To explore the transparent mice, Ertürk's team developed a way to home in on specific cell types, such as neurons or cancer cells. The scientists turned to 'nanobodies': antibodies that are found only in llamas, camels and alpacas, and are one-tenth the size of antibodies in other species.

Nanobodies can be engineered to stick to specific proteins that are found only in one type of cell — while carrying fluorescent green markers to label the chosen cells. And because nanobodies are so small, they can easily pass through tiny blood vessels and into organs.

When the researchers pumped nanobodies into the circulatory systems of dead mice, which carried the molecules throughout the body, they could see individual cells glowing bright green under a microscope.

The technique is the first to make whole animals truly transparent, says Kwanghun Chung, a medical engineer at the Massachusetts Institute of Technology in Cambridge. "I think it's a fantastic technology," he says.

The first experiments with vDISCO have yielded surprising discoveries. One involves mysterious vessels that run between the skull and the brain, which were discovered only in 2015 (ref 2). When a team led by Ruiyao Cai, a neuroscientist in Ertürk's lab, used nanobodies to light up lymphatic vessels in a mouse treated with vDISCO, the vessels in the head glowed green — confirming scientists' suspicions that the structures are part of the system that transports lymph.

"I think it's a fantastic technology."

Cai and Ertürk also used vDISCO to test how severe injuries to the brain and spinal cord affect cells elsewhere in the body. Labelling neurons showed that nerves in a mouse's torso degraded after the animal suffered a traumatic brain injury, even though the nerve cells were far from the injury site. In another case, the scientists spotted immune cells that had rushed to the site of a spinal-cord injury days before a mouse died — and, unexpectedly, into surrounding muscle and lymphatic vessels[3].

The combination of vDISCO and nanobodies is "kind of the direction for the future", says Hiroki Ueda, a biologist at the University of Tokyo.

Ertürk next plans to use vDISCO to trace how viruses, cancer cells and other invaders spread throughout the body. His group is also designing machine-learning approaches to count and assess labelled cells without introducing bias or human error. ■

1. Pan, C. *et al. Nature Meth.* **13**, 859–867 (2016).
2. Louveau, A. *et al. Nature* **523**, 337–341 (2015).
3. Cai, R. *et al.* Preprint at bioRxiv https://doi.org/10.1101/374785 (2018).

The destruction of olive trees infected with a bacterium has caused controversy in Italy.

FABIO SERINO/ROPI VIA ZUMA

ITALY

Deadly olive-tree disease spreads

Measures meant to stop bacterium's expansion across Italy have been delayed multiple times.

BY ALISON ABBOTT

A vicious bacterium devastating Italy's valuable olive groves is still spreading years after it was identified, because of opposition to measures meant to contain the pathogen.

After months of inaction, authorities in the Puglia region have now resumed efforts to track the spread of *Xylella fastidiosa*, which causes a disease called olive quick-decline syndrome (OQDS) that cannot be cured or eradicated.

But scientists say the delays in implementing disease-containment measures — Italy declared a state of emergency over the outbreak in early 2015 — have added to the growing risk that the infection will spread out of the Puglian peninsula, which lies within the heel of Italy's 'boot', and towards olive groves in the country's main landmass.

Quarantine efforts — which environmentalists and farmers have frequently opposed — stopped again most recently in May. In the same month, the European Commission extended the 'certified infection zone' where the disease is present by 20 kilometres.

The delays have been a problem, says plant pathologist Maria Saponari of the Institute for Sustainable Plant Protection in Bari, Puglia's capital: "The later you detect an infection, the later you can start all the containment actions that are needed."

The budget now allocated by the Puglian government to begin tracking the bacterium again — €1.8 million (US$2 million) — also falls short of what is needed to implement the full set of containment measures agreed to by the Italian government and the European Commission four years ago.

Italy could now face legal consequences for its inaction, after the European Commission made good in May on its longstanding threat to refer the nation to the European Court of Justice for violating its quarantine regulations. If found guilty, Italy could, for example, lose

access to important agricultural subsidies.

The bacterium had never been seen in Europe until 2013, when it was identified in southern Puglia. The outbreak was immediately subjected to stringent European Union quarantine regulations, which were agreed with the Italian government.

The original containment plan dictated that infected trees be uprooted and destroyed, as well as the apparently healthy trees surrounding them. It also required the application of insecticides to control spittlebugs, which transfer the bacteria between trees.

STRONG OPPOSITION

But environmentalists and some farmers have objected to these practices — and some have claimed that the containment measures were based on false science.

Politicians have wavered over whom to please, and protests and court cases have often stopped the activities. Some trees identified as infected through monitoring activities earlier this year remain standing. And in spring, mayors of eight communities in Puglia publicly declared that they would not comply with the insecticide requirement.

The area affected by the bacterium has expanded steadily since 2013. The European Commission's May update on the situation designated the whole of south and central Puglia as an infected zone, and a region to its north as a buffer zone that must be also carefully monitored for new cases of the disease.

Italy's agriculture minister, Gian Marco Centinaio, promised in July to propose a full containment plan within a few months, but has not done so, despite public nudges from EU and Puglian politicians. The agriculture ministry did not respond to *Nature*'s request for comment.

"The later you detect an infection, the later you can start the containment actions that are needed."

Last month, an association of olive growers called Coldiretti Puglia sent the government a list of proposals for the containment plan. The group wants special rules to be put in place to stop regional administrative courts from blocking containment measures. It also suggested tapping into national disaster funds that could be used to support the development of new *Xylella*-resistant olive trees and expand the monitoring programme.

GOVERNMENT HANG-UP

The long-running affair and its handling are now being dissected in Italy's parliament. In June, some parliamentarians formally deposited documents at the Senate, one of Italy's two houses of parliament, which challenged the scientific evidence on which *Xylella* management plans have been based. It also called for a Senate inquiry into whether scientists have misled the public. An independent analysis commissioned by the national science academy, the Accademia dei Lincei, repudiated these claims the following month in an article (see go.nature.com/2t5xiai). The Senate has not yet acted on the call for an inquiry.

The proposal has fortunately not been carried forward, says Michele Morgante, a plant geneticist at the University of Udine in Italy. Still, he says, it is disturbing that the anti-science activities have received attention at such a high political level.

Meanwhile, in a series of hearings launched independently in September by the Chamber of Deputies — Italy's second house — parliamentarians have interviewed scientists, olive producers and other stakeholders about the *Xylella* outbreak and what could be done about it; hearings are scheduled to continue into next month.

Morgante welcomes the hearings — but says they have come too late: "It is good that parliament [the Chamber of Deputies] finally wants to listen to scientists, but they should have paid attention much earlier when it would have been easier to control," he says. ■