

Borderlands No. 2: They almost got me
(Pajarita Wilderness), 2019. Hand-processed
watercolor on amate paper



Week 2 Field study 2019 Arizona Border Enforcement vehicle almost slammed into my rental around 3 a.m. while I was sleeping in the back. I heard multiple vehicles come right up to my driver's side and woke to headlights in a cloud of dust. I freaked and envisioned getting pulled from the car by my greasers and activated the car alarm while staring into the headlights. Just as Teller responded to my text the SUV pulled out. Pajarita Wilderness off the Ruby Rd April

- Frances Arnold, White House advisor
- Where the biggest instruments were built
- A warm farewell to Ernie
- Meet Caltech's accessibility specialist

Earth Tones

Six years ago, on a trip to Oaxaca, Los Angeles-based artist Sandy Rodriguez walked into a tiny bookstore and picked up a jar of powdered cochineal, the intensely red dye derived from insects. Her painting life has not been the same since.

"It was that carmine red, the most stunning red you've ever seen," says Rodriguez, whose work focuses on the intersections of history, social memory, contemporary politics, and cultural production. "I came back to my studio and made oil paint from it. That was the moment when I understood that this particular historic material could support the content of the work in a powerful way."

Following that artistic epiphany, Rodriguez began taking weeklong field-study trips off-grid in the California deserts to learn about native plants and continued to explore centuries-old methods and materials of painting in the Americas, with a focus on the minerals, plants, insects, and organic materials that go into making paint.

This winter, Rodriguez joined Caltech as artist-in-residence in the Division of the Humanities and Social Sciences' Caltech-Huntington Program in Visual Culture. Established in 2018 with a grant from the Andrew W. Mellon Foundation, the visual culture program is administered jointly by Caltech and The Huntington Library, Art Museum, and Botanical Gardens.

Rodriguez's current painting series, *Codex Rodriguez-Mondragón*, is inspired by manuscripts of the Mexican colonial era and takes the form of large-scale map paintings on amate, a traditional Mexican paper handmade from the bark of fig, jonote, and mulberry trees. Painted with hand-processed pigments, the works capture the timeless physical features of the landscapes, including the animals and plants, as well as contemporary political moments such as the police killings in

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Earth Tones

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Los Angeles, immigration detention facilities, and the building of child-separation centers that have impacted Latino communities on both sides of the border.

Each week during her Caltech teaching residency, which ran from January through March, Rodriguez introduced her students, via Zoom, to a new pigment or colorant. “We conducted our experiments and learned about meaning, use over time and across cultures,” she says. “After discussing our readings, we processed the color together into paint. Picture a live cooking show, but we were processing colors.”

Before the term began, Rodriguez mailed each of her students a “historic color box” filled with insects, mushrooms, and bark; gum arabic to bind the powder into paint; mus-sel shells for paint containers; and a variety of natural raw pigments native to Southern California. Although the limits of remote learning meant the students could not share the experience of processing colors in actual proximity, they were able to experience things individually, says Rodriguez, and then compare notes. For instance, she says, “when you crush the cochineal, it’s really interesting to see how different people respond to the fragrance. One of my students said it smelled faintly like M&Ms.”

Rodriguez (pictured below in her studio), says she found the opportunity to reconnect with lost knowledge and build community through shared experiences rewarding. “It is inspiring,” she says, “to get to work with this dynamic group of students and see how they respond to learning about materials that were instrumental to the artistic practice of the Americas.”



See more of Rodriguez’s work at www.studiosandyrodriguez.com



Frances H. Arnold
White House Advisor

“Like the rest of this extraordinary team, I am here today because of love. A love of science, yes, but also a deeper love, of our planet and of our people, without whom science has no purpose or meaning. ... In a moment of torrential divisions, science offers us a common shelter of facts and truth within which we can begin to come together and, in time, to heal. Science ... is not about cold solving of problems, it’s a warm and beautiful exploration of the unknown, an expression of human curiosity that propels us forward and allows us to fulfill our most important responsibility. The moment we fail to nurture it, we resign ourselves to living in the past and lose the chance to guide the future. ... When we put science back to work for the benefit of all people, revitalizing our economy, fueling our climate response, broadening our perspective as we rebuild around greater equity and opportunity, we are making a society worth passing on to our children and our grandchildren. It is an act of love, and I am honored by the opportunity to help nurture this effort.”

—Frances Arnold, 2018 Nobel laureate and Caltech’s Linus Pauling Professor of Chemical Engineering, Bioengineering and Biochemistry, accepting the nomination (at right) by then-President-elect Joe Biden to serve as co-chair of the President’s Council of Advisors on Science and Technology

Adiós, Ernie, and

Thank You

Ernie Mercado was a fixture on Caltech’s campus for more than three decades as the proprietor of Ernie’s Al Fresco, a food truck beloved by students, staff, and faculty alike. Mercado announced his retirement last October. Students and alums, upon hearing the news, organized an online collection effort to honor his retirement and thank him for his service. Here are some of the tributes that were posted.



Ernie’s tacos dorados played more of a role in my decision to go to Caltech than I’d like to admit. ... Good luck, Ernie! It’s the end of an era.

Sam Johnson (PhD ’16), Computational Scientist at Pacific Northwest National Laboratory

Ernie of Caltech food truck fame is retiring. ... End of an era!! I spent > \$6,000 at Ernie’s during grad school, and he got an acknowledgment in my thesis.

Ian Tonks (PhD ’11), Associate Professor of Chemistry, University of Minnesota

Just look at that smile. Anyone who went through Caltech knows the impact this man had on our community. Wishing you a happy and fulfilling retirement, primo. Legend!

Moh El-Naggar (PhD ’06), Robert D. Beyer Early Career Chair in Natural Sciences, USC

Ernie has been a member of the Caltech family for so long. No matter how tough grad school got, he always was there and always greeted you with a smile and a laugh. Ernie’s food truck may no

longer be in operation, but Ernie will not be forgotten!

Jeffery Byers (PhD ’07), Associate Professor of Chemistry, Boston College

Ernie has contributed to more science than any professor on campus! How lucky we’ve been to have Ernie’s food and joy in our lives.

Celeste Labeledz (MS ’19), Caltech Geophysics PhD Student

Ernie’s quick smile, as much as his hearty plates of food, have been an important support for generations of Caltech students and staff. There have probably been hundreds of scientific breakthroughs dreamed up over a round of his burritos; I know one of my papers was.

Jackson Cahn (PhD ’16), Postdoctoral Researcher at ETH Zurich

It’s too bad that next time [I visit] Caltech, I won’t be able to get my Ernie’s fix. Truly an end of an era. This guy was more popular than Nobel laureates, beloved by all, always up for a joke, and affordable! Enjoy retirement!

Roland Hatzenpichler, Assistant Professor, Chemistry & Biochemistry, Montana State University

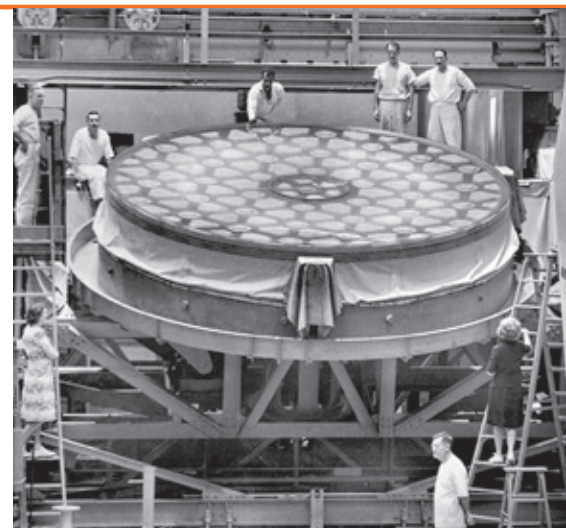


Read more about Ernie at magazine.caltech.edu/post/ernie

Where Big Ideas Take Shape

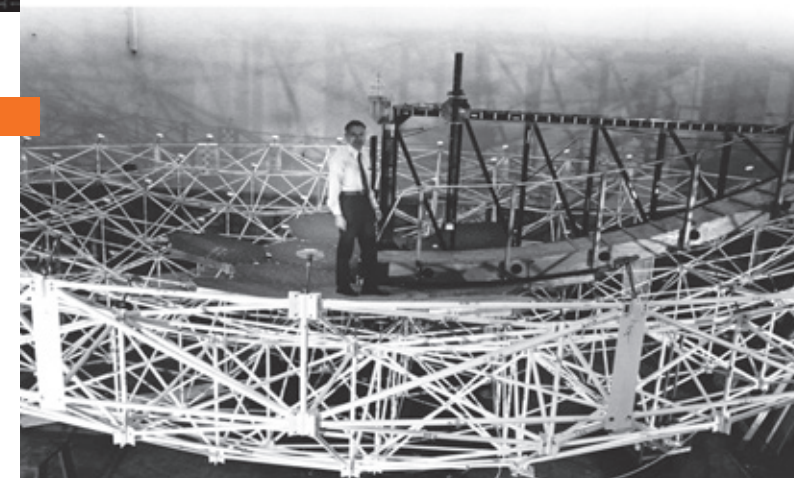


Situated inconspicuously on the south side of campus is a cavernous building that has witnessed some of the most influential developments in the history of astronomy and physics. Called the **Synchrotron Building**, the 48-foot-tall structure, originally dubbed the Optical Shop, was constructed in the 1930s as a place to polish and grind the giant 200-inch mirror of Palomar Observatory's Hale Telescope. In 1949, the building was renamed the Synchrotron Building when construction began on Caltech's synchrotron, a particle-smashing experiment that sped electrons up to nearly the speed of light. Shown here are a handful of the many projects to have been developed in the Synchrotron Building over the years.

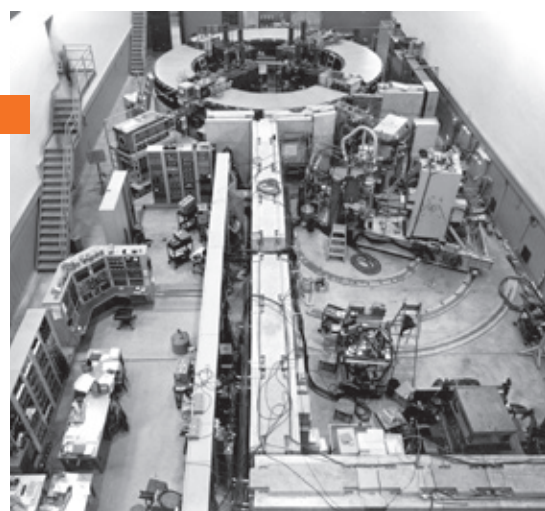


To prevent **Palomar's 200-inch mirror** from being scratched while it was being ground and polished, workers constantly swept and mopped the floor, and even washed the walls of the room. Upon entering the space, workers were required to remove their shoes and clothes, and don rubber-soled shoes and uniforms. A magnetic sweeper was also kept in constant operation on the floor.

Eight **10-meter radio dishes**, designed by the late Caltech physics professor **Robert Leighton** (BS '41, MS '44, PhD '47), were constructed in the building at the end of the 1970s. Six of these would go on to be used for studies of the cosmos at Caltech's Owens Valley Radio Observatory (OVRO); another dish became Caltech's Submillimeter Observatory in Hawaii; and the final dish went to the Raman Research Institute in India.



At the time of its operation in the 1950s and '60s, Caltech's **synchrotron** was the most powerful atom smasher ever built, operating at energy levels of 1 billion electron-volts. Today's largest atom smasher, the Large Hadron Collider (at CERN), reaches energy levels up to 14 trillion electron-volts.



The 4,500-pound **MOSFIRE** instrument now at W. M. Keck Observatory in Hawaii was assembled in the Synchrotron Building over a period of seven years. The near-infrared spectrometer is an astronomy workhorse and has been observing the cosmos since its installation in 2012.

Over the decades, the Synchrotron Building has been a hothouse in developing novel instruments to measure the cosmic microwave background, the glowing relic radiation from the Big Bang. Pictured above is the latest instrument, the **BICEP** (Background Imaging of Cosmic Extragalactic Polarization) Array, which, like its predecessors, will carry out observations at the South Pole in search of primordial gravitational waves from the Big Bang.



This giant thermos bottle-like vessel currently being built in the Synchrotron Building will be incorporated into the **nEDM experiment**, which will make precise measurements of the neutron's electric dipole moment. The experiment, planned to begin at Oak Ridge National Laboratory in Tennessee in about five years, will seek to answer the question: What happened to all the antimatter in our universe?

LIGO research took place in the Synchrotron Building in the 1990s and early 2000s. To accommodate the westward extension of a necessary beam tube, a tunnel was dug under the bridge between the Guggenheim and Firestone buildings. Today, one may notice a gentle bump in the pavement directly under the bridge; this is where the tunnel was built.

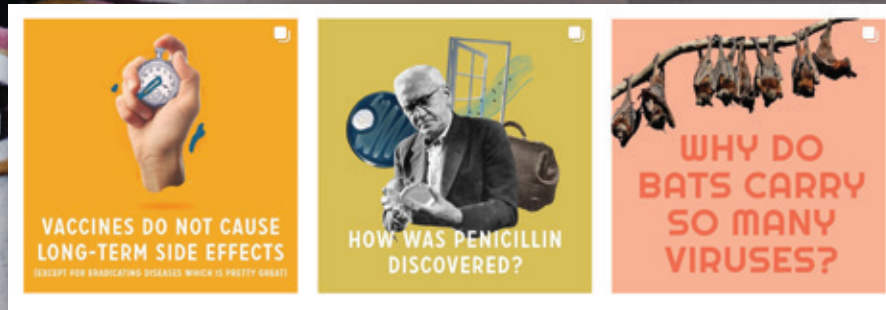


Jessica Griffiths (third-year graduate student)

#SoCaltech is an occasional series celebrating the diverse individuals who give Caltech its spirit of excellence, ambition, and ingenuity. Know someone we should profile? Send nominations to magazine@caltech.edu.

Jessica Griffiths is a bioengineering graduate student in the lab of Sarkis Mazmanian, Caltech's Luis B. and Nelly Soux Professor of Microbiology. With her sister, Kate, an art director in Portland, Oregon, she started an Instagram account, **Science Translators**, that aims to present scientific topics—from prion diseases to penicillin to vaccines—in an engaging and understandable way.

“My sister, Kate, has degrees in both advertising and theater, and works as an art director at an advertising firm. She’s very, very creative. As a bioengineering grad student, I have a different skill set. I was feeling a bit frustrated at the science material that’s out there. There’s a lot for kids—simple and basic things—but for adults it’s often just filled with jargon. I felt like there was an area in the middle to make something visually appealing and interesting that also would be understandable. We’ve really enjoyed starting this Instagram account, and we’ve gotten some good feedback, like, ‘I just spent all weekend trying to understand this concept and reading articles. And just going through this post, you’ve already put it all together, and now I understand it, so thank you.’ It’s not rocket science. Anybody with the scientific knowledge would be able to communicate this way if they had practice. Talking each post through with my sister and getting feedback about stuff she doesn’t understand, I’ve learned what the most important parts of explaining are. Distilling it down is a lot of the process because we have limited space on Instagram. But also, less is just sometimes more. Obviously, the thing on people’s minds right now is SARS-CoV-2, COVID-19, and the vaccine. We also have some more posts like the one we did on Alexander Fleming and his discovery of penicillin in the pipeline. When you tell those stories, about the individuals and what they thought about their research and how they stumbled along the way, it’s so much more relatable and exciting to people than just describing science as a series of chemical or biological interactions.”



For more #SoCaltech, go to magazine.caltech.edu/post/socaltech

The Campus COVID Response One Year Later

It has been a year since the COVID-19 pandemic changed every facet of campus operations. Following are examples of how the community has continued to adapt and connect during this time.

Caltech Together is a campuswide initiative and website designed to help community members support one another during the pandemic. Members of the community can find information on **testing, vaccine planning and distribution, current case activity, campus policies and preventative measures, remote teaching and learning tools, and mental health resources** at together.caltech.edu.

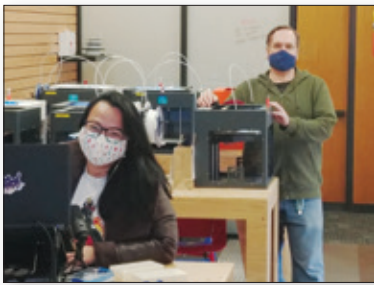
Virtual Rotation gave first-year students a way to experience rotation from home with events tailored to the virtual setting. For soon-to-be grads, the **Senior Series** includes online wine tasting and an evening of Pixar films.

A special social media series, **#CaltechTogether**, shines a spotlight on the many ways members of the community have been supporting each other during the pandemic.

“The fact that a brief conversation between staff members could turn into a small but meaningful project like this that helped out the COVID response team is pretty heartwarming.”

— Paula Gaetos

Gaetos manages Caltech Library's Techlab. Recently, she and system administrator Ian Roberts designed and 3D-printed specimen tube collection racks as part of the campus COVID-19 surveillance testing program.



New webinar series:

Conversations on COVID-19, hosted by the Caltech Science Exchange, features Caltech scientists talking about issues related to the coronavirus, such as the effectiveness of masks and vaccine development. Read more at: scienceexchange.caltech.edu/connect/conversations-covid-19

What Matters To Me and Why, an online interview series for students, explores the paths, choices, challenges, and joys encountered as part of the personal and professional journeys of a variety of speakers from the Caltech community. Read more at: ore.caltech.edu/events/WMTMW

Conversations with Caltech Faculty bridges the virtual gap between faculty and students with casual conversations that mimic the candid discussions that would normally happen naturally during office hours or in the hallways.

In Memoriam

While the pandemic has caused a sense of collective loss, for some in the Caltech community, the toll has been more tragic and personal.

José Mendez, a member of Caltech's custodial services group, died on January 4. José—along with his wife, Gloria Mendez—had been a Caltech employee since 2008. He is remembered as a caring, honorable person who enjoyed spending his spare time in the garden and with his family and dogs.

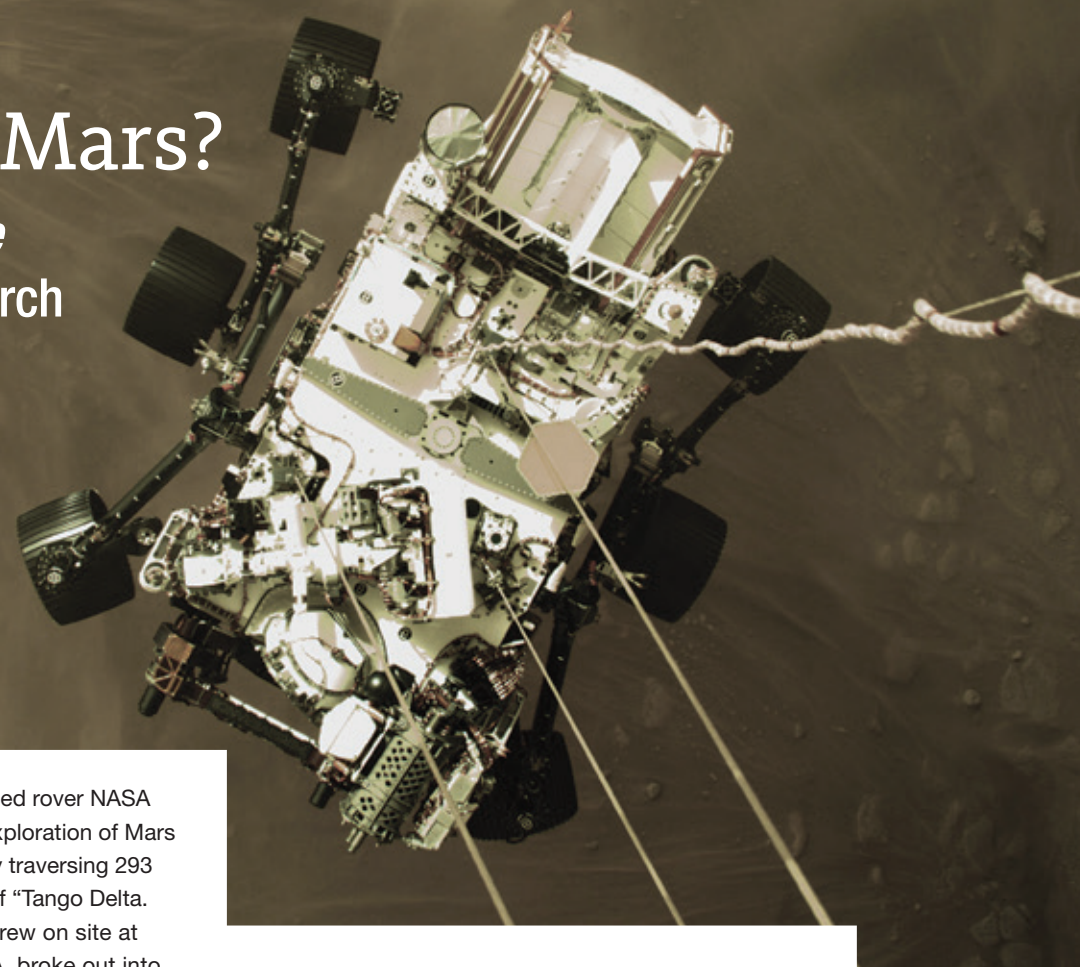
Ramon Ramirez, a Caltech roofer and valued member of the facilities group for the last 15 years, died on December 14, 2020. Ramon is remembered by close colleagues and friends as a caring individual whose goodwill and humor touched all who interacted with him.

Research across campus is contributing to a more thorough understanding of SARS-CoV-2 and informing societal response to the pandemic through studies on how the virus disables cells, how models can help track its spread, and how people perceive risk during the pandemic. Some of this work has a direct impact on the on-campus response. For example, researchers are currently partnering with Facilities to implement a new trace gas technique for assessing ventilation in campus buildings. Read more at together.caltech.edu.

Testing is offered free of charge to community members experiencing symptoms. Caltech's surveillance testing program, run in partnership with Swabseq, provides regular screening of all individuals reporting to campus or accessing campus facilities. Campus is currently operating at 25 percent capacity.

Life on Mars?

Perseverance Starts its Search



Perseverance, the largest, most advanced rover NASA has sent to another world, started its exploration of Mars on February 18, after a 203-day journey traversing 293 million miles. With the announcement of “Tango Delta. Touchdown confirmed,” the skeleton crew on site at JPL, which Caltech manages for NASA, broke out into applause as the rover landed on the planet’s boulder-strewn surface.

The 2,263-pound, car-sized rover is investigating the rocks and sediment of the ancient lakebed and river delta of Mars’ Jezero crater. A fundamental part of its mission is astrobiology, including the search for signs of ancient microbial life. To that end, the Mars Sample Return campaign will allow scientists on Earth to study samples collected by *Perseverance* to search for definitive signs of past life.

“The idea of bringing a sample back from Mars goes back decades,” says Ken Farley, Caltech’s W. M. Keck Foundation Professor of Geochemistry and the mission’s project scientist. “We are in a position now where if everything goes according to plan, samples will be coming back to Earth in 2031.”

Jezero crater sits on the western edge of Isidis Planitia, a giant impact basin just north of the Martian equator. Scientists have determined that 3.5 billion years ago the crater had its own river delta and was filled with water. “Life as we know it could have lived in that lake,” Farley says, “and the mud of a delta is really good at preserving the biosignatures of life.”

Equipped with seven primary science instruments, the most cameras ever sent to Mars, and a complex sample caching system (the first of its kind sent into space), *Perseverance* is now beginning to scour the Jezero region for fossilized remains of ancient microscopic Martian life, taking samples along the way.

A pair of zoomable science cameras on the rover’s remote sensing mast, Mastcam-Z, of which Caltech’s Bethany Ehlmann, professor of planetary science, is a co-principal investigator, will create high-resolution, color 3D panoramas of the Martian landscape. Also located on the mast, the SuperCam, which Professor of Geobiology Woody Fischer has helped develop, will use a pulsed laser to study the chemistry of rocks and sediment.

“There is this real opportunity for us to discover something amazing from Mars,” says Fischer, “but also to discover something on Mars that we take for granted on Earth. Maybe there are abiotic ways to generate some of the materials and textures that we assume to be produced by life on Earth.”

Meet some of the people involved and watch day-of-landing reactions at magazine.caltech.edu/post/perseverance

Five Questions for: Accessibility Services Specialist Marc Lazar

Marc Lazar recently joined Caltech in the newly created position of accessibility services specialist within Caltech Accessibility Services for Students (CASS). In this role, Lazar is the primary support person for students with disabilities, both undergraduate and graduate, with the goal of ensuring equitable access to the full experience of being a part of the Caltech community. Lazar has worked with individuals with disabilities in a variety of settings, including colleges, high schools, the community, and the workplace, and has particularly deep experience and expertise working with the autism community.



1. Why is it important to have someone in your role at Caltech?

Accessibility is a crucial issue in schools, including on college campuses. I think it’s really important to have somebody whose role is dedicated to focusing on accessibility, not just the physical accessibility of buildings but also giving students the access to fully participate in everything that the college experience has to offer. It’s a big equity issue for me.

2. What are some misconceptions about disability?

I think for a lot of people, when you talk about disabilities, the first thing that comes to mind is somebody in a wheelchair or somebody who’s visually impaired or deaf. It’s only more recently that people have begun to realize that invisible disabilities such as psychological and developmental and other less visible health disabilities actually impact a greater number of individuals.

3. What are some of the issues you want to address early on?

I think number one is really outreach, just increasing the visibility of CASS and accessibility throughout the Caltech community, and helping students feel more comfortable reaching out for help before they’re in a crisis situation.

Being at an elite institution like Caltech can be an obstacle for students seeking help. At the same time, there is a growing disability community that is finding support and strength in one another. And that’s starting to emerge throughout academia. I think it would be wonderful to tap into that and connect students and the whole Caltech community with the larger disability rights and support community.

4. What about the special challenges of adjusting to learning online?

Students who have executive functioning challenges, which can often be found with attention deficit disorders and autism, more of them have been struggling in this environment. I think that has to do with having a little bit less structure, having to really manage your time in an online environment. A lot of students with executive functioning challenges rely on routines and sometimes external reminders to really do their best. Being able to sustain attention for long periods of time staring at a screen is hard for everyone, but I think when you have challenges related to focus and attention, that can be especially difficult.

5. In terms of physical accessibility on campus, what are some challenges that you see?

I know that there are some older buildings on campus, so some things need to be retrofitted. My impression is that it’s not feasible to tackle everything at once. It’s more about addressing issues as the need arises. I’m interested in exploring how we can make it easier for students to reach out to us when an accessibility issue comes up for them so that we can address it as quickly as possible. And, hopefully, going forward, they can be more included in the planning phases for new facilities so things are fully accessible from the get-go.

Read the full interview at magazine.caltech.edu/post/lazar