

Stony Brook University

MAGAZINE 10

SPRING 2023

CHANGING THE GAME

How an SBU researcher is revolutionizing the study and treatment of brain disorders

14

Creative Chemistry
BY Greg Fillano

10

Engineering Success
BY Ellen Cooke

30

WE WON!
SEE INSIDE BACK COVER



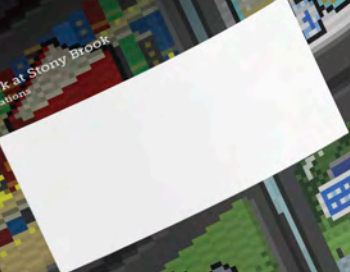
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PHOTO: JAMES HARRIS

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The many pieces of the puzzle that bring Story Brook to life.



INSIDE THIS ISSUE

Story Brook University has been "changing the game" since its inception in 1957. From our humble beginning as a tiny teachers college to becoming one of the leading research universities in the world, we've not only moved the goal posts, we've also reimagined the playing field.

Nowhere is that more evident than in the revolutionary work of Professor Lilliane Mujica-Parodi, a biomedical engineer and neuroscientist (Changing the Game, p. 14). She and her colleagues have developed a software platform, Neurobox, which will allow scientists and medical professionals to accelerate the study and treatment of brain disorders, such as bipolar disorder and Alzheimer's disease, by running tests on an artificial brain.

Distinguished Professor of Chemistry Ben Hsiao is another scientist disrupting the status quo (Creative Chemistry, p. 10). While visiting Northern Kenya, Hsiao witnessed the many challenges the people faced to sustain their lives and wanted to help. First he created natural water filters and now he and his team have discovered how to turn biomass into low-cost sustainable fertilizers, which will help improve the production of crops and plant growth by repurposing all the biomass waste that exists worldwide.

This issue also looks at how researcher Eden Figueroa is taking A Quantum Leap Forward (p. 8) to see how fast he can make data travel: how a team of linguistics students are working to preserve endangered languages (A Living Tradition, p. 26), and how a club provides support for students interested in STEM careers (Engineering Success, p. 30).

President Maurice McInnis shares her thoughts and her stunning photography with us following her January trip to Story Brook's facilities in Kenya and Madagascar (Reflections of Africa, p. 20), highlighting once again the incredible legacy of the late Richard Leakey and the ongoing work at the Turkana Basin Institute, as well as the renowned conservation achievements of Distinguished Professor Pat Wright in Madagascar.

What these stories all have in common is how they showcase the determination and commitment of our students, faculty and staff to make a difference, locally and globally. And now, we will have an even bigger opportunity to transform lives on a global scale. Please see the inside back cover for the monumental news about Story Brook University's selection to anchor the Center for Climate Solutions on Governors Island. We will have much more to say about this development in our fall issue.

This is an exciting time for Story Brook. We are changing the game, one discovery at a time.

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#StoryBrook



THE WONDERS OF AFRICA
A chameleon hides in plain sight in Zanzibar's
National Park. Turn to page 20 for more photos from
President McInnis' recent trip to SBU's facilities in Africa.
Photo by Maurice McInnis

Exploring issues, standout
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"I thought, if users can translate the principles of physics to become creators, then clinical neuroscientists, physicians and pharmacologists might be able to use Neuroblox in the same way: to create testable hypotheses and optimize treatments in meaningful ways."
— PROFESSOR LILLIANNE MUJICA-PARODI

CHANGING THE GAME

How biomedical engineer and neuroscientist Lillianne Mujica-Parodi is revolutionizing the study and treatment of brain disorders

BY
STEPHAN LEE
ILLUSTRATION BY
JENNIFER ADAMS

As for Jan Ellison Bazucki (right) who was searching for help for her son, she found Lillianne Mujica-Parodi. Their shared bond to help people with brain disorders has accelerated her research in this field, giving hope to families across the globe.

As for Ellison Bazucki looks back on her son Matt's journey with bipolar disorder, sadly, she knows their story is not unique. In the years that Matt suffered a manic episode. In the years that followed, he was hospitalized four more times, prescribed nearly 30 different medications during a nine-year period, and still, according to Jan, he was struggling to manage his own mind.

"Matt's experience sent me on a journey to understand what was happening in his brain. What was causing these symptoms?" she recalled. "What I found out was that we don't know."



For years, the complexities of brain-based disorders — including bipolar disorder, dementia and schizophrenia — have left millions of families, like the Bazuckis, searching for answers. And despite incredible advances in modern medicine, understanding the mysteries of the mind has lagged behind traditional medicine, posing an incredible challenge — and an urgent one — for the physicians and researchers tasked with finding a cure.

Now, one Stony Brook University researcher is answering this call for help with a bold, new solution: A blueprint for individualized care that is poised to disrupt clinical neuroscience and revolutionize mental health, all inspired by an unlikely source — the Bazuckis themselves.

An Inspired Approach

It was the Bazuckis, Jan and her husband, David, who sought out Lillianne "Lily" Mujica-Parodi, PhD, a professor in Stony Brook's Department of Biomedical Engineering and director of its Laboratory for Computational Neurodiagnostics, who also holds joint

CHANGING THE GAME

appointments in Stony Brook's Graduate Program in Neuroscience, Department of Psychiatry, Department of Neurology and Department of Physics. "Her interest was piqued after learning about Majica's Parodi's lab and her study exploring the role of telomeres in brain functioning. This was an area of particular significance for the Baszuckis, as her treatments — put their own son's bipolar disorder into remission.

"Here was a neuroscientist unraveling the mechanism by which ketones work to stabilize brain networks," Jan recalls. "This explained why a ketogenic diet gave our son his mind and life back. We had to wonder: could this be a bridge to the first step toward recovery?"

By early 2021, Majica-Parodi and her team had developed an important model on the regulation of mood — to understand anxiety disorders, an aversive circuitry play in the role neural circuits play in the regulation of mood. "The study on the neurobiology and psychiatric disorders," Majica-Parodi says about this study, "is the patient, the Baszuckis were fascinated by the connections she had made, and they could take that same approach to study bipolar disorder, specifically.

Collaboration has been key to the development of Neuroblox. Here, Majica-Parodi works with Helmut Stray, associate professor in Biomedical Engineering.



Photo by Adam Thomas

"Throughout my career, I've moved between fields to get the tools I need to answer the questions I'm interested in," Majica-Parodi said. "My approach to understanding psychiatric disorders is grounded in questions of how neurobiological and physiological function maintain stability in the face of chaotic environments, exactly what it means for biological control circuits to be dysregulated in different ways and why each of those different types of dysregulation leads to a particular set of signs and symptoms."

This engineering approach to psychiatric disease resonated particularly with Helmut Stray, a computer scientist and professor of engineering at Stony Brook University, where users can design their own immersive experiences in a collaborative and creative space, known as Holoblox. It has evolved into a physics engine intended to teach children how to interact with their environment.

The widely popular interactive platform, where users can design their own immersive experiences in a collaborative and creative space, known as Holoblox. It has evolved into a physics engine intended to teach children how to interact with their environment. Stray's users with the immersive experiences — from games to simulations to social experiences — and shares them with others around the world.

This accidental innovation meant that the complex programming typically required for building video games could be broken down into a system of "blocks" — pre-made pieces of code that could be combined to create games and be manipulated by anyone, even those with no prior experience in programming.

It was David's brainchild that quickly inspired Majica-Parodi's own research, even sending her back to the drawing board to tackle the challenge of bipolar disorder on a larger scale with a solution that — if executed correctly — could be applied to brain-based disorders more broadly.

With the right tools, she could determine the brain's modular functional components, or "blocks," allowing neuroscientists to visualize and streamline the identification and simulation of brain circuits through a revolutionary new approach: Neuroblox, a software platform for modeling neural circuits and their responses.

Just as Holoblox relies on developers to create user-generated content for games and experiences available on the platform, paring a Neuroblox platform would be to share, refine and connect other's models while seamlessly and iteratively, providing seamless integration and feedback, allowing models and experiments to be shared, refined and improved. According to Majica-Parodi, the tools open a world of possibility, accessible even to

David Baszucki and his wife, Jan Ellison Baszucki



NEUROBLOX AND ITS POTENTIAL

Computational neuroscience has the potential to advance psychiatry beyond a description of features. By running simulations with different initial conditions and using systems of coupled differential equations, it will be possible to test the power, accuracy and reliability of models, including pharmacological interventions. The advantage of this approach is that it will give the brain what Neuroblox models provided for physics — not only figuring out the differences in features between populations X and Y, but also their fundamental rules governing the brain and its disorders.

But computational neuroscience requires deep expertise in many areas, including physics, electrical engineering, computer science and pure mathematics. This kind of breadth is rare, and is one critical reason "computational psychiatry" has yet to gain traction. Majica-Parodi has set out to create a collaborative platform, one that will allow researchers worldwide to share, refine and test each other's models while seamlessly integrating data, models and experiments. While some tools exist today, none is as user-friendly, comprehensive or powerful as what Majica-Parodi is proposing.

Her family believes Neuroblox's impact on understanding and treating brain-based disorders, including bipolar illness, will be transformative.

— DAVID BASZUCKI, FOUNDER AND CEO, HOLOBLOX

tools we have to exploit that research," she said. "Neuroblox is doing something fundamentally different. It's trying to bridge that gap." At Majica-Parodi's request, the potential for impact extended far beyond bipolar disorder. She was no longer creating just one solution by taking a circuit-based approach to the problem. She was developing an infrastructure that could be applied to brain-based disorders more widely — a range of diagnoses from Alzheimer's disease to autism spectrum.

"My process of figuring out one specific piece of the prefrontal limbic circuit took nearly a decade. If I were to approach a different circuit or disorder, I would want to automate that scientific process in ways that would markedly accelerate how we harness data to create and test models," she explained.

One of the key advantages of Neuroblox is it would allow researchers to work with an artificial brain, creating an opportunity to test the full set of alternatives by hypothesis. All at once, a breakthrough that could provide an incredible benefit for brain-based disorders that many patients face, according to Majica-Parodi.

What is currently lacking is a clear understanding of brain-based disorders — from lifestyle of high-intensity activities — will work, changes like therapeutic interventions — will work, changes like medications and supplements — will work in what combination, and for which patient. With Neuroblox, Majica-Parodi and her team are working to create the tools that will give doctors the knowledge and confidence to identify the best course of treatment in a matter of minutes.

FEATURE

REFLECTIONS OF AFRICA

President Maurie McInnis shares her thoughts and photographs from her recent trip to Kenya and Madagascar

© stonybrook.edu/magazine



Photo by Savannah Hira

This past January, President McInnis traveled to Africa to visit the Turkana Basin Institute in Kenya and Centre ValBio in Madagascar, two of Stony Brook's most important international research endeavors. On the following pages, she shares her impressions and photography of the incredible and inspiring wildlife, the landscapes, the inspiring discoveries and the critical work being done.

Above: President McInnis prepares to take a photo during a tour of Sannamulana National Park as Distinguished Professor Patricia Wright looks on.

Right: A cheetah surveys the landscape in Kenya.



Photo by Savannah Hira

THEN & NOW

THE SCHOOL OF DENTAL MEDICINE

As we celebrate the 50th anniversary of the School of Dental Medicine (SDM) in 2023, we take a moment to look back at its many accomplishments and then look ahead to what's next.

START

1968

Howard Oaks, D.M.D., appointed inaugural dean of the School of Dental Medicine

Oaks begins recruiting faculty
6
DEPARTMENT CHAIRS hired in three years
MOVE AHEAD TWO SPACES.

1973
FIRST CLASS ENROLLS
GET A FREE TURN.

1974
PATIENT CARE CLINIC OPENS
MOVE THREE STEP AHEAD.

1974
1ST BOOK PUBLISHED BY SDM FACULTY
Periodontal Disease in Children and Adolescents

1977
First class of **23** new dentists graduates.
WITH A NEW TOOTHBRUSH.

1980
Professor Fred Ferguson initiates training students to care for special needs patients, later establishing the special needs dental care program.

1980
FIRST POST-DDS PROGRAM ESTABLISHED

1990
CREATED THE GERIATRIC DENTISTRY PROGRAM

1990s to 2000s
STUDENTS TRAVELED to provide care to those in an underserved area, as well as international.

Look Mom! No cavities!

2002
DENTISTRY program expands to include dental hygiene and dental radiology

2012
The Robles Center Clinics, in 2012, provided care to the most last treated patients

37K+ PATIENTS
33K+ PATIENTS
SDM FACILITY

2013
Launched a school-based dental health program through which SDM provided free preventive oral healthcare services to elementary school students in the Riverhead Central School District.

2017
Selected as one of five academic institutions by the American College of Prosthodontists to pilot a digital dentistry curriculum.

1,500+
DDS GRADUATES
ROLL THE GLOBE FOR A PRICE!

Missed your dental cleaning?
TWO STEPS BACK.

2019
Officially opened the doors to its Center for Implant and Digital Technology.

2023
The game continues as SDM peers into the future.

85,000+
PATIENTS TREATED IN 2022

Continued on next page.

SAVE THE DATE
All SDM alumni are invited to join us for our anniversary celebration.
Saturday, September 9
Bauman Center, located in H-Quad.
Details to be announced soon.

50
YEARS

COMMUNITY

SDM
MAGAZINE

THEN & NOW

A Look Ahead A Q&A with Dean Patrick Lloyd on what's next for the School of Dental Medicine

What are the strengths driving SDM's future?

Our school has long been recognized for its outstanding service to the public as well as for educational programs for dental students and residents. In the world of dental research, we are known for our expertise in inflammation, tissue engineering, dental trade and product development. Looking ahead, we intend to expand additional faculty and research efforts, while also investing in areas that will help us build on these clinical and research strengths and increase academic standing and scholarship. The university's investment in research facilities and technology is impressive, and we are excited about the opportunities that will be available to us in the future. During the upcoming year, we will also be focusing on beginning a new chair for our Department of Oral and Maxillofacial Surgery, a position that is our last connection with Stony Brook Medicine. Additionally, because so many patients are "pain" as the reason for their visits to the dentist, our

"In five years, I would like our school to be the destination of choice for those wanting to help shape the dental profession so that it is better prepared to meet the ever-changing and challenging needs of our society. — DEAN LLOYD

highest priority is the recruitment of a pain research team who can collaborate with others on campus in exploring pain transmission and in the development of new approaches in pain management.

Tell us about the role of SDM's special needs clinic.

The school's reputation in caring for those with intellectual and developmental disabilities began with recruiting faculty who made this area of practice and education a priority. They saw the growing demand for special needs dental care in our community, and seized the opportunity to share their

knowledge and expertise with the next generation of oral healthcare providers — in turn helping to address that need. Over the past 50 years, the school became a place where Long Island families seeking comprehensive dental care for their loved ones with special needs would feel welcome. Our special needs dental care clinics offer a comfortable environment for these patients. To ensure an even greater emphasis at SDU for this specialized education and training, the school became one of the first in the country to offer a fellowship in the care of special needs patients.

How will you be furthering care in the community?

With the growing need for dental care for underserved populations on Long Island and in New York, we are looking to provide our students and residents with experiences that have a long-term impact on the community. This includes dental workforce shortage areas where there are different models for delivering and financing dental care, both of which are influenced by social structures and behavioral characteristics that affect patients.

Where do you see SDM in five years?

I would like our school to be the destination of choice for those wanting to help shape the dental profession so that it is better prepared to meet the ever-changing and challenging needs of our society. Because of the rich opportunities at Stony Brook University, with its world-class education, flexible research environment, and well-respected academic and healthcare system, we believe we can continue to attract the best and brightest students, residents, staff and faculty.

To read more from Dean Lloyd on what's next for SDM, please visit sdm.phd.uconn.edu



Dean Lloyd speaks with students after their class in the Center for Implant and Digital Technology.

Photo by Juliana Thomas

SCIENCE SPOTLIGHT

Concise Communicators PhD candidates take on the challenge to carry their work in under three minutes

By Katherine Pridmore/STONY BROOK UNIVERSITY
Photo by John Goffey/Stony Brook University

PhD candidates at Stony Brook University are competing to win the title of "Concise Communicator" in a competition that challenges them to present their research in under three minutes. The competition is held annually at the University of Connecticut in Storrs, Conn., and is one of the most prestigious in the field. The competition is held in a room that is filled with students and faculty members who are interested in the field of communication. The competition is held in a room that is filled with students and faculty members who are interested in the field of communication.

their work more effectively to general audiences. Organizing at the University of Connecticut in Storrs, Conn., is now held in over 100 universities around the world.

The premise is simple: competitors — all doctoral candidates — have three to five minutes to present their research to a panel of judges. In addition to the time limit, presenters are allowed only one slide that best supports their work. Competitors are judged on the content, and the presentation and communication. The top three presenters are awarded prizes.



Left: Katherine King won first place for her presentation, "Paradise Lost in Madagascar?"
Above: Graduate students competed in this year's DMT contest, highlighting the variety of innovative research being conducted on campus and across the globe.

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