At Olorgesailie in Kenya, big hand axes (left) gave way to smaller, more precise blades and points (right).

more extreme. More than 80% of mammal species had vanished and new kinds of elephants, pigs, foxes, and springboks gathered at tree-lined streams. MSA tools—relatively sophisticated blades and points that would have been hafted onto spears—were plentiful.

The site yielded no human fossils in this key time frame, so researchers can't be sure who the new toolmakers were. But discoveries elsewhere offer a strong hint. For years archaeologists had thought the MSA tools were too old to have been made by our species. Then, last year, fossils resembling *H. sapiens* were found near MSA tools and dated to nearly 300,000 years ago at Jebel Irhoud in Morocco (*Science*, 9 June 2017, p. 993)—timing that fits the Olorgesailie chronology.

Features of the MSA tools also suggest they were the handiwork of sophisticated humans. The toolmakers were highly selective about their raw materials, importing obsidian from up to 90 kilometers away. Such far-flung connections are a "hallmark of human social organization, and an important buffer in forager societies," whose members may move to distant places in hard times, Brooks says. The tools also are smaller, more precise, and more uniform in shape than Acheulean tools. They represent a milestone in abstract thinking: A hand ax preserves the shape of the original lump of rock, but creating a blade from an already prepared core forces toolmakers to visualize its shape in advance, Brooks says.

The team also found chunks of black rock and pieces of red ochre that had been punctured by sharp stone chisels. They propose both were used as pigments to create marks of individual or group identity, suggesting a high degree of social organization.

Expanded social networks are "a key unique feature of modern humans," says archaeologist Curtis Marean of Arizona State University in Tempe, although he suspects there will be some debate about the evidence for long-distance networks, noting that most of the stone came from just 25 to 50 kilometers from the site.

By combining artifacts with environmental data, the papers help explain what drove the MSA, says archaeologist Shannon McPherron of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. "They were able to use the long time-sequence at Olorgesailie to demonstrate how changes in the environment and the fauna correspond to the shift to the MSA."

But these MSA toolmakers hadn't developed the full package of sophisticated behavior, Dunbar cautions. "It's at the bottom of the scale of modern behavior," he says. "We're not talking about Salvador Dalí." ■

PHOTO: REUTERS/STRINGER

INFECTIOUS DISEASE

Nigeria hit by unprecedented Lassa fever outbreak

As efforts to contain it mount, researchers are racing to find out what is driving this year's surge in cases and deaths

By **Leslie Roberts**

By early January, it was clear something "really, really extraordinary" was going on in Nigeria, says Lorenzo Pomarico of the Alliance for International Medical Action (ALIMA). Cases of Lassa fever, a rare viral hemorrhagic disease, were skyrocketing across the country—more were recorded in the first 2 months of 2018 than in any previous year. Unprepared for a disease that has no vaccines or drugs and kills 20% to 30% of those it sickens, eight health care workers were infected early on and three died. "Something was going very wrong with the outbreak," Pomarico says.

Since then, the situation has only gotten worse. The rodent-borne disease is endemic in Nigeria and several other West African countries, fluctuating with the seasons and usually causing "a trickle" of cases a year, says Chikwe Ihekweazu, who heads the Nigeria Centre for Disease Control in Abuja. But as of 11 March, 365 cases and 114 deaths had been confirmed across 19 states, with many more suspected. Ihekweazu says the record-setting figures are sure to be underestimates, because the disease is maddeningly hard to diagnose, and many cases go unreported.

Already, Nigeria's fragile health care system is overwhelmed. The one dedicated Lassa fever ward in the country at Irrua Specialist Teaching Hospital in Edo state has just 24 beds. Without access to proper training and personal protective equipment, health care workers continue to become infected—by now 16 cases have been reported, with one additional death.

As the government and its international partners scramble to set up isolation wards and deliver protective gear to health workers, researchers on three continents are racing to figure out what is driving the unprecedented outbreak. Is it simply better disease surveillance in the wake of Ebola, the similar but more deadly disease that began its rampage across West Africa in 2014? Has the virus changed in some way? Are there more of the rats that carry it, or are more of them infected? Or is another rodent capable of spreading the virus as well?

"There are lots of possible explanations," says Stephan Günther, who heads the virology department at the Bernhard Nocht Institute of Tropical Medicine in Hamburg, Germany, and whose team has long collaborated with Nigerian researchers. Considering how lethal Lassa fever is, shockingly little is known about it, he says. "We don't

This year, the rats that carry Lassa fever may be more numerous, or more likely to harbor the virus.

know why people die. We don't know about the pathophysiology of the disease. We don't know the point of no return."

That could be beginning to change. In 2016, the World Health Organization added Lassa fever to its new list of priority pathogens of epidemic potential, calling for more research. And last week, the recently created Coalition for Epidemic Preparedness Innovations, known as CEPI, awarded its first grant for development of a Lassa fever vaccine to Themis Bioscience in Vienna.

Lassa fever was discovered in 1969, when two missionary nurses died of a mysterious disease in the remote town of Lassa in Borno state in northeastern Nigeria. When a third nurse fell ill, she was evacuated to a hospital in New York City—along with a thermos full of blood and other samples from all three nurses, bound for Yale University's then-new Arbovirus Research Unit. There, a team led by Jordi Casals-Ariet isolated a novel virus from the samples. (He, too, almost died in the process, saved only by an infusion of antibody-rich plasma from the third nurse, who recovered.)

The cause is now known to be an arenavirus, one of a class of rodent-borne pathogens. Its natural reservoir is a multimammate rat, so-called for its rows of mammary glands, that is ubiquitous across West Africa. Cases peak in the dry season, when farmers burn the bushes in preparation for spring planting and rats scurry into houses in search of food. The rodents shed the virus in their urine and droppings, and people contract it by touching contaminated surfaces, inhaling viral particles, or eating contaminated food (including the rats). Like Ebola, the virus can also be spread through contact with bodily fluids from an infected person. Such human-to-human transmission is thought to be rare for Lassa, unlike Ebola, except in hospital settings without proper infection control. However, "The real rate of human-to-human transmission is unknown," says Augustin Augier, secretary general of ALIMA in Paris, which has just launched a Lassa fever research program with the French medical institution INSERM.

No one knows the true incidence of the disease. "Most cases we have found are in places where there are hospitals and labs," Günther says. "There is good reason to assume there are cases that are being overlooked." And because the rat vector lives across a broad swath of the continent, the disease might also be endemic, but unrecognized, outside of West Africa, where it could be responsible for undiagnosed fevers.

Initial symptoms are easily mistaken for malaria or typhoid fever—body aches, sore throat, fever, nausea, diarrhea—before the disease progresses to organ failure, shock, and sometimes internal hemorrhaging. By the time doctors suspect Lassa fever, it's often too late to save the patient. There is no rapid test; accurately diagnosing the disease requires a real-time polymerase chain reaction technique, but just three labs in Nigeria have that capability.

For now, the only treatment is a nonspecific antiviral drug, ribavirin. If it's administered during the first 6 days of the illness, it seems to improve a patient's prognosis, but "no one arrives before day 7," Augier says. Nor is everyone convinced that ribavirin works in Lassa fever, as the only data come from the 1980s, Augier says.

Several potential drugs are on the horizon, in addition to the vaccine. Christian Happi at Redeemer's University in Ede, Nigeria, and the Irrua Specialist Teaching Hospital is developing a rapid diagnostic test with colleagues at Tulane University in New Orleans, Louisiana; the Broad Institute in Cambridge, Massachusetts; and Zalgen, a company in Germantown, Maryland. Happi's group and its partners are also sequencing the virus "around the clock," he says, and trying to figure out whether the genetic changes they have seen could have made it more transmissible or virulent.

> ***"I used to scream and scream that Lassa is important, but no one listened. ... Lassa fever is a disease of the poor."***
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> **Christian Happi**, Redeemer's University

For Happi, who diagnosed Sierra Leone's first case of Ebola, the new attention to Lassa hasn't come a moment too soon. "I used to scream and scream that Lassa is important, but no one listened," he says. "I wrote so many grants" that were turned down. "Lassa fever is a disease of the poor ... it is confined to a part of West Africa, and it is not viewed as a global threat."

As research scales up, the government and its partners are focusing on training health care workers and providing the basics needed for infection control, as well as educating a frightened public about safety precautions.

Pomarico, who is leading ALIMA's emergency response to the outbreak in the two hardest hit states of Edo and Ondo, hopes cases will subside with the rains and cooler weather, as they usually do. "But this year is different. We are bracing for worst and preparing for the worst." ■

QUANTUM PHYSICS

Vibrations used to talk to quantum circuits

Sound waves could supplant microwaves in controlling quantum computers

By **Adrian Cho**, *in Los Angeles, California*

For the moment, microwave photons are the keys to many quantum computers: Physicists use them to program, read out, and otherwise manipulate the machines' quantum bits. But microwave technology is bulky, and its quantum states don't last very long. Now, several groups are exploring a new way to talk to a quantum computer: with tiny vibrations, normally carriers of pesky heat and noise.

The budding discipline of quantum acoustics could shake up embryonic quantum computers by miniaturizing technologies and producing longer-lasting quantum memories. "We're right on the cusp" of controlling quantum vibrations, says Andrew Cleland, a physicist at the University of Chicago in Illinois, whose group presented its latest work last week here at the annual March meeting of the American Physical Society.

Whereas an ordinary computer flips bits that can be set to either zero or one, a quantum computer uses qubits that can be set to zero, one, or, bizarrely, zero and one at the same time—potentially enabling huge boosts in speed. Companies such as Google and IBM are racing to demonstrate the superiority of quantum computers for certain tasks (*Science*, 2 December 2016, p. 1090), and many are betting on qubits made of superconducting metal circuits on chips.

To control or read out a superconducting qubit, researchers make it interact with a microwave resonator—typically a strip of metal on the qubit chip or a finger-size cavity surrounding it—which rings with microwave photons the way an organ pipe rings with sound. By adjusting the energy of the qubit, researchers can shuttle its quantum states into the resonator, so that a zero-and-one state of the qubit can be stored as a state of the resonator in which a photon is both present and absent. But some physicists

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