, and I was there with several other scientists. We were about to implement a study on developing better treatments for drug-resistant tuberculosis. We started looking at the news every day before breakfast, and we saw that the outbreak was getting larger. At that time nobody even knew how the virus was transmitted.

When I got back to the United States the last day of January, I met with some of my colleagues at Texas Biomed. We decided to create a coronavirus working group that would meet regularly and review all the research. Everybody looked at me, because I was the only one of the group who was not a virologist and decided I would be a great coordinator, because I had no conflicts of interest.

The initial team was formed by some of our Texas Biomed virology experts that could quickly jump into Coronavirus research: Drs. Jean Patterson, Luis Giavedoni, Ricardo Carrion, Jr., Luis Martinez-Sobrido, and animal model experts such as Drs. Deepak Kaushal, Joanne Turner, myself and a geneticist expert, Dr. Tim Anderson. Later this Coronavirus Working Group expanded to include more than 15 Texas Biomed scientists and growing.

We started to have very intensive weekly meetings to try and figure out the best way that Texas Biomed could assist in battling this problem. Dr. Schlesinger and Dr. Turner started fundraising to get the money needed to develop different animal models. We didn't know anything about which animal model would be the best, but we knew these models would be needed to start developing therapies and treatments. My main job was coordinating and keeping track of everything that was going on.

The first thing we needed to do was to obtain a sample of SARS-CoV-2. We got one that was a derivative of the strain found in a patient in Washington State. We began to focus our attention on non-human primate models and decided to go with three species: baboons, rhesus macaques and marmosets.

Then we received a call from the Jackson Laboratory in Maine, asking us if we were prepared to work on the development of a new mouse model of SARS-CoV-2 infection. Of course, we said yes. We had the team in place; we had the capacity in our biosafety level (BSL)-3 labs and we had the expertise.

We knew that the mouse model would be important for evaluating potential new therapies and vaccines, and that it would be needed to decide what approaches to test in higher animal models like non-human primates. It was a race against time to develop this model quickly. Other labs were working on the same problem, using different experimental designs. But in the end, we all got the same result.

Our team published two major papers on these animal models. The study on the transgenic mouse model for SARS-CoV-2 infection was published in *Nature Communications* in November 2020. The study on responses to infection with SARS-CoV-2 in the lungs of non-human primates was published in *Nature Microbiology* in January 2021.

Texas Biomed was also contacted by the Bill & Melinda Gates Foundation (BMGF) to participate in the Coronavirus Immunotherapy Consortium (CoVIC), an international collaborative group evaluating monoclonal antibody (MAb) therapeutics for COVID-19. Dr. Martinez-Sobrido and I were selected to co-lead a project to evaluate the efficacy of these MAbs in small rodent models. We have developed a screening platform to test the ability of the antibodies to protect against the progression of disease using our transgenic mouse models as well as golden Syrian hamster models. The ultimate goal of CoVIC is to identify the combinations of MAbs that offer the most protection.

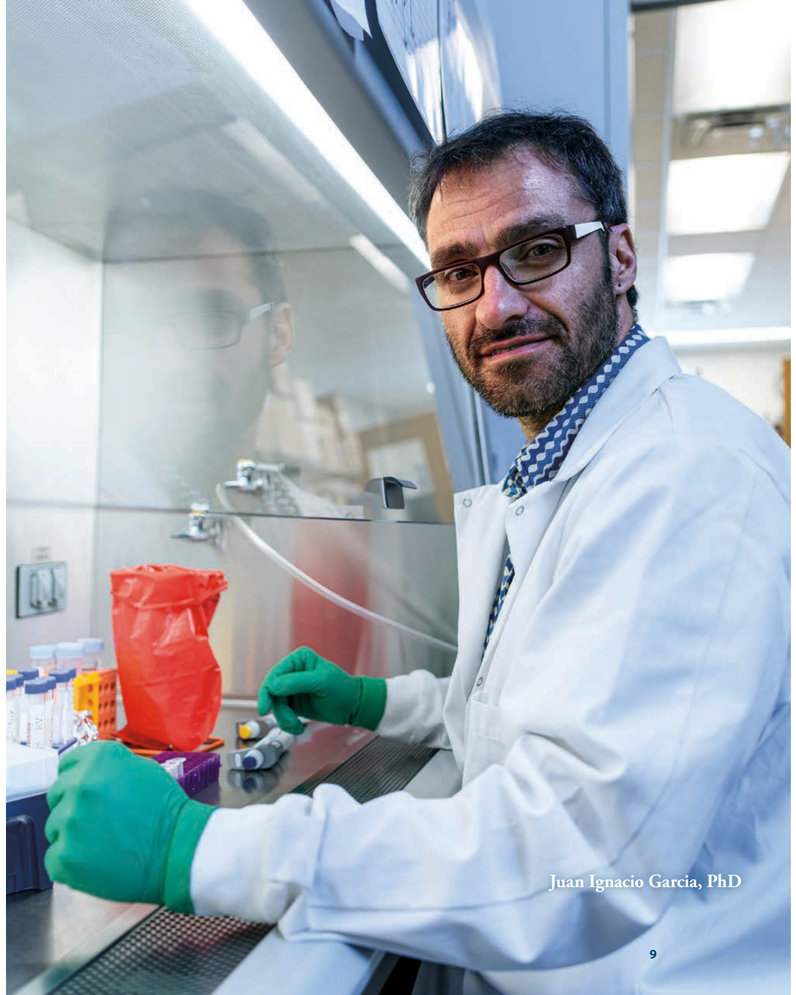
At the same time we were doing SARS-CoV-2 research, we were still doing work on tuberculosis. COVID-19 is the pandemic of the moment, but tuberculosis has not gone away. It kills someone every 21 seconds. Tuberculosis gets a lot less attention, because it mostly affects middle- and low-income countries, but it's actually a big concern along the Texas-Mexico border, where we have seen the development of drug-resistant disease.

We recognize the members of the Texas Biomed BMGF project team (Paula Pino-Tamayo, Jun-Gyu Park, Alison Whigham, Amberlee Hicks, Colwyn Headley, Juan I. Garcia, Andreu Garcia-Vilanova, Anna Allue Guardia, Oscar Rodriguez, Billie Maingot, Jennifer Delgado, Angélica Olmo-Fontánez and Chengjin Ye) for their dedication to this important project.

COVID-19 AND THE IMPACT ON OTHER PANDEMIC RESEARCH

Juan Ignacio Garcia, PhD, Postdoctoral Researcher

While many people in our group were working on COVID-19, I went to Mozambique to continue our tuberculosis project in January 2021. I had a lot of trouble getting there and getting back, but it was important for me to go.



Juan Ignacio Garcia, PhD

The research center that we collaborate with was hit very hard by COVID-19, and they had a lot of staff who were still sick and recovering. But I was vaccinated and I had masks, so I felt like I was safe enough.

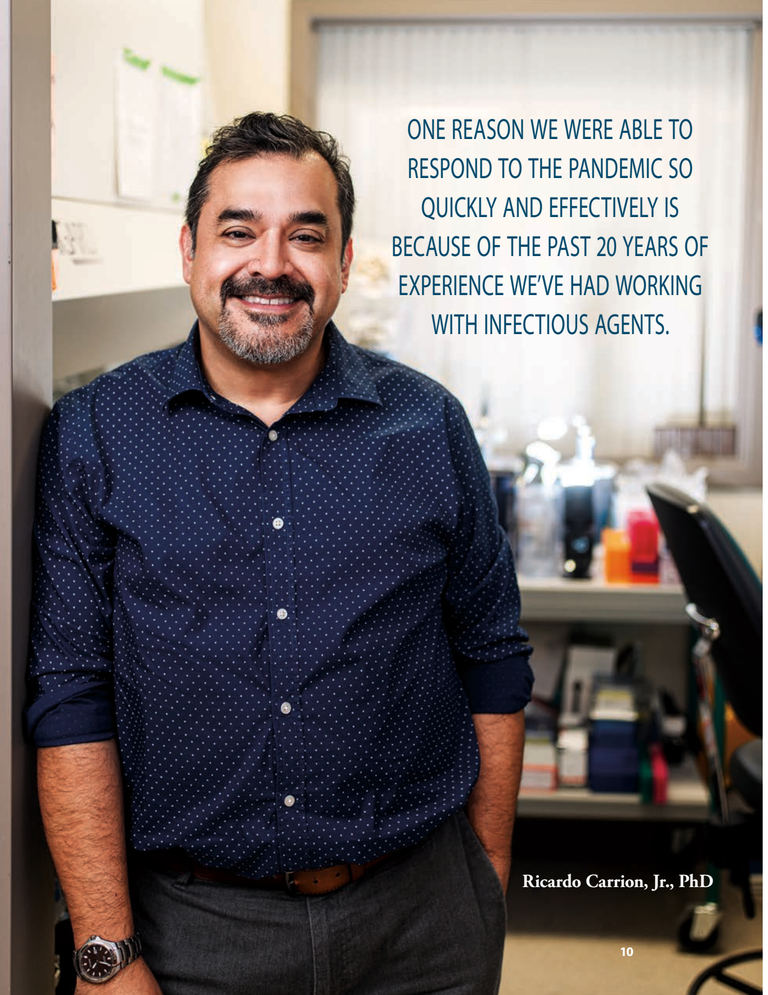
We were doing a lot of trainings with the staff there, things like collecting tuberculosis samples and growing them on plates. Many of the clinics there that normally do tuberculosis testing were using their testing equipment for COVID-19 instead. This pandemic has led to delays and setbacks in our research.

AN OVERNIGHT SUCCESS 20 YEARS IN THE MAKING

Ricardo Carrion, Jr., PhD, Professor, Director of High Containment Contract Research

In January of 2020, I was at a meeting in Washington, D.C., where the topic was this new emerging virus that could become a pandemic. Very early on, I started talking to my colleagues at Regeneron about a monoclonal antibody (MAb) they were developing for the treatment of COVID-19.

We already had a relationship with them, because my lab conducted a lot of the research on their MAb treatment for Ebola. A key part of developing these treatments is testing them in non-human primates. For COVID-19, we



demonstrated that we could replicate disease in three different animal models: rhesus macaques, marmosets and baboons. We ended up using our rhesus macaque model to do some of the validation studies for Regeneron's COVID-19 MAb treatment.

One reason we were able to respond to the pandemic so quickly and effectively is because of the past 20 years of experience we've had working with infectious agents. This includes not only Ebola virus but anthrax before that. We've been developing animal models as well as countermeasures such as vaccines and therapies against biosafety level (BSL)-4 infectious agents in advanced preclinical studies.

Anysha Ticer, Biocontainment Program Coordinator II

As a coordinator for these labs, I make sure that everything is calibrated and that the lab spaces have everything they need, including personal protective equipment (PPE) and other supplies. Of course with the pandemic, we were also hit hard with all of the demands for PPE as well as plastic pipette tips and syringes, and I've been very busy the past year because we've opened up new BSL-3 spaces on our campus.

Anysha Ticer prepares for the BSL-3 lab.

When COVID-19 first hit, we didn't know what BSL level it was. We did some of the work in BSL-4 labs. We had to make sure we had enough respirator shrouds and protective suits for everyone. There are many people who use these spaces, including lab personnel and animal care staff.

Dr. Carrion: There have been shortages of certain reagents because of delays in the manufacturing pipeline. Fortunately, because we have been working on COVID-19 vaccines and treatments, that comes with a special designation from the United States government, which allows us to jump to the front of the line for any supplies that are needed for our SARS-CoV-2 research.

Because we are doing so much research right now, we've tried to keep three months' worth of backup supplies for any type of experiment we might need to do. That way, if we encounter a situation where we can't get a reagent, we'll be able to finish the study we're doing. There has been a downstream effect in our laboratories. We barely have room to walk because it's crammed full of boxes of supplies.

We are continuing to do vital work. As variants of SARS-CoV-2 are emerging, we are doing more work in that area. We are looking at what the second generation of vaccines might look like — whether boosters might be needed, what they might look like, and how we can protect people against all the different strains of the virus.

Ms. Ticer: It's really rewarding to play such an important role in this research. Everyone at Texas Biomed has had to work together. We're all here for the same purpose. Because so many of us are considered essential staff, we never had a break away from campus. We had to keep the animal studies and all the other research going.

Everything happened at such a fast pace. We had to make sure that everything we needed to do was completely within the deadlines, while at the same time keeping all of our staff safe.

Elizabeth Clemmons, DVM

SPEEDING UP AS THE WORLD SLOWED DOWN

Elizabeth Clemmons, DVM, Assistant Professor, Veterinarian

The veterinarians at Texas Biomed provide clinical care for our animals on campus, but we also play a role in designing studies and developing new animal models. Before COVID-19, I was doing some work in the animal biosafety level (ABSL)-3 labs and also supporting the ABSL-4 lab's work with Ebola and other hemorrhagic fever diseases.

Thinking back to the beginning of the pandemic, the thing that stands out is how quickly everything moved. It was strange because outside of work everything was shutting down, but we were revving up and were busier than ever. I was in some of the initial planning meetings about SARS-CoV-2 research, when we were still having them face to face. And then we moved to very restricted interactions and virtual meetings, adding a new challenge to the work.

For the first SARS-CoV-2 pilot studies, we needed to figure out what kind of nonhuman primate would be the best one to study the infection. We gave the virus to baboons, rhesus macaques and marmosets. It's significant that we have such a variety of nonhuman primates at Texas Biomed,

THINKING BACK TO THE BEGINNING OF THE PANDEMIC, THE THING THAT STANDS OUT IS HOW QUICKLY EVERYTHING MOVED.

because most research centers would not be able to do this kind of work in multiple species. My main role was consulting with the veterinary radiologist. We were still learning what this disease would look like on X-rays and CT scans. There wasn't an established way to evaluate the disease in nonhuman primates yet.

The different species of nonhuman primates showed varying responses to disease. Additional studies have relied primarily on the macaques, partially because they are already a widely used model for infectious disease research. As the pandemic worsened, we had to be careful that our colony animals didn't naturally catch SARS-CoV-2. We've done some testing of these populations and have a lot of safety measures in place to protect both people and animals.

The nonhuman primate models from Texas Biomed were essential to the preclinical work for Regeneron's monoclonal antibody treatment and Pfizer-BioNTech's vaccine, both of which were eventually approved for emergency authorization use. I was mainly involved in evaluating the antibody treatment, while other veterinarians on our staff worked more on the Pfizer-BioNTech study.

Veterinary technicians do the majority of the hands-on work, watching the animals for any clinical signs of infection and documenting what they see. We also collect swabs and other samples and regularly monitor the animals' vital signs. We want to look at how the animals respond to the monoclonal antibody treatment or whether the vaccine protects them from infection.

The main focus for the year was our SARS-CoV-2 studies, but we were also extremely busy in the ABSL-4 lab, working on hemorrhagic fever projects. We've been refining models, including what is called a jacket and tether system. This allows us to draw blood or administer IV drugs through an indwelling catheter without handling an animal, so the monkey is sitting comfortably and doesn't have to be sedated. This method has been used in biomedical research quite a bit, but we have applied some new strategies that are well suited to the unique challenges in high containment labs. It was a privilege to be involved in this work at such a weird and uncertain time in our lives. I'm proud to work here and be part of these projects.

ONBOARDING AND TRANSITIONING A RESEARCH PROGRAM DURING THE PANDEMIC

Luis Martinez-Sobrido, PhD, Professor of Disease Intervention & Prevention

I joined Texas Biomed in February 2020. It was a challenging time, both personally and professionally. As soon as I got here, everything shut down.

I was lucky enough to have everybody from my former lab at the University of Rochester come with me to Texas, so I didn't have to recruit anybody during the pandemic. But, we didn't have all of our biosafety and animal protocol approvals in place right away. There also was a shortage of reagents and other supplies that we needed in the lab. We were following the virus very closely since January 2020, before coming to Texas, and we already knew it would be an important concern for human health.

My lab usually studies influenza, Zika, Ebola, and arenaviruses, but because everything changed this year, we switched our research program from those other infectious viruses to studying only SARS-CoV-2. During this last year, we have published 20 manuscripts on SARS-CoV-2 and have around 10 currently under review.

Our COVID-19 research has been focused on two major areas. One has been the development of animal models to study the virus. We have focused mainly on developing rodent models. One of them was a transgenic mouse model. This is a mouse that expresses the human receptor for the virus. This work has been in collaboration with Drs. Joanne Turner and Jordi B. Torrelles.

We also developed another rodent model, the golden Syrian hamster. Transgenic mice are great for studying some aspects of the pathogenesis of the virus, but they're not a good model for transmission studies. That's because mice don't cough or sneeze. We knew that — like influenza — SARS-CoV-2 is mainly transmitted by aerosol. So the hamster model was important for research on preventing the spread and transmission of the virus. We thought that developing small animal models to study SARS-CoV-2 infection and COVID-19 disease would be helpful for validating or supporting conclusions before moving research into larger animals.

The other thing we've invested a significant amount of time and effort since the pandemic started is developing reverse genetic approaches to generate recombinant SARS-CoV-2. We cloned the entire genome of SARS-CoV-2 into a plasmid, which is a small piece of DNA that can replicate independently in bacteria. The plasmid is then used to transfect cells and a few days later, you have SARS-CoV-2.

Reverse genetics is one of the most powerful tools in modern biology. We've been able to remove different proteins from the virus, in order to assess their contributions in viral pathogenesis. This technique also allows us to study the new variants of concern and variants of interest that have been emerging in different parts of the world and how the changes in these variants may contribute to SARS-CoV-2 pathogenesis.

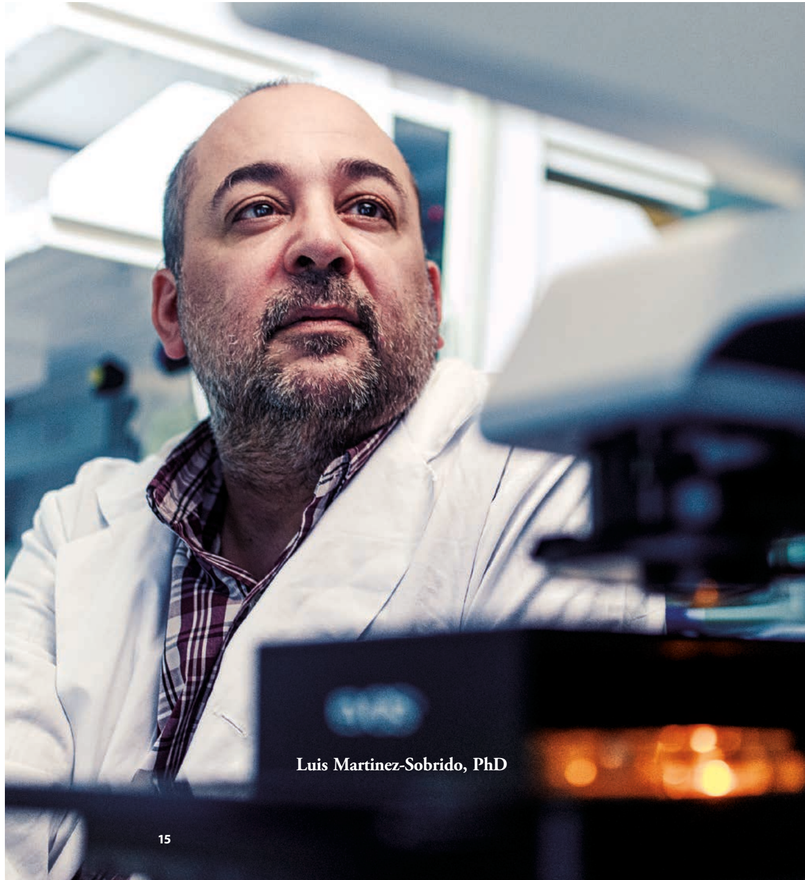
We've also used these reverse genetics approaches to generate recombinant SARS-CoV-2 that expresses fluorescent proteins. Now, when we infect cells with the virus, we can see where it goes. In animal models, this imaging allows us to see where the virus travels in the body. This is a technique that we had previously developed for studying other infectious viruses, and we brought this expertise and *in vivo* imaging with us to Texas Biomed. We thought it would be a great way to study SARS-CoV-2.

Since we published our research on reverse genetics and recombinant viruses in the middle of 2020, we've been contacted by close to 60 groups from around the world,

… WE'VE BEEN CONTACTED BY CLOSE TO 60 GROUPS FROM AROUND THE WORLD, ASKING US TO SHARE THIS TECHNOLOGY WITH THEM. WE THINK IT'S IMPORTANT TO DO THIS.

asking us to share this technology with them. We think it's important to do this. It's part of our obligation as good citizens to help fight the COVID-19 pandemic and contribute to other research to combat SARS-CoV-2. And, it helps put Texas Biomed out there, because everybody is now using our technology to generate recombinant SARS-CoV-2 and answer important questions in the biology of the virus, to identify new antivirals, and to develop new vaccines in our fight against COVID-19.

I want to recognize those in my lab who have contributed to this effort, including: Chengjin Ye, PhD; Jun-Gyu Park, PhD; Nidhi Kaushik, PhD; Desarey Morales Vasquez, graduate student; and Kevin Chiem, graduate student.



Luis Martinez-Sobrido, PhD

THE STAFF AND RESEARCH SUPPORT AT TEXAS BIOMED HAS BEEN AWESOME. WHEN WE GOT HERE THEY MADE SURE WE HAD THE SUPPLIES AND EQUIPMENT THAT WE NEEDED TO CONTINUE OUR RESEARCH. WE'RE VERY HAPPY TO BE HERE.

Binhua "Julie" Ling, MD, MMedSc, PhD and Grey De La Torre, Research Assistant

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CONTINUING RESEARCH ON THE HIV PANDEMIC WHILE ANOTHER PANDEMIC RAGES

Binhua "Julie" Ling, MD, MMedSc, PhD, Associate Professor

I came to Texas Biomed in the summer of 2020, during the pandemic. I was already in the process of interviewing when the pandemic started.

It's been a challenging time. Nobody has ever run into this kind of situation before. We didn't know how serious it would be and how long the pandemic would last.

My work focuses on HIV and AIDS research, which is biosafety level (BSL)-2. So I haven't been involved in the SARS-CoV-2 research, which requires a BSL-3 facility for cultures of the virus. But of course, we were affected by it. The members of my lab needed to social distance, and we needed to use all the protective and preventive methods to keep each other safe.

In my research, I use the simian immunodeficiency virus (SIV). It's like a brother or sister virus to HIV. When it infects non-human primates like rhesus macaques, they will develop a disease that is very similar to human AIDS if you don't give them treatment.

For more than 10 years, I have focused my research on finding a cure for HIV. The current antiretroviral treatments that we have are very potent and can suppress the virus very well. When people take their prescriptions daily, they can live a relatively normal life. But the treatments we have now are not curative, and long-term daily treatment causes other health issues.

We know that HIV can hide in the body. Even when it's undetectable in the blood, it may be hiding in cells and tissues, including in the gut and in the brain. I'm interested in studying the cell types where the virus can hide and finding out how we can get rid of it. Much of my current research has been funded by the National Institutes of Health to study virus persistence in the central nervous system.

When cells are infected with HIV (or SIV), the viral DNA gets inserted into the genome of the host cell. One thing we've done is use the CRISPR gene editing system to cut the viral DNA and remove it where it inserts into the genome of the host cell. In November 2020, we published a proof-of-concept study in *Nature Communications* that showed in SIV-infected macaques that the CRISPR gene editing system can remove the integrated viral DNA from infected blood cells and tissues with relatively high efficiency.

This research is ongoing. We're now studying what happens if we treat animals with this gene editing technology and then remove their antiviral treatments. We'll see if the virus comes back or not. This is critical to determine whether the virus has truly been removed, or whether you see a rebound where the infection comes back.

We also use barcoded viruses to try and track the source of the virus rebound and figure out where it hides. We use deep-sequencing technology to compare the virus from different parts of the body, lymph nodes, spleen, brain and other tissues, so that when the virus comes back, we detect where in the body it's coming from. This gives us an idea of where we should focus when trying to eliminate residual virus, so that we can design a particular technology or method that's focused on those types of cells in a particular tissue.

I have another project that's focused on HIV and aging. The population that's infected with HIV is shifting, and a good portion of the people who are infected are now over 50. Although antiviral treatments are very effective at controlling the virus, they do have side effects. Some studies have shown that they may play a role in accelerating the aging process.

Since our arrival, we have received incredible support from the staff and research operatives at Texas Biomed. They have made sure we had the supplies and equipment that we needed to continue and expand our research. We're very happy to be here.

A LEGACY OF PRIMATE RESEARCH

THE NATIONAL INSTITUTES OF HEALTH RENEWS SUPPORT FOR SNPRC FOR ANOTHER FIVE YEARS

THE Southwest National Primate Research Center (SNPRC) at Texas Biomedical Research Institute (Texas Biomed) reapplied in 2020 for its National Institutes of Health designation and funding as a National Primate Research Center and will receive an award of more than $37 million from the National Institutes of Health (NIH) to continue operations into 2026. The P51 grant, given by the NIH Office of Research Infrastructure Programs, provides essential funding to house and care for nearly 2,500 non-human primates that are part of life-science research programs at Texas Biomed and partners around the globe.


Deepak Kaushal, PhD

"Non-human primates play an essential role in pre-clinical research, including most recently helping to show the Pfizer-BioNTech COVID-19 vaccine would be safe and effective for humans," said Director of the Southwest National Primate Research Center (SNPRC) Deepak Kaushal, PhD. "The support from NIH for our Center will ensure we can continue this critical work finding new treatments and vaccines against a variety of infectious diseases, while maintaining the absolute highest standards of animal care."

The SNPRC is one of seven National Primate Research Centers in the U.S., all of which must have their P51 grants renewed every five years. This is the fifth renewal for the SNPRC, which was established in 1999 when it joined the national consortia. Located on the 200-acre Texas Biomed campus, researchers have been working with non-human primates at Texas Biomed since the 1950s. Today, SNPRC houses rhesus macaques, the nation's largest baboon colony and largest population of geriatric marmosets, all critical models in biomedical research.

The NPRC program celebrates its 60th anniversary in 2021 and will be providing outreach and education material throughout the year highlighting the dedication of NPRC teams nationwide and the exceptional basic science that has resulted in life-changing medical advancements, such as the neonatal high frequency ventilator, diabetes and high blood pressure medications, the Hep B vaccine and Hep C therapeutics, the new Ebola vaccine and so much more.

As part of the grant renewal process, the Center undergoes rigorous review by NIH officials and outside scientists to ensure high standards are met and identify opportunities for improvement. Since the 2015 review, SNPRC has restructured its management team, including bringing on Dr. Kaushal; expanded its team of veterinarians, technicians, animal caretakers and scientists; and added expertise and equipment in bioinformatics, genomics, single-cell sequencing and imaging. The Center has also increased collaboration with research partners throughout the U.S. and internationally, while clearly defining its own research priorities as Infectious Diseases Immunology and Control, and Comparative Medicine and Health Outcomes.

"The changes made over the past five years meant that when the COVID-19 pandemic hit, we were already very well-positioned with SNPRC, our high biocontainment laboratories, and experienced staff and scientists, to provide critical resources for rapid testing of COVID-19 vaccines," said Larry Schlesinger, MD, President and CEO of Texas Biomed, SNPRC's host institution. "That would not have been possible without the SNPRC and the ongoing support from NIH."

The Center and its staff look forward to continuing the important mission of supporting research for a wide range of diseases, from Alzheimer's disease to Zika virus, and raising awareness about the vital role non-human primates play in helping people around the world live longer, healthier lives.

AROUND THE INSTITUTE: REFLECTIONS ON 2020

The Texas Biomed team did an incredible job keeping the Institute and its critical research mission running smoothly and safely despite immense challenges presented by the pandemic. We asked team members from across the Institute to share their experiences, challenges and successes from 2020.

Working from home on a laptop, rather than two monitors, took some adjusting. My other challenge was when I would have to come to the office to print and file protocols and had to wear shoes. This sounds silly, but when working from home, I didn't wear shoes. I am thankful for my family remaining healthy during this pandemic.

— Johnny Saucedo, LVT, RLATG, *Institutional Animal Care and Use Committee (IACUC) Coordinator*

It was business as usual for the Shipping and Receiving crew. We knew that we still needed to get the product to the labs so that they could help find a vaccine. With everyone around the world looking for the same kind of PPE, we were getting slammed with more than the usual amount of orders for PPE and other material that the labs and the other folks on campus needed. Wearing a mask for over a year was a little tough, but I was proud that we stayed COVID-19 free by following the Texas Biomed rules, since we are pretty much all over campus delivering product.

— Daniel Salinas, *Shipping and Receiving Lead*
Finance

Texas Biomed researchers Alyssa Schami, Angélica M. Olmo-Fontánez, Anna Allue and Paula Pino celebrate Christmas during the pandemic.

Working during the pandemic was a bizarre experience that I will never forget. I am so grateful I was able to make further progress on my science research, work on COVID-19 projects and two peer-reviewed manuscripts. As a microbiologist, and proud Latina mom, I took this pandemic very seriously and was eager to share my scientific knowledge with my family and community. Being able to successfully explain how a vaccine works to my 85-year-old grandma was a true blessing!

— Angélica M. Olmo-Fontánez, MS,
PhD candidate, UTHSCSA
Population Health & Host Pathogen Interactions Programs

During the pandemic, Price used her spare time to transport, foster and adopt out around 30 dogs.

My hard-working team went above and beyond to maintain our baboon colony, which necessitated long work hours (nights, weekends, holidays), extra PPE, figuring out how to socially distance while performing tasks that normally require us to be in close proximity, and a willingness to show up despite the fear and uncertainty surrounding each new day. I am proud to have been a part of science in real time. Many of my baboons were chosen for the COVID-19 vaccine study, and were instrumental in its development. Even though it is extremely difficult on the care staff when animals are placed on terminal studies, it helps to know that they were key in pioneering new discoveries.

— Ashley Price, *Animal Caretaker IV,*
Colony Team Lead
Southwest National Primate Research Center

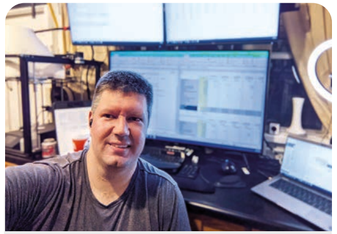
While his home office was productive, Hawkins is looking forward to having fewer online meetings and getting back to brainstorming ideas with his team in person.

Like many at Texas Biomed, I was part of the remote workforce during the pandemic. It took a couple of weeks to really get into the swing of working from home, but after that, I found that most tasks could be accomplished at home without much change. The IT department did an incredible job of getting people moved off-campus in such a short time, and we were able to give our users the same level of support regardless of whether they were on or off-campus. The most significant change for me was sharing an office for the first time in 25 years. My wife was a great office mate, but we had to coordinate our schedules to avoid interfering with each other's Zoom meetings.

— Terry Hawkins, *Director*
Software Development/IT

As an essential worker, I came into the office, which provided consistency during this very uncertain time. Early on, my leadership split the team into cohorts to minimize the quarantine time and missed days due to exposure, even with so many people still being "in office" to care for the animals and continue the important research work we do here. The most challenging thing about 2020 was not being able to see my two sisters, 95-year-old grandmother and closest friends. But on the positive side: I started my career at Texas Biomed in the baboon clinic, installed an in-ground pool in my home, maintained good mental health, and even created life-long friendships.

— Aurora Shingledecker, *Veterinary Technician*
Southwest National Primate Research Center



Scudder traded his work office with an over-zealous AC for a renovated shed.

The biggest hurdle was trying to fit in the increased volume of work that needed to be done, while also trying to ensure my daughter focused on virtual school rather than Minecraft. Our department has had a two-fold increase in proposal submissions and a three-fold increase in account setups and monitoring over the past year. (Shout out to Jen Gaitan, Juan Esquivel, Eduardo Meza, Mary Riedel and Ruth Arauz!) When all is said and done, I take solace in the fact that we in Sponsored Programs and Texas Biomed are doing our parts to bring COVID-19 to an end. I am extremely proud to be a small part of that.

— Jonathan D. Scudder, MS, MBA,
Manager
Sponsored Programs Administration

Fortunately, I was able to transition to working from home without changing my work responsibilities. I relied heavily on the essential SNPRC staff managing animals and research on-site and give a lot of credit to my other team members who transitioned to working from home. Like many parents, my biggest challenge was juggling work, managing a home daycare, and running a home school. The rapidly developed mRNA vaccines will undoubtedly be regarded as one of the biggest medical achievements of our lifetimes.
I'm proud that our Institution played an important role in its development and helped save countless lives.

While juggling work and childcare was a challenge, there were also more opportunities for family play time.

— Christopher Chen, *Staff Scientist III, Assistant Director for Research Support*
Southwest National Primate Research Center

I am so thankful to Texas Biomed, our insanely talented essential workers and all our administrative staff for pulling together to keep the Institute safe, operating and productive! The senior leadership team ushered the majority of administrative staff safely offsite during the onset of the pandemic, while limiting the exposure for critical workers onsite. My proudest work accomplishment was being able to create, build and implement a new performance management (EPM) platform during the pandemic with my work team. We worked very long hours to deliver a robust and functioning EPM prior to our 2020 performance launch.

— Savannah Wylie,
Benefits and Compensation Specialist
Human Resources

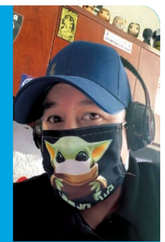
Wylie and her little "covid bubble" took advantage of low interest rates and bought their first home during the pandemic. They have spent their time off turning their house into a home.

The biggest challenge was balancing work and home life with the uncertainty of the virus. I didn't want to expose my family but still needed to work on campus. Fortunately, we all saw the COVID work at Texas Biomed with an amazing scientific research team, which infused layers of confidence that we would find a cure for this infectious disease. Still, we all dealt with forms of COVID-Fatigue and for me on a personal note, I lost my Mom (unrelated to COVID very suddenly in July 2020) and with rising COVID cases across the country was not able to travel to see my Dad. Now, we are all fully vaccinated and able to be together. We are so grateful to those amazing scientific research teams who tested vaccine efficacy.

— Mark A. Hammargren, CPP®, *Director*
Security & Emergency Preparedness

We're lucky because a lot of service people lost their jobs during this time. We were blessed to have a job that definitely kept going because our institute was doing research on COVID-19. I'm proud that we were able to get everything done with skeleton crews and everybody was willing to do what needed to be done — work weekends, work holidays — to make sure the mechanical systems and HVAC systems were running, especially for the biocontainment labs and animal areas. I'm glad that we helped everybody to keep moving with their science.

— Briana Mendez,
HVAC & Mechanical Systems Supervisor
Biocontainment Maintenance



Briana Mendez took on a supervisory role at the beginning of 2020, embracing the challenge of learning on-the-go during the pandemic.

I successfully completed a tuberculosis (TB) and simian immunodeficiency virus (SIV) co-infection study on rhesus macaques and participated in the COVID-19 studies on non-human primates. It was challenging for me as a mother and scientist to balance taking care of my 6-year-old daughter, especially with her virtual schooling, and perform high risk research with both COVID and TB/SIV in BSL-3. Despite the pandemic, I was extremely productive during 2020.
My biggest achievement in 2020 was being awarded the prestigious Early Career Investigator - K01 Mentored Career Development Award for 2021-2024 by the NIH to conduct independent research in the field of TB/SIV co-infection.

Dr. Sharan, masked up and having fun with her family at Disney World.

— Riti Sharan, PhD, *Staff Scientist I*
Host-Pathogen Interactions Program

It was a world that I could never have imagined, where every other day I was hearing that many friends, neighbors or social acquaintances sadly lost their friends or family members. It was particularly challenging to maintain the mental strength to work in those situations on the same virus. I was primarily involved in external contracts focused on developing vaccine and therapeutic targets against COVID-19. We tested various vaccines and drug-molecules for anti-SARS-CoV-2 efficacy in *in vitro* and *in vivo* models, so they could be taken to the next stage of development. It feels great that in this tough time, we were able to make a direct and positive impact on people's lives.

— Varun Dwivedi, PhD, *Staff Scientist I*
Disease Intervention & Prevention Program

ACCELERATING CHANGE

DIVERSITY, EQUITY, INCLUSION AND BELONGING COMMITTEE TAKES OFF

2020 was not just the year of a global health pandemic, it was also the year America's racial inequalities and systemic injustices were brought into acute focus by the death of George Floyd and many other Black Americans killed by white police officers. As people took to the streets and Black Lives Matter was painted on the road leading to the White House, companies across the country and the globe were finally saying enough is enough, and pledging to break down systemic barriers.

Texas Biomed has been working hard to improve diversity over the past few years. Diversity is one of the Institute's five core values — the D in TIDES. But it was time to tackle what that D really means and accelerate change.

"Our culture has reinvented itself in the past three years, and we're continuing to work on it. We haven't arrived," said Matt Majors, Vice President of Operations at Texas Biomed. "In 2020, we wanted to do something concrete, something that would last, something very significant."

Texas Biomed President/CEO Larry Schlesinger, MD, put out a call to the entire Institute to solicit participation in establishing a Diversity, Equity and Inclusion Committee, which is now the Diversity, Equity, Inclusion and Belonging (DEIB) Committee. The nearly 20 people who raised their hands were quickly organized into subcommittees and asked to craft their ideas of the committee's mission, vision and goals. How would this committee define its role? What would be the performance metrics for it and the Institute?

"I was surprised at how quickly they moved," said Maya Gough, PhD, a postdoc in Dr. Deepak Kaushal's lab, and one of the three core leads of the committee. "When we all joined, we didn't think we would accomplish so much in such a short amount of time."

In a matter of months, the committee had come to a consensus on its mission, vision and high-level goals, which were approved by Texas Biomed senior leadership. The committee identified staff support as a top priority; someone who could follow through and execute plans. Less than three months later, a brand-new position at Texas Biomed — an education and development specialist — had been created and filled.

Iris Perez is that specialist. She is helping fulfill Texas Biomed employee's calls for more learning and development opportunities, as well as facilitating the DEIB Committee meetings, policies and programs.

"I am so impressed with how the committee has emphasized improving knowledge and awareness, because that is critical and part of an ongoing process," Perez said. "Our next steps are to prioritize our goals and work together to define meaningful action that continues to move us forward."

The committee is now meeting monthly and expects to start putting plans into action in 2021. Gough described the committee as a place of learning and acceptance, where everyone is welcome to share their ideas for improving the Institute so that ultimately, anyone can walk into a room and feel like they belong – be it based on their cultural, racial, economic or educational backgrounds.

"Having a platform for people to improve their environment, it's going to improve the overall positivity of the workplace and how they interpret their job," Gough said.

Majors agreed. Not only is supporting diversity, equity, inclusion and belonging the right thing to do, it will also make Texas Biomed a stronger and more globally competitive organization that attracts and retains top talent.

"The work of this committee is fundamental to us having the type of culture we want and need to be successful in the years to come," Majors said. "I'm confident it's going to have a significant impact that's lasting."

D E I B

VISION

Texas Biomed is committed to discovery through diversity and innovation through inclusion. By being more aware and receptive to others' experiences and backgrounds at Texas Biomed, in our community, and around the world, we will build an organization where everyone can impact our mission to enhance health worldwide. We celebrate our differences and are united under the common goal of scientific advancement. We aspire to create equity by acknowledging and actively working to overcome persistent and unjust barriers so everyone can fully realize their potential in an environment of safety, trust and mutual respect.

GROWING INNOVATION AND ENTERPRISE

TEXAS BIOMED ESTABLISHES NEW DIVISION OF INNOVATION AND STRATEGIC PARTNERSHIPS

IN 2018, Texas Biomed released its 10-year strategic plan to grow and enhance its campus through recruitment, construction and the creation of new programs. One of the central goals was to expand the level of independent research that's supported by the National Institutes of Health (NIH) and other sources of funding, as well as to increase contract activities with pharmaceutical and biotechnology companies.

To help achieve that vision, the Institute recruited Cory Hallam, PhD, Vice President for Business Development and Strategic Alliances. Dr. Hallam, who has expertise in research and development management, production and commercialization, was brought in to lead efforts in innovation and strategic partnerships. He arrived at Texas Biomed on March 2, 2020. "I got here, and we immediately jumped in with all hands on deck to develop animal models for testing COVID-19 vaccines and therapeutics, and securing the funding to establish multiple animal models," Dr. Hallam said. "This eventually led to more than $20 million of contract work in 2020, in addition to a plethora of NIH grants submitted related to the SARS-CoV-2 pathogen. Essentially, it was a crash course of doing in one year what we had planned to do over the next 10 years."

The development of both rodent and non-human primate models of COVID-19 led to publications in many top journals. It also allowed Texas Biomed to attract some of the biggest companies in the world to use those models for challenge studies to evaluate vaccines and therapeutics. Two early collaborations were partnerships with Regeneron to test its monoclonal antibody therapy and with Pfizer-BioNTech to evaluate their COVID-19 vaccine, both of which received Emergency Use Authorization from the Food and Drug Administration in 2020.

"In addition to our contributions to combating COVID-19, a big part of what we did last year was expand global brand recognition for our science and use that status to drive broader recognition for the Institute and its capabilities," Dr. Hallam said. "Our currency is truly the quality of our science. Our quality is the underlying theme that continues to build our reputation, whether from the viewpoint of the public, the research community, or industry.

Texas Biomed currently has active research and development contracts with more than two dozen pharmaceutical and biotechnology companies. The Institute also has built a complementary network of R&D partners that are generating new work on a global scale. Strong collaborations with nongovernmental agencies and international partners are also on the horizon for generating new work.

"We currently have an expanding portfolio of inventions being generated by our faculty," Dr. Hallam said. "Combine this with increased visibility from industry

Cory Hallam, PhD

partners and we find ourselves at the nexus of a campus that can easily move from research-intensive discovery to real-time venture spin off or on-campus industry collaboration or co-location."

The Institute aims to grow additional capabilities for manufacturing and commercial sales of compounds, antibodies, reagents and other tools it develops. This growth will lead to a range of working relationships, from additional contract work to opportunities for industry people to co-locate at Texas Biomed. These relationships will contribute to funding both basic research streams and translational technology development programs.

One of the first expansion efforts from the strategic plan started this year with a $4 million grant proposal submitted to the Economic Development Administration to kick off construction of a new multi-species primate facility on campus. Through additional fundraising and support, the Institute secured the additional resources needed to launch this $10 million project.

"For all the work we plan to do over the next decade, it's absolutely necessary to increase our capacity to do multi-species primate research as well as to continue to expand, reinvigorate and renew our older facilities," Dr. Hallam said.

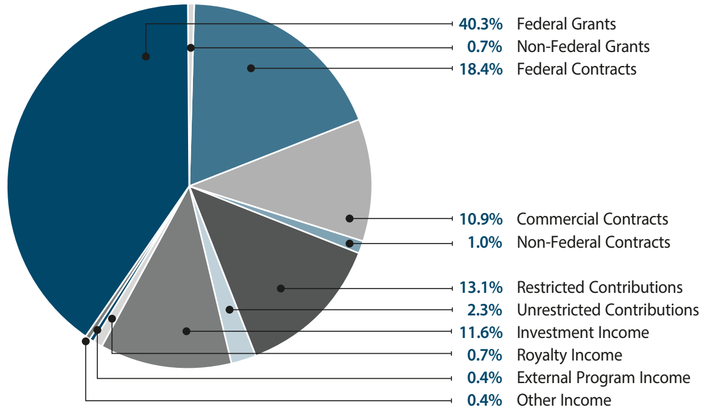
Texas Biomed is uniquely positioned to bridge the connections between basic science and more translational efforts. "The two feed off each other," Dr. Hallam explained. "New discoveries and techniques feed into this pipeline of ideas and capabilities that industry will pick up on. Meanwhile, industry is coming to us with a prioritization of the needs they're trying to meet in terms of new diagnostics, therapies and cures. We gain insight into future problems to tackle with basic research, and we deploy our new knowledge to enable the pre-clinical translation necessary for industry to move product to market. It is a positively reinforcing cycle that improves human lives."

The COVID-19 pandemic was a challenge that everyone at Texas Biomed faced with an incredible level of dedication, Dr. Hallam noted. Despite taking on a huge amount of new work, the Institute managed to succeed in these efforts with existing research staff and faculty who still labored tirelessly to maintain their existing research programs.

"Everything Texas Biomed accomplished in 2020 was done on the shoulders of our current team," he said. "This work got absorbed by our investigators who were willing to take time away from their ongoing research activities to tackle these problems. It should be a source of pride for Texas Biomed for decades to come that everyone quickly came together from across so many disciplines and leaned in to support these vital efforts."

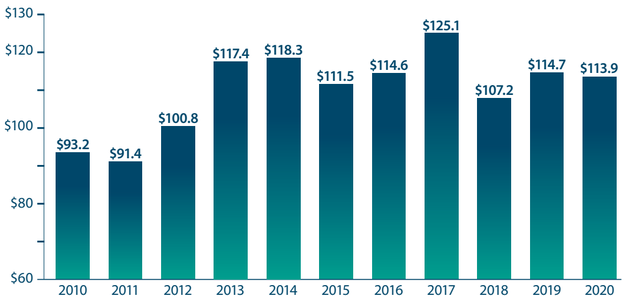
2020 REVENUE

BASED ON 2020 AUDITED REPORT



2020 VALUE OF ENDOWMENT

IN MILLIONS OF DOLLARS



RESEARCH GRANTS & CONTRACTS AWARDED IN 2020

INDUSTRY GRANTS AND CONTRACTS

SPONSOR AND TITLE	PRINCIPAL INVESTIGATOR	LENGTH	NEW AWARD TOTAL
AIRWAY THERAPEUTICS *AT-100 in vivo efficacy against SARS-CoV-2*	**Dr. Jordi B. Torrelles**	1 year	$82,106
ARIDIS PHARMACEUTICALS *Development of SARS-CoV-2 therapeutic monoclonal antibodies*	**Dr. Luis Martinez-Sobrido**	< 1 year	$119,514
EMERGENCE VENTURE PARTNERS, LLC *Development of small molecule therapeutics against SARS-CoV-2*	**Dr. Olena Shtanko**	1 year	$50,000
GILEAD SCIENCES *Remdesivir single infusion efficacy studies in SARS-CoV-2 infected rhesus monkeys*	**Dr. Ricardo Carrion, Jr.**	4 years	$1,679,725
IMMUNOBIO, INC. *ImmunityBio nonfederal MSA studies*	**Dr. Ricardo Carrion, Jr.**	< 1 year	$39,126
JANSSEN PHARMACEUTICALS, INC. *ELISPOT HEME analysis on 22 cyno blood samples*	**Dr. Luis Giavedoni**	< 1 year	$43,229
JANSSEN PHARMACEUTICALS, INC. *Janssen Vaccine study 2020 ELISPOT*	**Dr. Luis Giavedoni**	< 1 year	$33,025
JANSSEN PHARMACEUTICALS, INC. *NeoProstate ELISPOT analysis on 32 cyno blood samples*	**Dr. Luis Giavedoni**	1 year	$372,155
JANSSEN PHARMACEUTICALS, INC. *Screening ZEBOV ELISA assay*	**Dr. Luis Giavedoni**	2 years	$89,359
LEXICON PHARMACEUTICALS *In vitro evaluation of small molecules for antiviral activity against SARS-CoV-2*	**Dr. Varun Dwivedi**	1 year	$38,704
MEDMIRA INC. *Performance evaluation of a working prototype, VYRA, for simultaneous detection of SARS-CoV-2 and Influenza A/B in the human saliva or oropharyngeal specimens*	**Dr. Viraj Kulkarni**	1 year	$74,279
PARTICLE INC. *Covid-19 Efficacy Study*	**Dr. Viraj Kulkarni**	1 year	$136,914
REGENERON PHARMACEUTICALS, INC. *Monoclonal Antibody Neutralization assay SARS-CoV-2 (Regeneron nonfederal in vitro assays)*	**Dr. Ricardo Carrion, Jr.**	1 year	$15,921
TRITERPENOID THERAPEUTICS *Effect of CDDO-2P-Im on COVID-19 infection in cell culture*	**Dr. Varun Dwivedi**	1 year	$82,477
UV INNOVATORS, LLC *Inactivation of pathogens using UVC handheld*	**Dr. Viraj Kulkarni**	< 1 year	$71,813
XENEX DISINFECTION SERVICES LLC *Evaluate the capacity of Xenex UV Disinfection handheld device to inactivate live SARS-CoV-2*	**Dr. Ricardo Carrion, Jr.**	< 1 year	$79,093
XENEX DISINFECTION SERVICES LLC *Xenex COVID-19 testing*	**Dr. Ricardo Carrion, Jr.**	5 years	$99,532
INTERVIR RX/WELLCOME TRUST *Compound testing in cell-based Lassa virus model*	**Dr. Olena Shtanko**	1 year	$5,080
INTERVIR RX/WELLCOME TRUST *Evaluation of Intervir antiviral compounds for inhibition of SARS-CoV-2 replication*	**Dr. Olena Shtanko**	< 1 year	$5,080
MAPP BIOPHARMACEUTICAL, INC. *Efficacy testing of a Pan-Ebolavirus monoclonal antibody medical countermeasure (Sudan)*	**Dr. Ricardo Carrion, Jr.**	4 years	$4,657,239
SABIN VACCINE INSTITUTE *Demonstrate the immunogenicity and efficacy of the testing vaccine ChAd3-SUDV using the established non-human primate filovirus challenge model*	**Dr. Ricardo Carrion, Jr.**	1 year	$3,196,762
BATTELLE MEMORIAL INSTITUTE *Completion of filovirus project study report*	**Dr. Ricardo Carrion, Jr.**	1 year	$78,374
BATTELLE MEMORIAL INSTITUTE *Continuation of BSL-4 challenge phase*	**Dr. Ricardo Carrion, Jr.**	< 1 year	$78,374

OTHER INDUSTRY PARTNERS (INDIVIDUAL CONTRACTS UNDER NDA)

NUMBER OF CONTRACTS & SPONSORS	PRINCIPAL INVESTIGATOR	NEW AWARD TOTAL
11 CONTRACTS *Regeneron Pharmaceuticals; Novavax, Inc.; Southwest Research Institute; MAPP Biopharmaceutical, Inc.; Inovio Pharmaceuticals; Nantworks; RAIN Scientific*	**Dr. Ricardo Carrion, Jr.**	$21,596,396
4 CONTRACTS *3V Medical Research Group and Renibus Therapeutics*	**Dr. Varun Dwivedi**	$391,313

NUMBER OF CONTRACTS & SPONSORS	PRINCIPAL INVESTIGATOR	NEW AWARD TOTAL
1 CONTRACT *3V Medical Research Group*	**Dr. Luis Martinez-Sobrido**	under NDA
2 CONTRACTS *Heat Biologics and Inovio Pharmaceuticals*	**Dr. Jordi B. Torrelles**	$284,883
1 CONTRACT *Janssen Pharmaceuticals, Inc.*	**Dr. Luis Giavedoni**	under NDA
3 CONTRACTS *Pfizer*	**Dr. Deepak Kaushal**	under NDA

FEDERAL GRANTS AND CONTRACTS

SPONSOR AND TITLE	PRINCIPAL INVESTIGATOR	LENGTH	NEW AWARD TOTAL
DEPARTMENT OF DEFENSE/UNIVERSITY OF ROCHESTER *Development of a new, more effective live-attenuated influenza vaccine: an essential platform for future pandemic protection*	**Dr. Luis Martinez-Sobrido**	2 years	$115,746
DEPARTMENT OF DEFENSE/UNIVERSITY OF ROCHESTER *Development of live-attenuated old world arenavirus vaccines based on temperature-sensitive viruses*	**Dr. Luis Martinez-Sobrido**	2 years	$180,490
DEPARTMENT OF DEFENSE *Development of a live-attenuated vaccine platform against hemorrhagic fever causing arenaviruses*	**Dr. Luis Martinez-Sobrido**	2 years	$1,069,679
FEDERAL EMERGENCY MANAGEMENT AGENCY *Texas Biomed facility protection enhancement*	**Mark Hammargren**	1 year	$100,000
NATIONAL INSTITUTES OF HEALTH (NIH) *The Rv2623-Rv1747 interaction: regulation of the in vivo fate of M. tuberculosis*	**Dr. Jordi B. Torrelles**	5 years	$2,025,029
NIH *Blinded, vehicle-controlled, treatment delay evaluation of the efficacy of intravenous Galidesivir in a cynomolgus macaque Marburg virus disease model*	**Dr. Ricardo Carrion, Jr.**	2 years	$2,495,533
NIH *Collaborative cohort for COVID-19 research (C4R)*	**Dr. Shelley Cole**	2 years	$32,820
NIH *NHP TB vaccine challenge studies (CT and PET-CT) (FFP)*	**Dr. Deepak Kaushal**	1 year	$484,974
NIH *Coordinating center for collaborative marmoset research*	**Dr. Corinna Ross**	5 years	$1,071,268
NIH *Development of a high-throughput microfluidics-enabled functional assay for rapidly identifying neutralizing antibodies*	**Dr. Luis Martinez-Sobrido**	4 years	$403,289
NIH *Roles of the nucleoprotein 3'-5' exonuclease domain in arenavirus biology*	**Dr. Luis Martinez-Sobrido**	3 years	$730,116
NIH *Development of the new synthetic triterpenoid CDDO-2P-Im for chemoprevention of the ARDS of COVID-19*	**Dr. Jordi B. Torrelles**	1 year	$227,629
NIH *Host-directed therapy to augment anit-M. tuberculosis responses in the setting of HIV co-infection and to sterilize the tuberculoma*	**Dr. Deepak Kaushal**	2 years	$2,300,895
NIH *Dynamics of the protective vaccine-induced human influenza neuraminidase B cell response*	**Dr. Luis Martinez-Sobrido**	4 years	$917,141
NIH *Nanopore-based multi-target analysis of Zika virus infection*	**Dr. Jean Patterson**	1 year	$146,203
NIH *CD40 regulation of acute virus infection*	**Dr. Olena Shtanko**	2 years	$126,720
NIH *Effect of neonatal hyperoxia on alveolar development and infection*	**Dr. Luis Martinez-Sobrido**	3 years	$42,543
NIH *Natural history and mechanism of protection of human vaccine induced influenza B virus (IBV) neuraminidase (NA) broadly neutralizing monoclonal antibodies (BNhmAbs)*	**Dr. Luis Martinez-Sobrido**	1 year	$75,343
NIH *NYICE: Pandemic response to influenza virus infections*	**Dr. Luis Martinez-Sobrido**	1 year	$221,485
NIH *Collaborative expansion of marmoset colonies for neuroscience research*	**Dr. Corinna Ross**	5 years	$2,518,165

RESEARCH GRANTS & CONTRACTS AWARDED IN 2020

SPONSOR AND TITLE	PRINCIPAL INVESTIGATOR	LENGTH	NEW AWARD TOTAL
NIH *A Novel TH17-inducing mucosal vaccine for tuberculosis*	**Dr. Deepak Kaushal**	4 years	$1,179,360
NIH *Understanding the functional role of myeloid-derived suppressor cells in tuberculosis*	**Dr. Deepak Kaushal**	5 years	$1,237,500
NIH *Age-related cognitive decline in baboons, a new model of cognitive impairments*	**Dr. Marcel Daadi**	1 year	$482,996
NIH *Attenuation of Lassa virus via codon deoptimization*	**Dr. Luis Martinez-Sobrido**	1 year	$144,892
NIH *BD FACSymphony*	**Dr. Joanne Turner**	1 year	$462,958
NIH *Characterization of marmosets as a geroscience model by the San Antonio MAP*	**Dr. Corinna Ross**	3 years	$1,362,452
NIH *Determining the efficacy of a novel TB diagnostic test to monitor treatment success in drug resistant TB patients*	**Dr. Jordi B. Torrelles**	2 years	$422,733
NIH *Downstream sample analyses from 2 NHP species infected with SARS-CoV-2*	**Dr. Joanne Turner**	1 year	$1,179,314
NIH *Engineering pathogen triggered biomineralization to enable a new generation of point-of-care tests*	**Dr. Andrew Hayhurst**	2 years	$544,500
NIH *Epigenetic mechanisms underlying cannabinoid modulation of neuroinflammation in HIV/SIV infection*	**Dr. Mahesh Mohan**	5 years	$3,525,492
NIH *HIV-induced long non-coding RNA's in viral replication and immune response*	**Dr. Smita Kulkarni**	1 year	$490,292
NIH *Impact of concurrent HIV and latent TB therapies on Mtb-specific immune function*	**Dr. Maya Gough**	1 year	$148,967
NIH *Linking receptor-mediated phagocytosis and cAMP pathways in macrophage responses to tuberculosis*	**Dr. Chrissy Leopold Wager**	3 years	$224,123
NIH *Microbiome-mediated therapies for aging and healthspan in marmosets*	**Dr. Corinna Ross**	5 years	$3,381,296
NIH *Molecular pathology of pral immune dysregulation in HIV/SIV infection*	**Dr. Mahesh Mohan**	1 year	$82,000
NIH *Nonhuman primate model of age-related cognitive decline and dementias*	**Dr. Marcel Daadi**	1 year	$482,996
NIH *PCR and antibody screening for SARS-CoV-2 in the SNPRC rhesus macaque colony*	**Dr. Deepak Kaushal**	3 years	$1,385,268
NIH *Renovation of SPF rhesus production colony housing and development of a multispecies stand-alone BSL-2 research area*	**Dr. Larry S. Schlesinger**	1 year	$499,999
NIH *Role of microRNAs in B-cell dysfunction in HIV/SIV infection*	**Dr. Mahesh Mohan**	2 years	$1,482,515
NIH *Significant expansion of the SNPRC ABSL-3 capability in the wake of COVID-19*	**Dr. Deepak Kaushal**	1 year	$2,000,000
NIH *Significant upgrade and expansion of the Southwest National Primate Research Center pathology unit*	**Dr. Deepak Kaushal**	1 year	$489,000
NIH *The role of macrophage podosomes in Ebola virus pathogenesis*	**Dr. Olena Shtanko**	2 years	$544,500

NON-FEDERAL GRANTS & CONTRACTS

SPONSOR AND TITLE	PRINCIPAL INVESTIGATOR	LENGTH	NEW AWARD TOTAL
BILL & MELINDA GATES FOUNDATION *COVID-19 CTA: Preclinical models for SARS-CoV-2 infection*	**Dr. Jordi B. Torrelles**	1 year	$1,000,000
SAN ANTONIO PARTNERSHIP FOR PRECISION THERAPEUTICS (SAPPT) *Blocking SARS-CoV-2 evasion from innate antiviral defenses*	**Dr. Luis Martinez-Sobrido**	1 year	$80,000
SAPPT *Mechanism-based targeting of an RNA processing pathway of SARS-CoV-2*	**Dr. Luis Martinez-Sobrido**	1 year	$50,000
SAPPT *Role of Furin in COVID-19 and underlying molecular and immunological mechanisms*	**Dr. Diako Ebrahimi**	2 years	$20,000
SAPPT *Small molecule regulation of Mitochondrial Ca2+ Uniporter (MCU) channel for treatment of multi-organ failure*	**Dr. Diako Ebrahimi**	1 year	$54,000
SAPPT *Pilot Research: COVID-19*	**Dr. Luis Giavedoni**	1 year	$50,000
SOUTHWEST RESEARCH INSTITUTE *Compound testing for therapeutic development against COVID-19*	**Dr. Ricardo Carrion, Jr.**	<1 year	$32,365
THE INSTITUTE FOR ETHNOMEDICINE (BRAIN CHEMISTRY LABS) *Amino acids and lewy body formation in marmosets*	**Dr. Corinna Ross**	1 year	$349,052
UNIVERSITY OF CALIFORNIA IRVINE *An optimized human neural stem cell line (hNSC) for the treatment of traumatic brain injury (TBI)*	**Dr. Marcel Daadi**	1 year	$1,035,855
COLUMBIA UNIVERSITY *Retinoid antagonists as novel contraceptives in primates*	**Dr. Corinna Ross**	<1 year	$16,482
UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT SAN ANTONIO (UTHSCSA) *Evaluation of the risk of TB reactivation in BCG vaccinated marmosets treated with IL-17 antagonist, Secukinumab*	**Dr. Deepak Kaushal**	1 year	$45,000
UTHSCSA *Mechanistic understanding of SARS-CoV-2 RNA methylation*	**Dr. Luis Martinez-Sobrido**	1 year	$15,000
UTHSCSA *Probing the binding interfaces of RNA synthesis and processing complex of SARS-CoV-2*	**Dr. Luis Martinez-Sobrido**	1 year	$10,000
UTHSCSA *Understanding and prevention of COVID-19-induced cardiomyopathy*	**Dr. Luis Martinez-Sobrido**	1 year	$10,000
UTHSCSA *UT Health SA COVID-19 Pilot Program: role of the polybasic furin cleavage site sequence in SARS-CoV-2 biology and therapeutic implications*	**Dr. Diako Ebrahimi**	1 year	$22,500

PHILANTHROPIC GRANTS

SPONSOR AND TITLE	PRINCIPAL INVESTIGATOR	LENGTH	NEW AWARD TOTAL
COWLES MEMORIAL TRUST *Determining the efficacy of a novel TB diagnostic test to monitor treatment success in drug resistant TB patients*	**Dr. Juan I. Garcia**	2 years	$195,198
DOUGLASS FOUNDATION *2019 Douglass Foundation Fellowship*	**Angélica Olmo-Fontánez**	2 years	$87,600
KRONKOSKY CHARITABLE FOUNDATION *Acquisition of a confocal microscope for core research support*	**Dr. Larry S. Schlesinger**	3 years	$750,000
TEXAS BIOMEDICAL FORUM *Exploiting museum rodent collections to understand zoonotic disease reservoirs*	**Dr. Egie Elijah Enabulele**	1 year	$30,000
WILLIAM & ELLA OWENS MEDICAL RESEARCH FOUNDATION *GEMM Family Study: diabetes prevention*	**Dr. Raul Bastarrachea**	1 year	$23,936
WILLIAM & ELLA OWENS MEDICAL RESEARCH FOUNDATION *Tumor-causing mutations triggered by the immune response to viruses within our DNA*	**Dr. Diako Ebrahimi**	1 year	$100,000

SUBTOTAL: $52,282,304

NDA* TOTAL: $27,768,719

TOTAL OF NEW GRANTS AND CONTRACTS: $80,051,023

*Contracts not shown due to non-disclosure agreement.

THE NEXT CHAPTER IN PHILANTHROPY

As a leader in the study of infectious disease for the past 80 years, Texas Biomed has built a solid foundation of research into the nature, causes, prevention and eradication of these diseases. While the Institute furthers its 10-year mission to double the size of its research enterprise and build global standing, one necessity underlies these broader goals: raising the funds needed to support these many efforts.

In July 2020, Akudo Anyanwu, MD, MPH, joined Texas Biomed as Vice President for Development, where she now leads the Institute's fundraising efforts. Dr. Anyanwu, who has nearly two decades of experience working in global health, has big goals for building the Institute's reputation and bringing in the support needed to carry out cutting-edge research.

"Because we're at the forefront of addressing COVID-19, Texas Biomed is probably one of the most important institutions on the planet right now," Dr. Anyanwu said. "But we have so many important contributions to make beyond COVID-19 — to HIV, tuberculosis, malaria and all these other diseases. This work has huge implications for improving global health."

To help raise its reputation as a leader in health on an international scale, Texas Biomed hosted its first Global Health Virtual Symposium in April 2021. The symposium resulted from Dr. Anyanwu's months-long review in 2020 of the Institute's global impact and leadership. Texas Biomed's thought-leadership was front and center during the pandemic, so her idea was born to host a two-day event, featuring more than 50 world experts and thought leaders involved in global health, research, sustainability, business and policy. "Science, Global Health and Policy in a Time of Pandemics" is the result.

"This symposium tackles a lot of important conversations and questions with very inspiring speakers," Dr. Anyanwu said. "One goal of the event is to really place us on the map and to reach out to people who were not previously in contact with us."

According to Dr. Anyanwu, COVID-19 has "opened the world's eyes back up to the importance not just of infectious disease research but also put public health front and center. Since the big push to address HIV and AIDS 20 years ago, global health has been somewhat minimized and not prioritized the way it once was. But the pandemic has put this important issue back on everybody's agenda."

As the founder and former leader of Friends of The Global Fund Africa, an international nonprofit organization launched to support Global Fund to Fight AIDS, tuberculosis, and malaria, Dr. Anyanwu is well-versed in the importance of infectious disease research. She noted that the tremendous advances that have been made around COVID-19 help "bring science closer to the conversations around policy and the implementation of new measures to improve global health."

One of Dr. Anyanwu's major focuses is to attract foundations and corporations that previously have not had a relationship with Texas Biomed to create partnerships. She also aims to build stronger connections with various United Nations-related agencies, including the World Health Organization, UNAIDS and other groups.

Texas Biomed also has plans to strengthen relationships with U.S. government organizations and build them with the governments of other countries as well. "We're reaching out to the British, Canadian and German governments," Dr. Anyanwu said. "We want them to learn more about us and partner with us and invest in the Institute."

Building stronger relationships with individuals is also a major priority. "One thing we're focusing on is increasing engagement. This means involving them in our webinars, reaching out to them to share information, reaching them through social media and ensuring that people know who we are and what we do, so that they can really plug in to our vision," she said. "We hope to connect not only with individuals in Texas, but around the United States and the rest of the world."

Akudo Anyanwu, MD, MPH

FUNDING THE FUTURE OF BIOMEDICAL BREAKTHROUGHS

SINCE its inception in 1941, donors have been indispensable in the success of Texas Biomedical Research Institute. Supporters come in all forms, from groups of women to young professionals to business leaders. As an independent, nonprofit scientific facility, Texas Biomed is honored by the generosity of donors in 2020. So many people found a way to step up personally and through their companies to help get our local and global communities through the most trying time in recent history. While highlighting just a few individuals here, there are thousands of people to be thanked for their generosity and support this past year, and we will be creating a new Thank You section on our website in the coming months. So please visit *www.txbiomed.org/supportus* in the weeks ahead to see who is a part of the Texas Biomed family and thus a part of history.

JAMES GRIFFIN
FOUNDER'S COUNCIL

San Antonio attorney James Griffin was at the helm of the Founder's Council in 2020. Having been involved in the young professionals' group for a decade, he served on the board before becoming president.

"I jokingly tell prospective members this is the best deal in town," Griffin said. "There are different levels of membership, you get luncheons at The Argyle with a great meal, unique events and education programs, and you meet all kinds of people in the community."

Membership levels range from $150 for an individual to $1,500 for a corporate membership.

Griffin's favorite event each year is called Dining and Discourse. Attendees sit at a dinner table with eight or nine people and converse one-on-one with researchers.

"It's important and impactful to have personal, engaging conversations with scientists who are on the front lines of finding treatments and cures for COVID-19 and other infectious diseases," Griffin said. "Texas Biomed is such a unique organization."

Many of the traditional in-person events were canceled when the pandemic shutdown started in earnest in March of 2020.

"It was terrifying at first," Griffin recalled. "These events are key, a big part of what makes the Founder's Council special. Without those, I didn't think we had anything."

Jumping to virtual events was a challenge. With infectious disease making headlines all over the world, interest and engagement remained high.

"Texas Biomed President & CEO Dr. Larry Schlesinger spoke at every single virtual event," Griffin said. "We had the huge advantage of talking about something incredibly timely, something that was impacting the whole world."

Griffin added he felt personally lucky and blessed to be involved with Texas Biomed in 2020 and had the good fortune of hearing firsthand from the scientists on the front line of the pandemic.

The Founder's Council raised $153,150 in 2020, enabling the organization to provide two large gifts to Texas Biomed scientists. Staff Scientist Roy Nelson Platt II, PhD, was granted $50,000 for two servers. Professor Patrice Frost, DVM, was given $60,844 for the purchase of a portable x-ray machine.

While membership took a dip during 2020, by March 2021, the Founder's Council will have 98 members.

The group will have its first in-person event in well over a year in May 2021.

The same vaccine Texas Biomed helped get to the market, the Pfizer-BioNTech vaccine, no doubt helped many of the Founder's Council members reclaim their ability to mingle in public.

CYNTHIA KERBY
TEXAS BIOMEDICAL FORUM

Since 1970, the women of the Texas Biomedical Forum have been working to educate the South Texas community about the groundbreaking work at the Texas Biomedical Research Institute.

In 2020, Cynthia Kerby served as president.

"My husband and I had the pleasure of learning about Texas Biomed at a Golden Circle event about 10 years ago," Kerby said. "Since then, we have continued to learn about the Institute and the various ways to get involved."

Kerby's husband, Dr. Paul Kerby, is a physician who studied biomedical engineering. The couple has always had an interest in science and the advancement of medical research.

"We are those types of parents who stored our children's cord blood," she noted.

With the challenges of running a fundraising and support organization during a pandemic, Kerby stressed that first and foremost, she reminded herself of who the Forum supports.

"I felt that decisions I made needed to be in-line with the Institute's guidance and the CDC recommendations to set a good example," she said. "The next challenge was acknowledging everyone's personal circumstances that informed their comfort level along the way regarding anything in person. It was definitely a hot button for some, but I always found a way to accomplish our goals and provide options."

Some Forum events were canceled altogether. Board meetings were all offered via Zoom. A couple of member events were optional and planned for the safety of those who attended.

As far as their important fundraising goals, Kerby and the Forum had to get creative.

The ever-popular spring Gala at The Argyle could not take place as usual. Other events paved the way for successful fundraising.

"We had a 'Cookies with Santa' event in December at The Argyle," Kerby explained. "Santa was staged behind Plexiglas. Families registered for a time slot to come by one at a time to take photographs and receive a cookie decorating kit to take home."

The event sold out. The Forum was praised by attendees who said their families might not have had an option for their children to visit with Santa otherwise.

"The photos looked amazing," she added.

"With the professional photography, the plastic barrier was virtually undetectable."

In February, the Forum hosted a virtual Valentine's Day raffle that netted more than $14,000.

"This event was a fun way for donors to support our efforts," Kerby said. "Our members participated to raise money while hoping to be a lucky raffle winner."

In 2021, as events begin to open up again after the introduction of COVID-19 vaccines, the Forum hosted an online auction with a few people in attendance. The final board meeting for the 2020 members took place on May 5 with a year-end luncheon to celebrate the accomplishments during a strange and challenging year.

"Although it was far from a normal year," she noted, "it ended quite successfully. We were able to raise $510,000 for Texas Biomed."

When Kerby heard that Texas Biomed was involved in the testing of the successful Pfizer-BioNTech COVID-19 vaccine, she said it was surreal.

"I kept thinking that I was part of a smaller group helping to support and raise funds for Texas Biomed's larger global impact," Kerby said. "The experience was truly remarkable! As president of the Forum, I was honored to be leading such an extraordinary group of women in support of science."

RICHARD KARDYS

GOLDEN CIRCLE AND BOARD MEMBER

Having served on the Board of Texas Biomed for the last decade, Richard Kardys is now in charge of an ambitious capital campaign committee with a goal of raising $50 million for important campus improvements.

"Probably the biggest item on the capital campaign list is a new building for housing research scientists," Kardys said. "This would help us to attract more researchers."

Kardys stressed that supporting biomedical research transcends background.

"Anyone who is giving significant money through philanthropy does it because they feel it will be effective at accomplishing something to help society and make the world a better place," he noted. "That's where you get passionate. For me and my wife, we've always seen Texas Biomed on the leading edge of research in medical care. The work these scientists concentrate on has the potential of making the world a better, safer place for families here in San Antonio, around the country and worldwide."

Those ideas came into sharp focus when COVID-19 arose. Texas Biomed immediately plugged into the global search for a vaccine.

When Kardys learned of Texas Biomed's experiments that helped speed the Pfizer-BioNTech vaccine to market, he was heartened.

"They helped develop the most recognized, trusted and effective vaccine to-date," he said. "It was very satisfying and rewarding that the board and the community leaders were on the front lines of this battle. Knowing that we made a huge contribution and that the world knows we helped find a good vaccine, that is just so wonderful."

Kardys added he believes getting the vaccine to market so early — with the help of Texas Biomed scientists and the nonhuman primates used in the experiments — saved tens of thousands of lives in the U.S. and millions worldwide.

Along with his wife, Jessie, Kardys has pledged a donation to the capital campaign. The couple also donated money to a special COVID-19 fundraising effort launched in 2020.

Retired from a 42-year career at Frost Bank, Kardys also noted the incredible economic impact of the development of a vaccine less than a year after the COVID-19 crisis began.

"If we could not find a way to let people get back to work, go to restaurants and shop in stores, keeping people employed, we could have faced a global economic collapse," he said. "In addition to saving lives — which is most important — these scientific advances may have just saved the world economy."

CRAIG BOYAN

GOLDEN CIRCLE AND BOARD MEMBER

President of H-E-B, Craig Boyan, has been on the Texas Biomed Board for a dozen years.

As the largest private employer in the state of Texas, the retailer has long prided itself on stepping up to help in times of crisis.

"Our mission begins with taking care of our nearly 140,000 Partners," Boyan said. "Our top priorities are to take care of Texas families with low prices and excellent service, and give back to our communities. In times of need, our sense of purpose is to be the best we can be when things are most difficult for Texans."

In a progressive move, H-E-B enacted pandemic planning in 2005. Those plans were tested during the swine flu (H1N1) epidemic in 2009 when H-E-B organized personal protective equipment (PPE) and distributed drugs like Tamiflu to help treat the sick.

"We had been preparing for how we would handle a COVID-19 kind of outbreak for the last 15 years," Boyan stressed. "Last year, H-E-B increased donations to food banks by a third, totaling 41 million pounds in 2020. We provided meals for first responders. We helped restaurants by selling some of their products in our stores and buying meals from them."

While H-E-B had already committed $2 million in funding to Texas Biomed, the company donated $300,000 for the COVID-19 effort during an emergency funding request in 2020.

"I had seen the amazing record Texas Biomed scientists had in helping find tests, treatments and cures for diseases like Zika and Ebola," Boyan pointed out. "We thought it would be important to donate money to accelerate the work on COVID-19 and help speed development of a vaccine."

Boyan calls the emergence of a safe, highly-effective vaccine just nine months after the start of the COVID-19 pandemic "fantastically remarkable. This is one of the greatest medical accomplishments in our lifetime."

As for his professional and personal financial support of Texas Biomed's mission to be a global leader in eradicating infection, Boyan said he is really proud of his investment in what the scientists and staff at the Institute are building.

"They have such a positive impact on so many people," he said. "I am an honored and grateful participant."

Among the many protective measures H-E-B took to protect its Partners, customers and products, H-E-B retrofitted stores, warehouses and manufacturing plants, and its Curbside and Home Delivery services were in high demand.

At the same time, Boyan and H-E-B found the time and the resources to support Texas Biomed.

"We are a purpose-driven company," he said. "So is Texas Biomed. The Institute is one of the great assets of San Antonio and Texas. It gave me such an amazing sense of pride and admiration to watch the scientists take part in a medical advance like we have never seen."

BECOME A PART OF THE FUTURE

To get involved in one of the many opportunities to support Texas Biomed's critical mission, go to ***www.txbiomed.org/support-us/donate/****.*

THE ARGYLE

THE Argyle is a unique, private dining club in San Antonio that was established as a means of the San Antonio community to support Texas Biomedical Research Institute (Texas Biomed). The Argyle serves as a bond between the Institute and those who give time and money to support it. For many private clubs, and those in the hospitality industry, 2020 was a devastating year, and The Argyle experienced its fair share of challenges. But, The Argyle was able to sustain operations and is rebounding thanks to its Board, its leadership and its dedicated staff.

Throughout 2020, the restaurant and food service industry lost more than $240 billion in sales, and more than 110,000 eating and drinking places completely closed. Millions of people were laid off or furloughed.

The Argyle was able, with member support, to weather the pandemic. The attrition levels were in line with any other year pre-pandemic, retaining more than 93% of the majority of its workforce from pre-pandemic levels compared to 50% for clubs nationwide. While there were reports that the average club lost 70% in revenues, The Argyle fared significantly better.

Safety was the number one priority last year for both employees and guests. The Argyle reduced hours of operation, while allowing staff to socially distance at all times, conducted daily building sanitation, wore masks at all times, allowed management to work from home and tested employees regularly with an on-site physician, among many other protocols. Dr. Bruce Chandler, a member of The Argyle, supplied The Argyle with hundreds of PPE equipment and masks, allowing the Club to remain operational and safe.

More than 80% of all private gatherings were canceled or moved to a future date, so club management and the Board knew they had to find a strategy for alternate revenue and reduce expenses, which meant cutting staff hours. But, with member support, the Club created the COVID Fund which allowed every hourly staff member to receive an additional $400.00 per month for 7 months, which compensated for the reduction in hours, and The Argyle continued to provide much-needed health care insurance to all employees.

The Coates-Kelso patio development coincided with the beginning of the pandemic, allowing The Argyle to use the outdoor space safely and implemented several To Go efforts, allowing The Argyle to minimize revenue loss. The Argyle introduced the “Argyle at Your Service” delivery program, where members were able to send delicious meals and beverages to family members and friends on special occasions.

All of these efforts did not go unnoticed. The Argyle celebrated its fourth year receiving the status of Distinguished Club Award in 2020. This prestigious designation comes from the number one Club Magazine Publication in the World, the Boardroom Magazine, which reflects member experiences, club usage, facilities, mission statement, and employee relations. The Argyle is the only Private Club in San Antonio to have ever been awarded such designation and one of only 200 clubs out of the 4,000 private clubs nationwide.

The Argyle’s success in 2020 is a reminder that the San Antonio community has a big heart, and with the community’s support, both The Argyle and Texas Biomed continue to thrive into 2021, making significant contributions to life-saving science.

— **Michael Vlad**
Club Manager

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Executive Vice President for Finance and Administration, Chief Financial Officer (CFO)
Bruce Edwards

Senior Administrators

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