A pilot malaria-vaccination programme began in Malawi on 23 April.

AMOS GUMULIRA/AFP/GETTY

Army Institute of Research in Silver Spring, Maryland, began testing the RTS,S vaccine in 1987, they quickly recognized how hard it would be to target the malaria parasite. Unlike viruses and bacteria, *Plasmodium falciparum* changes shape in the human body, which makes it hard for attacking proteins triggered by the vaccine to recognize the parasite.

Over the next three decades, GSK and the Bill & Melinda Gates Foundation in Seattle, Washington, supported development of the vaccine — at a cost of $700 million. The effort culminated in 2015, when a 15,000-person clinical trial found[1] that giving 4 doses of RTS,S over 18 months cut the number of malaria episodes that young children experienced by 36%.

But data from an earlier trial suggest that that partial protection fades over several years[2]. And a deep dive into data from the 2015 trial revealed that girls who had received the RTS,S vaccine were slightly more likely than those who weren't vaccinated to die from all causes — including severe malaria[3]. At the same time, Tibenderana says, officials at malaria-control agencies in Africa worried about how to afford a multi-dose vaccine when they already struggle to deploy bed nets and drugs to treat the infection.

Mindful of such concerns, the WHO recommended in 2015 that the RTS,S vaccine be rolled out in phases, to identify any safety issues and to determine the feasibility of wider distribution. In 2016, three non-profit health groups — the Global Fund to Fight AIDS, Tuberculosis and Malaria, the vaccine alliance Gavi, and Unitaid — agreed to fund a pilot programme for four years, at a cost of $52 million.

Mary Hamel, a medical epidemiologist at the WHO in Geneva, Switzerland, says that researchers will compare the health of vaccinated children in Malawi, Ghana and Kenya with that of unvaccinated kids in neighbouring regions. "We will be watching for imbalances in deaths, severe malaria and meningitis," she says. The WHO's models suggest that one life will be saved for every 200 children who are immunized.

That means the pilot could save thousands of people. But Sabra Klein, a public-health researcher at Johns Hopkins University in Baltimore, Maryland, worries that the cause of any safety issues that arise will be hard to identify, because the pilot is not a controlled trial. "We need to address this to improve the science behind our vaccines," she says.

Others, such as Adrian Hill, a vaccine researcher at the Jenner Institute in Oxford, UK, argue that the money for the pilot programme could be better spent on supporting the development of more effective vaccines; Hill is helping to develop a malaria vaccine called R21 that is set to begin phase II trials in Burkina Faso later this year. And some scientists want to re-engineer RTS,S to better defend against the most common strains of malaria parasite in Africa[4].

"Someone needs to take a hard look at how money is being spent," Hill says. "There isn't a very independent entity that can ask if, in the current environment, it's worth putting another $52 million into a vaccine designed in 1987." ■

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2. Olotu, A. *et al. N. Engl. J. Med.* **374**, 2519–2529 (2016).
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ASTROPHYSICS

Black hole possibly ate neutron star

Gravitational-wave detectors spot what might be the first evidence of such an event, as their activity picks up.

BY DAVIDE CASTELVECCHI

The newly upgraded detectors of the LIGO and Virgo gravitational-wave observatories have sent astronomers on a wild ride. Last week, the detectors heard gravitational waves from a merger of two neutron stars for only the second time — creating a frenzy of activity. Just a day later, the observatories made the first possible sighting of a black hole devouring a neutron star. If confirmed, it would be the first evidence that the Universe harbours such binary systems. Observations of their dramatic collisions can produce a wealth of information that no other event could provide, including precise tests of the general theory of relativity and measuring the Universe's rate of expansion.

On 25 April, a train of waves hit one of the two detectors of the Laser Interferometer Gravitational-wave Observatory (LIGO), in Livingston, Louisiana, and the Virgo observatory, near Pisa, Italy. (At the time, LIGO's second machine, in Hanford, Washington, was briefly out of commission.) That event was a clear-cut case of two merging neutron stars, and came nearly two years after the historic discovery of such an event in August 2017. The researchers estimated that the collision occurred some 150 megaparsecs (500 million light years) away, around three times farther than the 2017 merger.

A day later, on 26 April, another train of waves hit both LIGO detectors and Virgo. So far, researchers have performed only a preliminary analysis of that event, but they are considering the tantalizing prospect that they have detected a merger of a black hole and a neutron star.

"I think that the classification is leaning towards neutron star–black hole" merger, says Chad Hanna, a member of LIGO's data-analysis team and a physicist at Pennsylvania State University in University Park. ▶

But the signal for that event was not very strong, which means that it could be a fluke. "I think people should get excited about it, but they should also be aware that the significance is much lower" than in many previous events, he says. LIGO and Virgo have already detected gravitational waves — faint ripples in the fabric of space-time — from two types of cataclysmic event: the mergers of two black holes, and the collision of two neutron stars. The latter are small, ultra-dense objects formed after the collapse of stars more massive than the Sun.

The latest event, provisionally labelled S190426c, seems to have occurred around 375 megaparsecs (1.2 billion light years) away, the LIGO–Virgo team calculated. For both of last week's detections, the researchers also drew 'sky maps', showing where the gravitational waves are most likely to have originated, and sent this information out as public alerts, so that astronomers around the world could begin searching the sky for light from the events. Matching gravitational waves to other forms of radiation in this way can produce much more information about the event than can either form alone.

For both detections, astronomers worldwide raced to make follow-up observations in different wavelengths — a practice known as multimessenger astronomy — but have been unsuccessful so far, perhaps because the events were far away and the signal was too faint.

For the 26 April event, part of the sky map extended over the north polar region, where telescope coverage is poor, making the search more difficult, says Daniel Perley, an astronomer at Liverpool John Moores University, UK, who was involved in the follow-up searches. Another possibility is that the source was hidden behind the Milky Way's 'dustier' regions. As days went by, the odds of finding the source became longer. "The expectations are not too high at this point," Perley says.

If the 26 April event was not a black hole–neutron star merger, it was probably also a collision of neutron stars, which would bring the total detections of this type up to three.

But seeing a black hole sweep up a neutron star could help to answer a host of questions. These long-sought systems are thought to originate from binary stars of very different masses. The orbits the two objects trace in the final phases of their approach could be rather different from those followed by pairs of black holes. In the black hole–neutron star case, the more-massive black hole would twist space around it as it spins. "The neutron star will be swirled around in a spherical orbit rather than a quasi-circular orbit," says B. S. Sathyaprakash, a LIGO theoretical physicist at Pennsylvania State University. This gravitational complexity means "neutron star–black hole systems can be more powerful test beds for general relativity".

Moreover, the gravitational waves and the companion observations from astronomers could reveal what happens in the final phases before such a merger. As tidal forces tear the neutron star apart, they could help astrophysicists to solve a long-standing mystery: what state is matter in inside these ultra-compact objects?

The LIGO–Virgo collaboration began its current observing run on 1 April, and researchers had expected to see roughly one merger of black holes per week and one of neutron stars per month. So far, those predictions have been met — the observatories have also seen several black-hole mergers this month. "This is just amazing," says Mansi Kasliwal, an astrophysicist at the California Institute of Technology in Pasadena who works on follow-up searches. "The Universe is fantastic." ■

HUMAN EVOLUTION

Biggest Denisovan fossil yet spills ancient human's secrets

Jawbone identified using only protein analysis reveals that the species was widespread.

BY MATTHEW WARREN

Scientists have uncovered the most complete remains yet from the mysterious ancient-hominin group known as the Denisovans. The jawbone, discovered high on the Tibetan Plateau and dated to more than 160,000 years ago, is also the first Denisovan specimen found outside the Siberian cave in which the species was discovered a decade ago — confirming suspicions that the hominin was more widespread than the fossil record currently suggests.

The research marks the first time an ancient human has been identified solely through protein analysis. In the absence of usable DNA, scientists examined proteins in the specimen's teeth, raising hope that more fossils could be identified even when DNA is not preserved.

"This is fantastic work," says Katerina Douka, an archaeologist at the Max Planck Institute for the Science of Human History in Jena, Germany, who was not involved in the research. "It tells us that we are looking at the right area".

So far, everything scientists have learnt about Denisovans has come from a handful of teeth and bone fragments from Denisova Cave in Russia's Altai Mountains. But many expected that it was only a matter of time before traces of the group were found elsewhere. Some modern humans in Asia and Oceania carry traces of Denisovan DNA, raising the possibility that the hominin lived far away from Siberia. And some researchers thought that unclassified hominin fossils from China could be Denisovan.

The latest fossil, described in *Nature*[1], consists of half of a lower jaw, with two complete teeth. It was found by a monk in Baishiya Karst

DONGJU ZHANG, LANZHOU UNIV.

A Denisovan jawbone was discovered on the Tibetan Plateau at an altitude of more than 3,000 metres.