



# A NEW FORCE EMERGES IN GENOMICS



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With vision and a big personality, Christian Happi has built a world-class genomics center so Africans can help Africa

By **Jon Cohen** and **Abdullahi Tsanni**, in Ede, Nigeria  
Photography by **Andrew Esiebo**

**F**rom the dirt road that fronts Redeemer's University, all you can see are modest, low-slung buildings and a sports field with a threadbare carpet of grass. Redeemer's is a private, little-known school owned by a Pentecostal megachurch in this hardscrabble farming town. But beyond that sparse field is a cluster of state-of-the-art labs, classrooms, and sleek dormitories with distinctive rammed-earth walls—the new campus of the 10-year-old African Centre of Excellence for Genomics of Infectious Diseases (ACEGID).

Leading a tour in late April, Director Christian Happi, the molecular biologist who founded ACEGID, promises not to brag. "I'm not a

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puffy person," he says. He breaks his pledge within minutes. Stepping outside a lab where graduate and post-doctoral students from five African nations are at work, he says, "If these kids keep working hard, it's possible that in next 20, 25 years, a Nobel Prize will come out of here."

Established to address emerging infectious diseases in Nigeria and its neighbors, the institute has trained more than 1600 scientists from around the continent in genomics. Its original focus on Lassa fever and Ebola has expanded to include a host of other urgent diseases, including COVID-19 and mpox, as well as the hunt for novel pathogens in animals and humans. ACEGID's scientists have engineered disease diagnostics, tracked genetic changes in viruses

in real time, and published a steady stream of papers in top-tier journals. And the center has become a shining example of how a research institution run by Africans in a once-colonized country can serve the continent's needs.

Nigeria, an oil-rich nation of 220 million, has been free of British rule for 6 decades and boasts solid universities as well as one of the largest economies in West Africa. But many young researchers still leave the country for better opportunities, and “the scars from what has transpired over hundreds of years” remain vivid, says Muhammad Ali Pate, Nigeria's minister of health. The extraction of resources by colonial powers—be it fossil fuels, enslaved people, intellectual property, or biological samples—created imbalances that linger today. “When folks talk about decolonizing global health, all they want is fairness, more equity, more respect, and more acknowledgement of the relative contributions of everyone,” Pate says.

When it comes to battling infectious diseases, Africans want to track the pathogens harming them, help develop drugs and vaccines they need, and train young scientists on sophisticated equipment. All of this is happening now at ACEGID. “I see the center as a pathway for the continent to evolve,” says virologist John Nkengasong, a native of Cameroon who heads the U.S. President's Emergency Plan for AIDS Relief and previously ran the Africa Centres for Disease Control and Prevention.

The center's ambitions go further, however. Pardis Sabeti, a computational geneticist at the Broad Institute who helped found ACEGID, bristles at the common plaudit that it could become Africa's best genome center. “Why would you stop there?” she asks. “I think it can be the best in the world.”

Outsiders say much of the institute's success stems from the powerful personality and hands-on approach of Happi, who was born in neighboring Cameroon (see map, above). Happi “is a brilliant mind and an asset for Africa,” Nkengasong says. Happi has admirers from villagers to presidents, and he is unapologetically blunt. He takes pride in ACEGID's entirely African management team and challenges decolonization narratives he thinks overemphasize the need for former colonizers to atone for the past.

Instead, Happi focuses on holding African countries accountable for their own actions today: He has sharply criticized Nigeria and other African countries for not supporting the highest quality science. He has also had

showdowns with the high and mighty, including the Nigeria Centre for Disease Control and Prevention (NCDC), Harvard University, and the World Health Organization (WHO). “I've got a lot of enemies out there because of the way I talk,” Happi says. “And I don't give a hoot.”

**WHEN CHRISTIAN** Tientcha Happi was born in 1968 in Cameroon, Nigeria's eastern neighbor had been independent for 8 years. First colonized by Germany, it was ruled by both France and the United Kingdom in the wake of World War I. French and English are of-

## Bringing science home

Born in Sangmélina, Cameroon, Christian Happi has set up a powerful genomics institute in Ede, Nigeria. The center's work extends throughout Nigeria and beyond.



official languages, but its many ethnic groups speak at least 250 native tongues. Happi is fluent in French, English, German, and Bana.

One of eight children born to a father who was a midlevel civil servant and a mother who sold vegetables, Happi lived in Sangmélina, a small town surrounded by dense rain forest. Speaking in a preacher's cadence, constantly gesticulating, he recounts how he found his life's calling.

When he was 8 years old and attending a Catholic, French-speaking elementary school, Happi developed a high fever, gasped for air, and couldn't eat or stand. His mother hoisted him onto her back and lugged him on foot to the hospital. On the way home, she took a break under a tree. Happi asked why he was so sick. The doctors said he had malaria, she said.

“I told her that when I grow, if this disease is still on, I will find a cure for it,” Happi says.

“That is not possible,” she said, “but I wish you well.”

In his teens, Happi switched to a government-run school, where he read that DNA is the “molecule of life.” Rather than pursuing a medical degree, as relatives and friends expected, he entered a biochemistry program at the University of Yaoundé. “If I understand this DNA very well, then this malaria thing, I'm going to solve it,” he told his befuddled father, who by then had become a diplomat and represented Cameroon in the African Union.

In 1993, Happi moved to Nigeria for graduate work at the University of Ibadan, one of the continent's top-ranked schools, originally an offshoot of the University of London. “It was a huge transition to go to a British, Anglo-Saxon program,” says Happi, whose English skills were rudimentary on arrival. “The thinking process was different.”

In graduate school, Happi sequenced the genomes of malaria-causing parasites and met his wife, Anise, a veterinary student also from Cameroon who now works at ACEGID. In 1998, he left Africa for the first time to present a poster at a Gordon Research Conference on malaria at the University of Oxford.

On a bus from the London airport to Oxford, he had a pivotal encounter. Dyann Wirth, a renowned Harvard immunologist, was also aboard and they began talking. Over lunch at the meeting, she invited Happi to visit her lab, and he soon decided to continue his work there, receiving his Ph.D. in 2000 and then staying on as a postdoc. “She took me under her wings,” Happi says. His resulting research on malaria drug resistance ultimately led Nigeria to change its policy on which treatments to use.

At Harvard, Happi met Sabeti, another postdoc, who had developed a genomics tool to explore the recent evolution of humans. The strongest signal of natural selection she found popped up in certain Nigerians whose genomes had unique changes in two genes she thought might protect against Lassa fever, a deadly viral hemorrhagic disease endemic in Nigeria and other West African countries.

In 2007, she reached out to Happi, who by then had moved back to the University of Ibadan with Anise. “Christian moves quickly,” Sabeti recalls. “Before I knew it, I'm boarding a plane to Nigeria.”

Named for the Nigerian town where it was first identified in 1969, Lassa fever is thought to have sickened 10,000 people last year in Nigeria alone. Although about 80%



Construction workers in late April put finishing touches on a new, \$10 million sequencing center in Ede, Nigeria, which includes a conference room, dorms, and classrooms.

of Lassa infections are mild, up to 70% of severe cases are fatal. During that first trip in 2008, Happi and Sabeti traveled to a local hospital in Irrua, in southern Edo state, the hotbed of the disease. To diagnose patients, the hospital sent samples to labs in Germany and waited weeks or months for results.

“Most of those patients are dead by that time, so what’s the point?” Happi says. He wanted to do more than simply study the disease. “Within Harvard, we were basically just pushing the boundaries of molecular biology,” he says. “I wanted to be more useful.” Happi and Sabeti set up a molecular lab in Irrua to diagnose Lassa fever.

In 2009, Sabeti won \$4.5 million—a large sum for an early-career scientist—from the U.S. National Institutes of Health, to collect patient samples at Irrua to unravel the co-evolution of the Lassa and human genomes and develop a simpler diagnostic. Happi was a co-principal investigator. But a critic at Harvard (whom Happi does not want to name) told Happi he and Sabeti were too young to manage such a big grant. “Let me complete the sentence for you,” Happi says he told the man. “Too young and too Black.”

What followed also rankles: A research compliance officer at Harvard questioned Sabeti’s transfer of funds from Harvard to the Irrua hospital to purchase a Lassa drug, and Sabeti was investigated. She was ultimately exonerated, and the probe did not target Happi. But the incident solidified his decision to stay in Africa. “Somebody just wanted to take over the program,” he says. “I was still one leg here, one leg there, but I said, ‘I’m out of here.’”

Oyewale Tomori, Nigeria’s top virologist, had been recruiting Happi to come to Redeemer’s, where Tomori had recently become vice chancellor. Tomori, who has dedicated his career to building research in Africa, worried Harvard or another top university would lure Happi away from Nigeria.

Happi cast his lot with Redeemer’s, surprising friends at Harvard. “Some people said, ‘We know how tough it is in Africa, we know you will be back,’” he recalls. “But I told myself, ‘I’ve got ideas and ideas are wealth. We’re going to turn those ideas to reality.’” In 2013, Happi and Sabeti won an \$8.5 million grant from the World Bank to establish a modest incarnation of ACEGID at the new Redeemer’s campus in Ede.

**ON 20 JULY 2014**, Nigeria got a warning. A man named Patrick Sawyer collapsed after arriving at the Lagos airport from Liberia, where an Ebola epidemic was exploding. Nigeria had never had a case of Ebola. If the virus had arrived in Lagos—the largest city in Africa—disaster loomed. Tests showed Sawyer had a filovirus, the family Ebola belongs to, but doctors had made no definitive diagnosis, according to Happi. Sawyer wanted to leave the hospital. On the evening of 24 July, Tomori called Happi and asked him to help. “I may not be back,” Christian told Anise as he got in his car, “but it’s better for a few to die than to just let the thing spread.”

Happi’s lab at ACEGID then consisted of two rooms at Redeemer’s original campus in Lagos—a far cry from the biosafety level-4 (BSL-4) facility typically required for handling Ebola. He stayed up all night to

confirm Sawyer had Ebola. Sawyer died the next day, and a massive contact tracing effort by the government found 19 others who had been infected. The outbreak in Nigeria stopped there.

One aspect of the experience, however, led to a tragic personal outcome and reaffirmed Happi’s commitment to building up infectious disease expertise in Africa. Lassa researcher Sheik Humarr Khan, Happi’s longtime collaborator in Sierra Leone, became infected while treating Ebola patients and died 4 days after Sawyer. Khan received standard care in a field hospital in Sierra Leone while afflicted doctors and nurses from wealthy countries were being airlifted home and given experimental treatments. “I was going around begging for ways to save his life,” recalls Happi, who grows emotional at the memory. “I realized that being an African makes you a second-class person. I felt that our lives are not equal.”

Today, ACEGID has a BSL-3 lab and 117 employees, including 47 Ph.D. scientists and 28 students, many of whom visit Broad or Scripps Research for training. About 25% of the \$10 million annual budget comes from research grants from foreign governments, with the rest donated by a handful of philanthropies, including the ELMA Relief Foundation—one of Africa’s largest charities—and familiar names such as Gates, Wellcome, and Rockefeller. Foundations, led by ELMA, are paying for the new, \$10 million genome center.

Workers are finishing the 1300-square-meter facility, set to open in October. Once up and running, the center will have 12 petabytes of storage to help collect and store mas-



Veterinarian Anise Happi visits a pig farm to sample the animals' blood for hidden infections.

sive amounts of sequence data. “It’s going to be the highest performing computer on the continent,” Happi says.

The main lab is already running full tilt, analyzing samples sent from across Africa. ACEGID scientists use sophisticated sequencers and complex bioinformatic analyses to identify pathogens and analyze genetic variants in the samples—and they hope to sequence patients as well, in order to tailor treatments. “We just performed the very first human genome sequence on African soil with this machine,” Happi says, pointing to a nondescript black metal box the size of a refrigerator.

A neighboring room holds a state-of-the-art Illumina sequencer that will soon supplant the older machine. In 2023, Happi pressed Illumina’s then-CEO, Ethiopian-born Francis deSouza, to put ACEGID at the front of the purchasing line. “You can’t just do what you’ve done in the past, where the U.S. has all the new machines and Africa has none,” Happi told deSouza. Today, says longtime Happi collaborator and evolutionary biologist Kristian Andersen, ACEGID has “more sequencing capacity than we do here at Scripps Research.”

ACEGID has benefited from its ties with prominent U.S. universities, Happi acknowledges. But he says another factor in its success is the expectation that its staff will perform just as well as its U.S. collaborators. African scientific institutions need to reject mediocrity, agrees pediatrician

Nadia Adjoa Sam-Agudu, who worked at the Institute of Human Virology, Nigeria (IHVN) for 13 years and is now at the University of Minnesota. Originally from Ghana, Sam-Agudu says, “We have to be excellent or more than excellent to be able to catch up because of the ... erasure of what we had established prior to colonization.”

Importantly, Happi and his team, rather than ACEGID’s funders, have set the institution’s research priorities, says Tulio de Oliveira, a bioinformatics specialist who founded the Centre for Epidemic Response and Innovation (CERI), a similarly scaled genomics center at Stellenbosch University in South Africa (*Science*, 7 October 2022, p. 17). “He’s driving the scientific research from the continent.”

De Oliveira, who collaborates with Happi and has worked with him to push vaccine equity and coordinate SARS-CoV-2 surveillance in Africa, says both ACEGID and CERI bring an invaluable asset to South-North collaborations: their intimate knowledge of the politics, cultures, and health needs of their regions. “We understand the research questions that need to be answered and we understand [our countries’] system,” he says. “By understanding the system on the ground, you can respond much, much, much quicker.”

To make all this happen, Happi and ACEGID must overcome challenges not seen in wealthier nations. ACEGID bypasses Nigeria’s daily blackouts with a massive new solar grid on its campus, backed by a building

stuffed with German-made TESVOLT batteries. For internet access, the institute taps into Starlink, the company owned by Elon Musk’s SpaceX that relies on low-altitude satellites.

Key reagents are unavailable in Nigeria or even in Africa. Imports require voluminous paperwork and reagents often travel through several countries en route, racking up tariffs and delays. “In the U.S., we need something today, tomorrow morning it’s here,” Happi says. “Here it takes 4 weeks to get things.” To keep work on track, ACEGID researchers order reagents when they’re down to 50% of the needed supply and synthesize some biochemicals themselves.

It has been “amazing” to watch Happi navigate obstacles and build the institute, says Robert Garry, a Tulane University virologist who has collaborated with Happi and Sabeti since 2007. “Christian is a force of nature. Outbreaks, pandemics, politics, you name it—nothing can stop him.”

**AS PUNISHING** afternoon sunshine blazed, Anise Happi stood outside of a small pig farm in Ede. Anise, who left the University of Ibadan in 2020 to join ACEGID as head of zoonotic research, slipped a Tyvek “bunny suit” over her elegant cream-colored pantsuit, swapped high red rubber boots for her pumps, and snapped on gloves and mask. With two similarly attired vets on her team, she entered the concrete-walled pens. The vets pried open the jaws of the pigs to swab their mouths, took their rectal temperatures,

listened to their chests, and drew blood. The animals' squeals bounced off the corrugated roofs at ear-piercing levels. The pigs looked and sounded healthy, but sequencing the RNA or DNA in the samples might reveal pathogens—an approach known as metagenomic surveillance that has already paid off for ACEGID.

“Without focusing on anything, we found Crimean-Congo hemorrhagic fever virus in cattle, sheep, and goats,” she says. ACEGID's metagenomic studies in humans have also uncovered surprises, including an entirely new virus the researchers dubbed Ekpoma.

Lassa, the virus that led to ACEGID's founding, remains a top focus. The institute has amassed the world's largest catalog of Lassa genomes, sequencing more than 1000 isolates. The data set has helped ACEGID and U.S. collaborators clarify the virus' origin (*Science*, 23 February, p. 810) and show that jumps from rodents drove a large outbreak in 2017–18. The team has also worked with the Broad to develop diagnostic tests for Lassa using the genome editor CRISPR.

None of this work is funded by the Nigerian government. “They do not understand the importance,” Anise Happi says. “When COVID hit, I think they woke up a little bit, but they've gone back to sleep.”

To Christian Happi, that lack of support is a sign that “decolonization” as the word is sometimes used—as a call for more investment from former colonizers—is “a very lazy narrative.” Instead, he points the finger at Nigeria and other countries in sub-Saharan Africa. In 2006, many declared they would invest 1% of their gross domestic products in R&D; none has done so. “We keep putting responsibility on others, ‘It's because of colonization,’” Happi says. “No. We need to be very responsible ourselves.”

Tomori agrees. “The need for decolonization is not on the colonizer,” he says. “This idea is on we, the colonized, to rethink our minds.” Tomori also decries Nigeria's infamous corruption. “We don't even need the foreign aid we are getting if we use our money well.”

ACEGID has had its funding challenges, including a rancorous confrontation with NCDC and the Coalition for Epidemic Preparedness Innovations (CEPI), a nonprofit that funds development of vaccines for emerging infectious diseases including Lassa. Happi felt the agency gave special treatment to a competing NCDC Lassa proposal. “I was just firing at all of them from all directions,” he recalls. (He was on CEPI's advisory board but recused himself from evaluating this proposal.)

Alash'le Abimiku, a molecular virologist at IHVN who collaborates with Happi, also served on the CEPI advisory board at the time. “Happi is really a mixed grill,” Abimiku

says. “He is just a fabulous scientist who really doesn't have time for diplomacy.”

Epidemiologist Chikwe Ihekweazu, who headed NCDC from its inception in 2016 until 2021 and now runs WHO's Hub for Pandemic and Epidemic Intelligence, sees Happi as “a phenomenal guy,” but says, “you not only need expertise, you also need sometimes a little bit of humility.” He notes that resources are scarce in Nigeria and investments other than science may seem more attractive. “For politicians, it's much easier to show you a new bridge or dam than to tell people, ‘Listen, your investment will get you value 10, 20 years down the road,’” he says.

Despite the frictions, ACEGID worked closely with NCDC during the COVID-19 pandemic, sequencing the first SARS-CoV-2 in Africa as well as more than 5000 other isolates from Nigeria, and tracking the emergence and spread of variants. Happi has also forged strong bonds with government officials who have helped the country respond to public health threats; he is now what Nigerians call a “big man,” as an incident at the La-

Otuh, an ACEGID collaborator who grew up in the village, asked how many wanted to become doctors at the new, as-yet-unopened clinic ACEGID had built on Otuh's family land up the road. A few students shyly raised hands. Then a mother entered the cluster and slapped one child's back. Nearly all the hands flew up. Happi and the mothers burst out laughing.

But the question was no joke. Happi, working with Otuh and parents, plans to establish a nonprofit with Sabeti that will support the college educations of two doctors and five nurses from among these children; once trained, they would agree to work at the clinic for at least 5 years. They would not just treat patients, but also send samples to the lab at Ede, building up African science as well as its health infrastructure.

Standing by the clinic's “female ward” with its bright pink sheets, Happi stresses how much he appreciates his partners from the U.S., calling Sabeti not just his “academic better half,” but a sister and equal partner. Yet, he says, because this commu-



In the village of Amaewula, Nigeria, Patricia Otuh (right) asks children how many want to be doctors or nurses at a nearby clinic built by the African Centre of Excellence for Genomics of Infectious Diseases.

gos airport made clear. A gaggle of police and airport employees demanded his driver pay a fine for briefly violating a no parking sign. Happi swiftly phoned a retired, high-ranking military official. Two soldiers pulled up and the gaggle instantly dispersed.

**IN THE SMALL VILLAGE** of Amaewula, amid rice fields 600 kilometers southeast of Ede, Happi and veterinarian Patricia Otuh of the University of Ibadan stood under a palm tree with two dozen kids, most dressed in blue-and-white school uniforms.

nity is similar to the one where he grew up, “I can always see farther than the person who is at the Broad.”

That vision spurs his bolder goal for the new incarnation of ACEGID. “There's so much to be done in Africa,” he said. “Can we together work to correct the mistakes of the past, and then make not just Africa a better place, but actually make the world better because of contributions from Africa?” ■

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