

► seismologists because it followed a ‘strike-slip’ tremor, in which continental plates move horizontally. Such quakes should trigger small tsunamis; large waves usually result only when tectonic plates move up and down.

UNCONVENTIONAL EVIDENCE

Many tsunami researchers suspected that the quake had triggered a submarine landslide in Palu Bay, causing the tsunami. But with limited scientific data available, geophysicist Haase and her team went hunting for another source of information.

“We started looking at different social-media platforms like YouTube, Twitter, Facebook, Instagram,” says Matías Carvajal, a seismologist at the Millennium Nucleus the Seismic Cycle along Subduction Zones, a research collaboration between several universities in Chile. He found 38 amateur video and surveillance clips of the tsunami. Where possible, the team pinpointed the location of the videos on a map and synchronized them. This allowed the researchers to reconstruct how the tsunami had moved through Palu Bay.

The reconstruction shows that the tsunami inundation occurred only a few minutes after the earthquake shaking, and that successive waves came just 1–2 minutes apart. This suggests that the source was close to the shore, which is indicative of a submarine landslide, says Carvajal. The team published its findings last month (M. Carvajal *et al.* *Geophys. Res. Lett.* <http://doi.org/c53c>; 2019).

Carvajal’s use of “unconventional evidence” to determine how the tsunami behaved is useful because few local data are available for this event, says Anne Socquet, a seismologist at the University of Grenoble in France, who has studied the event. This is because Indonesia has few research buoys or tide gauges.

The study offers a significant piece of evidence to support the idea that submarine landslides caused the tsunami, says Purna Sulastya Putra, a tsunami specialist at the Indonesian Institute of Sciences in Bandung.

The results suggest that tsunami warning systems need to be modified to detect landslide-triggered events, says Ignacio Sepúlveda at the Scripps Institution of Oceanography, a co-author on the study. Tsunami warning systems are typically triggered by seismometers and then verified using recorded changes in sea level.

“If you’re on a coastline and feel severe shaking, run for high ground.”

But most systems only record long-period waves that displace buoys and tide gauges for several minutes. Indonesia’s systems, like most, aren’t designed to detect landslide-triggered tsunamis with shorter periods.

The Indonesian geophysics agency that issues warnings was widely criticized because it cancelled the Palu tsunami alert half an hour after it was issued. The one tide gauge in Palu Bay that the tsunami passed through didn’t

pick up the huge waves, says Carvajal.

Accounting for the risk of marine landslides is also difficult because there are no detailed maps of the Indonesian sea bed that could be used to pinpoint areas of loose sediment, says Putra. Coastal engineer Mohammad Heidarzadeh at Brunel University London is leading an effort to map the sea bed off Indonesia over the next three years, with the goal of forecasting tsunamis more accurately.

RISK MANAGEMENT

But even with maps, tsunamis triggered by landslides are particularly hard to predict because they usually affect a relatively small area compared with quake-triggered events, says Abdul Muhari at the Ministry of Marine Affairs and Fisheries in Jakarta. He suggests focusing on places that have experienced landslides before.

And Mika McKinnon, an independent disaster researcher in Vancouver, Canada, questions whether improved warning systems are the answer for landslide-triggered tsunamis. The best way to save lives is to ensure that people know what to do during a disaster, she says. Tsunami warning systems are useful for places far from the earthquake epicentre, where the wave is minutes away. But when the quake is closer to shore, as in Palu, the tremor itself is the warning, she says, because even an advanced warning system is unlikely to get an alert out in time. “If you’re on a coastline and feel severe shaking, run for high ground.” ■

VIROLOGY

How baby’s first flu shapes the immune system

Two wide-ranging studies will follow children for years to monitor how their first influenza infection affects their natural immunity and vaccine response.

BY DECLAN BUTLER

The US National Institute of Allergy and Infectious Diseases (NIAID) has awarded two major grants to fund the first large-scale, long-term studies of how infants’ first exposures to influenza shape their immune systems. Researchers will follow the children for several years to decipher how these early imprints affect an individual’s ability to fight off different strains later in life.

The work could also help to explain why a flu vaccine administered in any given year might work well in one person but not in another, and whether a child is better protected if their first

encounter is with a wild virus, rather than the weakened forms found in vaccines. It will also feed into efforts to develop a universal flu vaccine that could offer lifelong protection against most seasonal strains.

Paul Thomas, an immunologist at St. Jude Children’s Research Hospital in Memphis, Tennessee, and Aubree Gordon, an epidemiologist at the University of Michigan in Ann Arbor, lead a consortium that will share a 7-year, US\$35-million grant. Their team will establish infant cohorts — groups to be followed long-term — in Nicaragua, in Los Angeles, California, and in Wellington, New Zealand, with a total of 2,200–3,500 children.

A second 7-year award, of \$31 million, went to a group led by Mary Allen Staat, an epidemiologist at Cincinnati Children’s Hospital Medical Center in Ohio. Her team will establish cohorts in Mexico City and in Cincinnati, totalling around 1,080 infants.

Influenza viruses are constantly mutating, and a new vaccine has to be developed and administered afresh with each flu season. Current vaccines are not very effective, and the protection they offer fades within months.

But the strains to which individuals were first exposed in childhood influence how they respond in a given flu season. This imprinting confers protection for life from closely related strains, and also makes people more responsive

ISTOCK/GETTY to vaccines for similar strains.

How this works is unclear, however. “While it is well accepted that imprinting happens, the mechanisms that govern it essentially remain a black box,” says Matthew Miller, who works on flu immunology at McMaster University in Hamilton, Canada.

The researchers running the cohort studies will take blood and other samples from the infants periodically. Using recently developed technologies that sort single cells from samples, they will sequence RNA from individual immune-system cells to track patterns of gene activity over time and in response to flu exposures. These techniques allow researchers to profile entire repertoires of immune cells and other components of the immune system at depths impossible until now.

The scientists will be able to analyse samples taken from individual infants over years — including before and after the initial imprinting events, during later flu infections and convalescence, and before and after flu vaccinations.

Thomas expects the study to generate models of how children’s immune systems respond to flu infections and vaccinations, depending



Early influenza infections shape a child’s immunity to later strains of the virus.

on their history. “The impact of this work is potentially enormous,” says Miller. The two consortia have begun talks to see how they might best work together. “It is my hope that

there will be a great deal of collaboration and complimentary expertise that will improve upon what both groups have proposed,” says Staat. ■

SEXUAL HARASSMENT

NIH critics want stronger action

US biomedical agency is reworking its policies on harassment.

BY SARA REARDON

The women came to the podium one by one to recount how they had been sexually harassed by their graduate-school advisers, senior scientists or other colleagues. Many said they had left science to escape retaliation and feelings of powerlessness after struggling to find anyone who would believe them.

Francis Collins, director of the US National Institutes of Health (NIH), sat metres away, in the front row. He organized the 16 May meeting at the NIH campus in Bethesda, Maryland, as part of his agency’s ongoing effort to revise its policies for addressing sexual harassment by the scientists whose work it funds.

The NIH has come under fire in recent years for moving too slowly to address harassment by its grant recipients. Another major US government research agency, the National Science Foundation, last year began to require research institutions to notify it when they put a principal investigator (PI) or co-PI of

an agency-supported project on leave during a sexual-harassment investigation, or when people in those roles are disciplined. But the NIH requires institutions to report only if a person working on a project it supports has been taken off a grant or fired, and it does not require them to give a reason.

“To the NIH, as long as you continue to fund the harassers, you are part of the problem,” said one speaker, Alysha Dicke, to applause.

Some of the women who addressed the meeting said they had quit academia because they were frustrated with the culture. Others left because their former mentors and departments refused to write letters of recommendation for them after they reported that they had been harassed.

“There are a lot of people who should be in this room who aren’t,” said BethAnn McLaughlin, a neuroscientist at Vanderbilt University in Nashville, Tennessee, who has pushed the NIH to reform its sexual-harassment policies.

McLaughlin asked the packed auditorium, which included a number of top NIH officials,

to remain silent for 47 seconds — one for each year since the passage of Title IX, the US statute that provides a legal basis for combating sexual harassment in academia. The system that the law sets out to address harassment in education is ineffective, she said, because it allows universities to police themselves. “The NIH is failing us,” McLaughlin added.

Sonia Flores, vice-chair of diversity and justice at the University of Colorado Denver and a member of the NIH’s working group on sexual harassment, says it is clear that people want action. “The working group will make recommendations that have implementation and teeth,” she says, including a timeline for the agency to implement specific reforms. “The NIH has the power of the purse. That’s the only way institutions listen.”

NEXT STEPS

In February, the NIH announced that — for the first time — it had taken disciplinary action against people found to have committed sexual harassment. The agency replaced 14 PIs on its grants and banned 14 from participating in peer-review panels. It also said that 21 PIs had been disciplined or fired by their employers.

February also marked the first meeting of the NIH’s harassment working group. The panel will present its interim recommendations to Collins in June.

At the listening session, NIH principal deputy director Lawrence Tabak apologized to the women who had spoken about their experiences with harassment. “Thank you for holding us accountable,” he said. “We can do better, we must do better and we will do better.” ■