to enrol all participants by 2018.

Certain factors make researchers optimistic that the British study will succeed where the US one failed. One is the National Health Service, which provides care for almost all pregnant women and their children in the United Kingdom, and so offers a centralized means of recruiting, tracing and collecting medical information on study participants.

In the United States, by contrast, medical care is provided by a patchwork of different providers. "I think that most researchers in the US recognize that our way of doing population-based research here is simply different from the way things can be done in the UK and in Europe, and it will almost always be more expensive here," says Mark Klebanoff, a paediatric epidemiologist at Nationwide Children's Hospital in Columbus, Ohio, who was involved in early discussions about the US study.

At one stage, US researchers had planned to knock on doors of random houses looking for women to enrol before they were even pregnant. "It became obvious that that wasn't going to be a winning formula," says Philip Pizzo, a paediatrician at Stanford University in Palo Alto, California, who co-chaired the working group that concluded that the National Children's Study was not feasible. "The very notion that someone was going to show up on your doorstep as a representative from a government-funded study and say 'Are you thinking of getting pregnant?' was not so attractive sociologically."

Researchers involved in the UK study say that they hope to learn from the challenges faced by their US counterparts — they have a clear study design and recruitment strategy — and that they are keen to collaborate internationally. The major concern is whether enough interested parents will sign up, something that will become apparent only in the next few months. "It's the known unknown," says Dezateux.

US researchers mourn the demise of their study. "We have now lost the opportunity to remain at the forefront of this field, and to collect the crucial life-course data," says Ezra Susser, an epidemiologist at Columbia University in New York City. But starting a study that lasts a lifetime comes with particular challenges wherever it is done, says Pizzo. For instance, about one-third of the children in the UK study are expected to live to 100. The scientists designing the study will be long dead by then, and can only hope that the information they collect will still be useful. "The responsibility of getting it right will be enormously significant," says Pizzo. "If you think of what's happened in the last decade — in terms of social media, how we connect, the insights around basic biology — 100 years from now, it's almost imponderable to think where knowledge is going to be." ■

The Francis Crick Institute sits at the nexus of three central London railway hubs.

LAING O'ROURKE/FRANCIS CRICK INST.

URBAN SCIENCE

Biology powerhouse raises railway alarm

Central London's Francis Crick Institute fears that proposed train line will disrupt delicate science experiments.

BY DANIEL CRESSEY

A landmark addition to London's science scene is on a collision course with the expansion of the city's transport system. The Francis Crick Institute warns that vibrations and electromagnetic fields generated by Crossrail 2, a proposed railway line that would skirt the institute, could interfere with scientific work there. The teams behind both efforts are now seeking a solution.

Set to employ 1,250 scientists and to have an annual budget of more than £100 million (US$154 million), the Crick, as it is known, is destined to become one of Europe's medical-science powerhouses. Construction is due to be completed in November. The warnings about Crossrail 2 first emerged from the UK Medical Research Council (MRC), which provided the lion's share of the Crick's construction budget and will move staff from its National Institute of Medical Research (NIMR), in another part of London, to the new facility.

In public documents submitted to a UK parliamentary committee and discussed at the MRC over the past year, the council warned of "potentially serious consequences for operation of sensitive scientific equipment" if Crossrail 2 goes ahead, and said that "expensive remediation works" might be required.

The Crick has now sounded its own warning in a statement to *Nature*: "The Crossrail 2 trains stopping and starting at the proposed station would have an electromagnetic impact on our imaging facilities." The imaging equipment — which includes nuclear magnetic resonance spectrometers, electron microscopes and super-resolution microscopes — will support "a significant component" of research at the building, says the Crick.

When the institute was first proposed, some scientists at the NIMR raised concerns about interference from multiple railway lines that already surround the site (see 'Science in the city'). MRC chief executive John Savill says that the Crick's design "fully took into account" vibration, noise and electromagnetic interference from these; the Crick team says that it deliberately located its imaging facilities away from the major Thameslink line. But in 2013, Crossrail 2's proposed route was modified to allow the line to connect with Euston station, which, says the Crick, would place the railway too close to the imaging facilities.

The government will decide next month whether to use the proposed route in the next stage of planning; the Crossrail 2 team hopes to start construction in 2020 at the earliest.

"The Department for Transport has given assurances that the route selected will

not impede any research activities due to interference from railway operations or construction works," says Savill. Transport for London (TfL), the local government organization that is driving the Crossrail 2 plans, says that it takes the concerns "very seriously". The MRC is now working with TfL to find a solution.

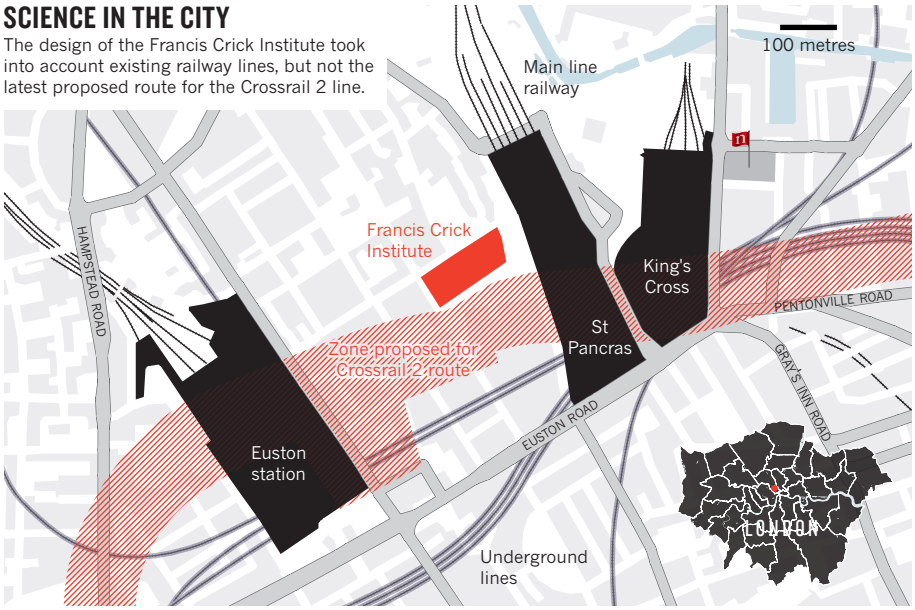
The Crick team would like Crossrail 2 to be diverted back to its former route, away from the institute. But Michèle Dix, managing director for Crossrail 2, says that plans have already changed because of concerns from the Crick. Among other things, the planned tunnel has been shifted farther underground. "You can't just keep on moving it deeper and deeper," she says, adding that further concerns should be addressed through engineering — for example by making the tunnel linings thicker.

Daniel Moylan, a TfL board member and a transport adviser to London mayor Boris Johnson, says that the mayor is a huge supporter of both Crossrail 2 and the Crick. The latter is a major element in Johnson's plans to promote the capital as 'MedCity' — a global hub for life-sciences research. Moylan is confident that the institute's "legitimate" concerns can be allayed by means of technical solutions.

Objections from Parisian academics in the first half of the twentieth century are said to have affected the route of the Métro, but there have also been more-modern conflicts between scientific equipment and transport infrastructure.

SCIENCE IN THE CITY

The design of the Francis Crick Institute took into account existing railway lines, but not the latest proposed route for the Crossrail 2 line.



In 2013, the proposed route of a US light-rail line was diverted after concerns from the University of Colorado Denver about the effects on spectroscopy and microscopes at its medical campus in Aurora. In 2011, the University of Maryland in College Park dropped its opposition to a new 'Purple Line' link to the Washington DC Metro once the local transportation agency agreed to bury and shield power lines.

Other labs have depended on engineering solutions. The New York Structural Biology Center, located near a number of subway lines, placed its most sensitive equipment on concrete slabs attached directly to Manhattan bedrock. It experiences no problems from vibration now, says executive director Willa Appel. If there is no solution in London for the Crick, Appel says, "tell them they're welcome to come here". ■

ARTIFICIAL INTELLIGENCE

DeepMind algorithm beats people at classic video games

Computer that learns from experience provides a way to investigate human intelligence.

BY ELIZABETH GIBNEY

DeepMind, the Google-owned artificial-intelligence company, has revealed how it created a single computer algorithm that can learn how to play 49 different arcade games, including the 1970s classics *Pong* and *Space Invaders*. In more than half of those games, the computer became skilled enough to beat a professional human player.

The algorithm — which has generated a buzz since publication of a preliminary version in 2013 (V. Mnih *et al.* Preprint at http://arxiv.org/abs/1312.5602; 2013) — is the first artificial-intelligence (AI) system that can learn a variety of tasks from scratch given only the same, minimal starting information. "The fact that you have one system that can learn several games, without any tweaking from game to game, is surprising and pretty impressive," says Nathan Sprague, a machine-learning scientist at James Madison University in Harrisonburg, Virginia.

DeepMind, which is based in London, says that the brain-inspired system could also provide insights into human intelligence. "Neuroscientists are studying intelligence and decision-making, and here's a very clean test bed for those ideas," says Demis Hassabis, co-founder of DeepMind. He and his colleagues describe the gaming algorithm in a paper published this week (V. Mnih *et al. Nature* **518,** 529–533 (2015); see also News & Views on page 486).

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For a video that peeks inside the offices of DeepMind: go.nature.com/2kqata

Games are to AI researchers what fruit flies are to biology — a stripped-back system in which to test theories, says Richard Sutton, a computer scientist who studies reinforcement learning at the University of Alberta in Edmonton, Canada. "Understanding the mind is an incredibly difficult problem, but games allow you to break it down into parts that you can study," he says. But so far, most human-beating computers — such as IBM's Deep Blue, which beat chess world champion Garry Kasparov in 1997, and the recently unveiled algorithm that plays Texas Hold 'Em poker essentially perfectly (see *Nature* http://doi.org/2dw; 2015) — excel at only one game.

DeepMind's versatility comes from joining two types of machine learning — an achievement that Sutton calls "a big deal". The first, called deep learning, uses a brain-inspired