of the year," Fauci said at a press conference about the launch of NIAID's first COVID-19 efficacy vaccine trial on 27 July.

Regeneron's Christos Kyratsous notes that vaccine trials must wait a few weeks for a person's immune system to develop appropriate responses to shots and further weeks for "the event"—a chance exposure to SARS-CoV-2. This means those trials require time and many people. In contrast, for the antibody treatment trials, "your event has already happened," Kyratsous says. And in the prevention studies, the household contacts of COVID-19 cases will be much more likely to be exposed than people who typically join a vaccine efficacy study.

Immunologist Dennis Burton, whose group at Scripps Research has isolated highly potent monoclonal antibodies against SARS-CoV-2 that it hopes to move into human studies (*Science*, 15 June, DOI: 10.1126/science.abc8511), says he is optimistic that monoclonals will protect people from infection for months with a single shot. "It's much easier to take care of a few incoming virus particles than to try and resolve or cure an ongoing infection." The same logic holds for treatment. "Hit the virus hard and early," Burton says.

Kyratsous says even if monoclonal antibodies don't beat vaccines to the finish line, they still might have a role to play against COVID-19. "We're going to need both approaches in the long run," Kyratsous suggests. Vaccines are rarely 100% effective, and many people may decline a vaccine or skip immunization for other reasons. What's more, he notes, the elderly or people who are immune compromised may not mount robust immune responses after being vaccinated.

Supplies of monoclonal antibodies may be limited, however, in part because of modest investment. Operation Warp Speed, for example, has committed $8 billion to six different COVID-19 vaccines; for monoclonals, the government has invested about $750 million, much of it in Regeneron, which will produce somewhere between 70,000 and 300,000 doses before it even has efficacy data. Lilly says it will have 100,000 doses by the end of the year.

But no one knows how far those doses would stretch, says Janet Woodcock, who is on leave from the Food and Drug Administration to lead Warp Speed's therapeutic effort. If the antibodies work, a study from the Duke University Margolis Center for Health Policy estimates the United States alone could require nearly 40 million doses next year for prevention and treatment. "Unlike with vaccines, it is hard to project the number of treatment courses that will be available," Woodcock says. Prevention, which would be a single intramuscular shot, requires less product than the intravenous infusions used in treatment, she notes, but the amount needed depends on a person's weight.

Although how to prioritize vaccine distribution has already sparked extensive debate, no such discussion has yet taken place about monoclonal antibodies. But DOJ acknowledged the supply concerns on 23 July, giving the six companies that had petitioned it the green light to share production information.

Regeneron is not part of that group, yet Kyratsous is optimistic about meeting the need. "The good thing with some of these biologics is you can ramp up production fairly fast," he says. Nirula agrees. "If we have success in these clinical trials, we will have a lot of drug available," he says.

> **"Antibodies have the potential to be an important bridge until the vaccine is available."**
>
> **Ajay Nirula**, Eli Lilly

The cost of monoclonals, especially for the higher doses needed for treatment, could split the world into the haves and have-nots. "It's unlikely that that treatment will get down to a price point in the near future that it would be easily affordable globally," says Seth Berkley, who leads Gavi, the Vaccine Alliance, and heads an international COVID-19 vaccine effort.

Jenkins says a key aim of the P3 project, which has provided four groups with $96 million in seed money, has been to develop monoclonal antibodies that can be made by the body itself, instead of in large fermentation tanks. The idea, which has not yet been tested in humans for COVID-19, is to inject people with DNA or messenger RNA that encodes a desired antibody, allowing their own cells to make it. "We think we can bring down the cost of monoclonal antibodies," Jenkins says.

Regardless of cost, evidence that monoclonals work as preventives could benefit everyone by giving vaccinemakers a clear sign that antibodies against the surface protein of SARS-CoV-2 are enough to protect a person. This, in turn, could provide a strong indicator for evaluating the worth of a candidate vaccine short of actual efficacy data. "It will be earthshaking to the vaccine field in a positive way," says Myron Cohen of the University of North Carolina, Chapel Hill, who leads testing of monoclonal antibodies for CoVPN. "It provides a thousand opportunities to move forward faster." ■

COVID-19

For science in Latin America, 'a fascinating challenge'

Pandemic shows benefits of investments in research but also poses grave threats

By **Rodrigo Pérez Ortega** *and* **Lindzi Wessel**

As the COVID-19 pandemic surged across the United States and Europe in February, scientists at Mexico's Center for Research and Advanced Studies (Cinvestav) sprang into action. They quickly converted one of their research labs into a diagnostic clinic, and by mid-March, as cases began to mount in Mexico, they had launched seven other COVID-19–related projects.

Then a second crisis hit. On 2 April, Mexican President Andrés Manuel López Obrador ordered the termination of public trust funds, which pay for special and long-term projects at Cinvestav—a public institute with nine campuses that employs 7500 people—and other institutions. Three weeks later, he announced a 75% cut for some federal institutions' operating budgets, including Cinvestav's, that would have forced the institute to shut down, says Cinvestav Director José Mustre de León.

Another blow followed on 14 May, when the National Council of Science and Technology (Conacyt) asked scientists to donate their monthly federal supplement, a typical part of Mexican researchers' income, to the nation's health system to support the COVID-19 response. "Not only would we not have any money, but we'll have to take money out of our own pockets," says Gabriela Olmedo, a genetic engineer and director of Cinvestav's Irapuato campus.

Mexican scientists aren't alone in feeling conflicting pressures from the pandemic. Across Latin America, researchers have raced to contribute their expertise to the worst public health crisis in a century and demonstrate that several decades of investment in research—including the capacity to run large clinical trials—has paid off. "We basically showed that we have knowledge in the country that can be put to work for

Students protest against a cut in the education budget at the Central University of Ecuador on 5 May.

PHOTO: RODRIGO BUENDIA/AFP/GETTY IMAGES

the benefit of the society as a whole," says Aisén Etcheverry, who heads Chile's National Agency for Research and Development. At the same time, the pandemic has created deep economic and financial problems for the region, which faces a projected 5.3% contraction in gross domestic product this year. The resulting cuts are hitting science hard and threatening hard-won gains.

Latin America comprises less than 10% of the global population yet accounts for nearly one-third of reported COVID-19 deaths. In deaths and case counts, Brazil ranks second only to the United States; Colombia, Chile, Peru, and Mexico have been hard hit as well. The fallout could push an additional 16 million residents of the region into extreme poverty, according to a report from the United Nations.

Latin America's growth in basic research, achieved through decades of investment in many countries, has put the region in a better position to fight back, says Hernando García Martínez, director of the Alexander von Humboldt Biological Resources Research Institute in Bogotá, Colombia. "We wouldn't have had the capacity to respond to such a direct and real problem for society as COVID-19," says García Martínez, who describes the crisis as a "fascinating challenge."

In early April, Colombian researchers were among the first to start a clinical trial of convalescent plasma—antibody-rich serum from people who have recovered—for COVID-19 patients. More than 190 other clinical trials are ongoing in Latin America. Researchers in Brazil, Mexico, and Argentina have joined the race to develop their own vaccines and are partners in phase II and III trials of international vaccine front-runners.

In Argentina and Chile, science's political standing has risen in the crisis. Argentine President Alberto Fernández, elected in 2019, was already taking a science-friendly approach, generally heeding his science advisers and promising more funding—a shift from his predecessor, who implemented devastating budget cuts and demoted the science ministry to a subsection of the Ministry of Education. Now, the public sees that prioritizing science helps Argentina respond to the pandemic, argues Juan Pablo Paz, secretary of scientific and technological coordination. "I think science will remain in a stronger position than before."

In Chile, Etcheverry redirected her agency—part of a new science ministry and only 3 months old when the pandemic struck—to provide COVID-19 testing and other aid to the pandemic response and made money available to track societal impacts of the crisis, such as increases in domestic violence. Showing that science could help "generated a conversation inside the government that never had happened before," Etcheverry says. "It's definitely a turning point on how the sector is perceived."

Still, the economic crisis has not spared Chilean science. Becas Chile, a scholarship program that funds international study for aspiring researchers and has boosted growth of many scientific fields in Chile, has been partly suspended. "Having that frozen or put into question just because we're in a crisis is not the right decision because these are the kinds of things that prepare you for the next one," says César Fuentes, an astronomer at the University of Chile.

The picture is darker in Peru, says Gisella Orjeda, former president of the country's National Council of Science, Technology and Technological Innovation (CONCYTEC). This year, the government paused certain funding programs; by July's close, CONCYTEC had spent just 16% of its 2020 budget.

In neighboring Ecuador, new threats of cuts to higher education and the economic crisis have led scientists to ramp up efforts to secure funding by collaborating with researchers from the United States and the European Union, says Diego Quiroga, dean of research at San Francisco de Quito University. "If we don't look abroad for funding, we'll have nothing," says Quiroga, who predicts the pandemic will cause an exodus of young scientists. As Mustre de León puts it: "We're losing an entire generation of scientists."

In Mexico, after an outcry from researchers, students, and the media, the president ordered Conacyt officials to drop their plea for donations. Cinvestav was allowed to keep its public trust funds for now and is negotiating a smaller budget cut. But other federal institutions will still see cuts, and the episode left scientists shaken and worried. "If we hadn't had this budget cut environment, we could have done much more," Mustre de León says. And the pandemic has worsened an already-tense relationship between the scientific community and Conacyt Director and developmental biologist María Elena Álvarez-Buylla Roces, whose response to the pandemic they have criticized.

Elsewhere, too, the pandemic has deepened rifts between scientists and politicians. Brazilian President Jair Bolsonaro has repeatedly called into question scientific expertise, downplaying the severity of the pandemic and promoting treatments lacking evidence. In Venezuela, scientists' alarms prompted threats from high-level government officials. And in Colombia, seven senators sent President Iván Duque Márquez a letter on 27 July complaining about a lack of leadership during the pandemic by Mabel Torres Torres, who leads the new Ministry of Science, Technology and Innovation and was previously engulfed in scandals over her promotion of an untested cancer treatment. "It's an absent ministry," says immunologist Gabriela Delgado Murcia of the National University of Colombia, Bogotá. "We feel desolate." Two days later, the Ministry of Finance proposed a 35% cut for the country's 2021 science budget.

Despite the challenges that the pandemic has brought, García Martínez remains hopeful. Years of scarce funding have taught Latin American researchers to do a lot with very little, he says—an especially helpful skill these days. "We are very adaptive." ■

Rodrigo Pérez Ortega is a science journalist in Washington, D.C. Lindzi Wessel is a journalist in the San Francisco Bay Area.

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