

► spotted in Kentucky in 2011, but vigorous surveillance helped to stop it spreading in the United States.

In South America, the disease tends to take hold in hot and humid spells. Such conditions are present in Bangladesh, and the disease could migrate across south and southeast Asia, say plant pathologists. In particular, it could spread over the Indo-Gangetic Plain through Bangladesh, northern India and eastern Pakistan, warn scientists at the Bangladesh Agricultural Research Institute (BARI) in Nashipur.

Bangladeshi officials are burning government-owned wheat fields to contain the fungus, and telling farmers not to sow seeds from infected plots. The BARI hopes to identify wheat varieties that are more tolerant of the fungus and agricultural practices that can keep it at bay, such as crop rotation and seed treatment.

It is unknown how wheat blast got to Bangladesh. One possibility is that a wheat-infecting strain was brought in from South America, says Nick Talbot, a plant pathologist at the University of Exeter, UK. Another is that an *M. oryzae* strain that infects south Asian grasses somehow jumped to wheat, perhaps triggered by an environmental shift: that is what happened in Kentucky, when a rye-grass strain infected wheat.

To tackle the question, this month Kamoun's lab sequenced a fungus sample from Bangladesh. The strain seems to be related to those that infect wheat in South America, says Kamoun, but data from other wheat-infecting strains and strains that plague other grasses are needed to pinpoint the outbreak's origins conclusively.

The Open Wheat Blast website might help. Kamoun has uploaded the Bangladeshi data, and Talbot has deposited *M. oryzae* sequences from wheat in Brazil. Talbot hopes that widely accessible genome data could help to combat the outbreak. Researchers could use them to screen seeds for infection or identify wild grasses that can transmit the fungus to wheat fields.

Rapid data sharing is becoming more common in health emergencies, such as the outbreak of Zika virus in the Americas. Kamoun and Talbot say that their field should follow suit. "The plant-pathology community has a responsibility to allow data to be used to combat diseases that are happening now, and not worry too much about whether they may or may not get a *Nature* paper out of it," says Talbot.

Last month, Valent's team reported the first gene variant known to confer wheat-blast resistance (C. D. Cruz *et al.* *Crop Sci.* <http://doi.org/bfk7>; 2016), and field trials of crops that bear the resistance gene variant have begun in South America. But plant pathologists say that finding one variant is not enough: wheat strains must be bred with multiple genes for resistance, to stop *M. oryzae* quickly overcoming their defences.

The work could help in the Asian crisis, says Talbot. "What I would hope for out of this sorry situation," he says, "is that there will be a bigger international effort to identify resistance genes." ■



Robin Li, head of China's web giant Baidu, unveils the firm's intelligent digital assistant, Duer.

ARTIFICIAL INTELLIGENCE

AI firms lure academics

Shift to industry sparks excitement — and some concern.

BY ELIZABETH GIBNEY

When Andrew Ng joined Google from Stanford University in 2011, he was among a trickle of artificial-intelligence (AI) experts in academia taking up roles in industry.

Five years later, demand for expertise in AI is booming — and a torrent of researchers is following Ng's lead. The laboratories of tech titans Google, Microsoft, Facebook, IBM and Baidu (China's web-services giant) are stuffed with ex-university scientists, drawn to private firms' superior computing resources and salaries. "Some people in academia blame me for starting part of this," says Ng, who in 2014 moved again to become chief scientist at Baidu, working at the company's research lab in California's Silicon Valley.

Many scientists say that the intense corporate interest is a boon to AI — bringing vast engineering resources to the field, demonstrating its real-world relevance and attracting eager students. But some are concerned about the more subtle impacts of the industrial migration, which leaves universities temporarily devoid of top talent, and could ultimately sway the field towards commercial endeavours at the expense of fundamental research.

Private firms are investing heavily in AI — and in particular in an AI technique called deep learning — because of its promise to glean understanding from huge amounts of data. Sophisticated AI systems might be able to create effective digital personal assistants, control self-driving cars, or take on a host of other tasks that are too complex for conventional programming. And corporate labs' resources allow progress that might not be possible in academic departments, says Geoffrey Hinton, a deep-learning pioneer at the University of Toronto in Canada who took up a post at Google in 2013. The fields of speech and image recognition, for instance, had been held up for years by a lack of data to use in training algorithms and a shortage of hardware, he says — bottlenecks that he was able to get past at Google.

"AI is so hot right now. There are so many opportunities and so few people to work on them," says Ng, who says he was attracted by Google's reams of data and computing power, and its ability to tackle real-world problems. Another temptation is that private firms can offer "astronomical" wages, says Tara Sinclair, chief economist at Indeed, a firm headquartered in Austin, Texas, that aggregates online job listings and has chronicled a rising demand for jobs in AI in Britain and the United States.

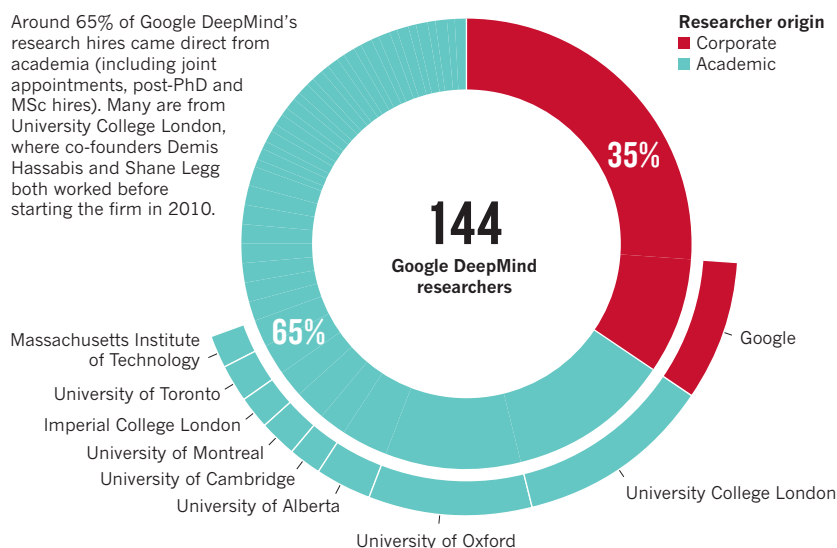
The excitement shows that AI is at a point at

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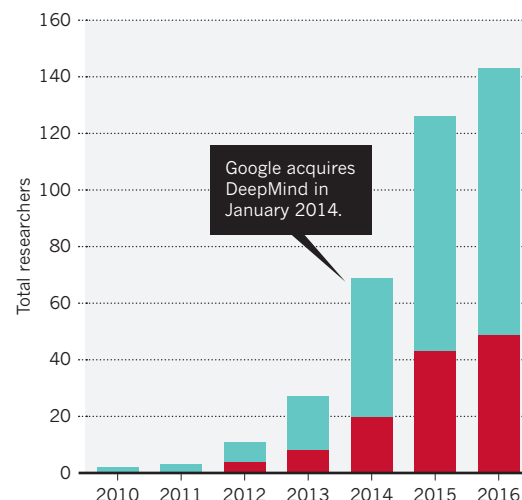
GOOGLE DEEPMIND'S TALENT GRAB

Google DeepMind, an artificial-intelligence firm in London, has embarked on a hiring spree since 2014. Its staff declined to discuss the migration of AI talent, but data gathered by Nature suggest that the firm's current roster includes at least 144 researchers — almost two-thirds of them drawn from universities.

Around 65% of Google DeepMind's research hires came direct from academia (including joint appointments, post-PhD and MSc hires). Many are from University College London, where co-founders Demis Hassabis and Shane Legg both worked before starting the firm in 2010.



Cumulative growth in Google DeepMind research staff.



Data collated by Nature from online sources including Scopus, LinkedIn, Google Scholar and personal webpages. 'Researchers' excludes most software engineers and developers, and all administrative or other staff. Researchers were identified by title (such as 'research scientist' or 'research engineer') or previous role. Not all institutions shown in breakdown.

which it can achieve real-world impact — and companies are the natural way to make this happen, says Pieter Abbeel, a specialist in AI and deep learning at the University of California, Berkeley. In the 1950s, a similar job migration occurred in semiconductor research, when many of the field's leading figures were poached to become heads of industrial research-and-development labs, says Robert Tijssen, a social scientist at Leiden University in the Netherlands. Moving academics bring expertise while extending their new-found corporate networks back to their former colleagues and students — making the scenario a "classic win-win situation," Tijssen says.

CORPORATE COLLABORATIONS

Herman Herman, director of the US National Robotics Engineering Center based at Carnegie Mellon University in Pittsburgh, Pennsylvania, subscribes to that view. In 2015, car-hailing app Uber, which was collaborating with the centre, hired almost 40 of his 150 researchers, mainly those working on self-driving cars. Reports at the time suggested that the centre was left in crisis, but Herman says this was overblown; the project was one of dozens across Carnegie Mellon's Robotics Institute, which has about 500 faculty members. The move was a chance to bring in new blood, and shortly afterwards, Uber donated US\$5.5 million to support student and faculty fellowships at the institute. Meanwhile, the publicity raised the profile of the centre's work, says Herman — and student applications are up.

The loss of expertise in academia concerns Yoshua Bengio, a computer scientist at the

University of Montreal in Canada, which has also seen a surge in graduate-student applications. If industry-hired faculty members do retain university roles — as Hinton has at the University of Toronto and Ng has at Stanford University in California — they are usually only minor, says Bengio. Losing faculty members reduces the number of students that can be trained, especially at PhD level, adds Abbeel.

Hinton predicts that the shortage in deep-learning experts will be temporary. "The magic of graduate research in universities is something to be protected, and Google recognizes that," he says. Google is currently funding more than 250 academic research projects and dozens of PhD fellowships.

In supplying industry with talent, universities are fulfilling their natural role, says Michael Wooldridge, a computer scientist at the Uni-

"There are so many opportunities and so few people to work on them."

versity of Oxford, UK. And with interest in AI generally booming, he struggles to see a situation in which academia is left deserted. The London-based firm Google DeepMind hired ten researchers from Oxford in 2014 — but Google gave the university a seven-figure financial contribution, and formed a research collaboration (see 'Google DeepMind's talent grab'). Many of the poached staff still hold active teaching positions at the university — giving students opportunities they might otherwise never have had.

Bengio is also concerned about the long-term impacts of corporate domination.

Industry researchers are more secretive, he says. Although scientists in some corporate labs (such as those at Google and Baidu) are still publishing papers and code openly — allowing others to build on their work — Bengio argues that corporate researchers still often avoid discussing their work ahead of publication because they are more likely than academics to have filed for patents. "That makes it more difficult to collaborate," he says.

Some industry insiders are concerned about transparency, too. In December 2015, SpaceX founder Elon Musk was among a group of Silicon Valley investors who launched a non-profit firm called OpenAI in San Francisco, California. With \$1 billion promised by its backers, it aims to develop AI for the public good, sharing its patents and collaborating freely with other institutions.

Although Google, Facebook and the like seem committed for the moment to tackling fundamental questions in AI, Bengio fears that this might not last. "Business tends to be pulled to short-term concerns. It's in the nature of the beast," he says. He cites telecommunications firms Bell Labs and AT&T as examples of companies that had strong research labs, but eventually lost their talent by putting too much emphasis on the short-term objective of making money for the company.

Hinton insists that basic research can thrive in industry. And because of the urgent need for AI research, some of today's expansion in basic research is inevitably taking place at corporate firms, he adds. But academia will still play a crucial part in AI research, he says. "It's the most likely place to get radical new ideas." ■