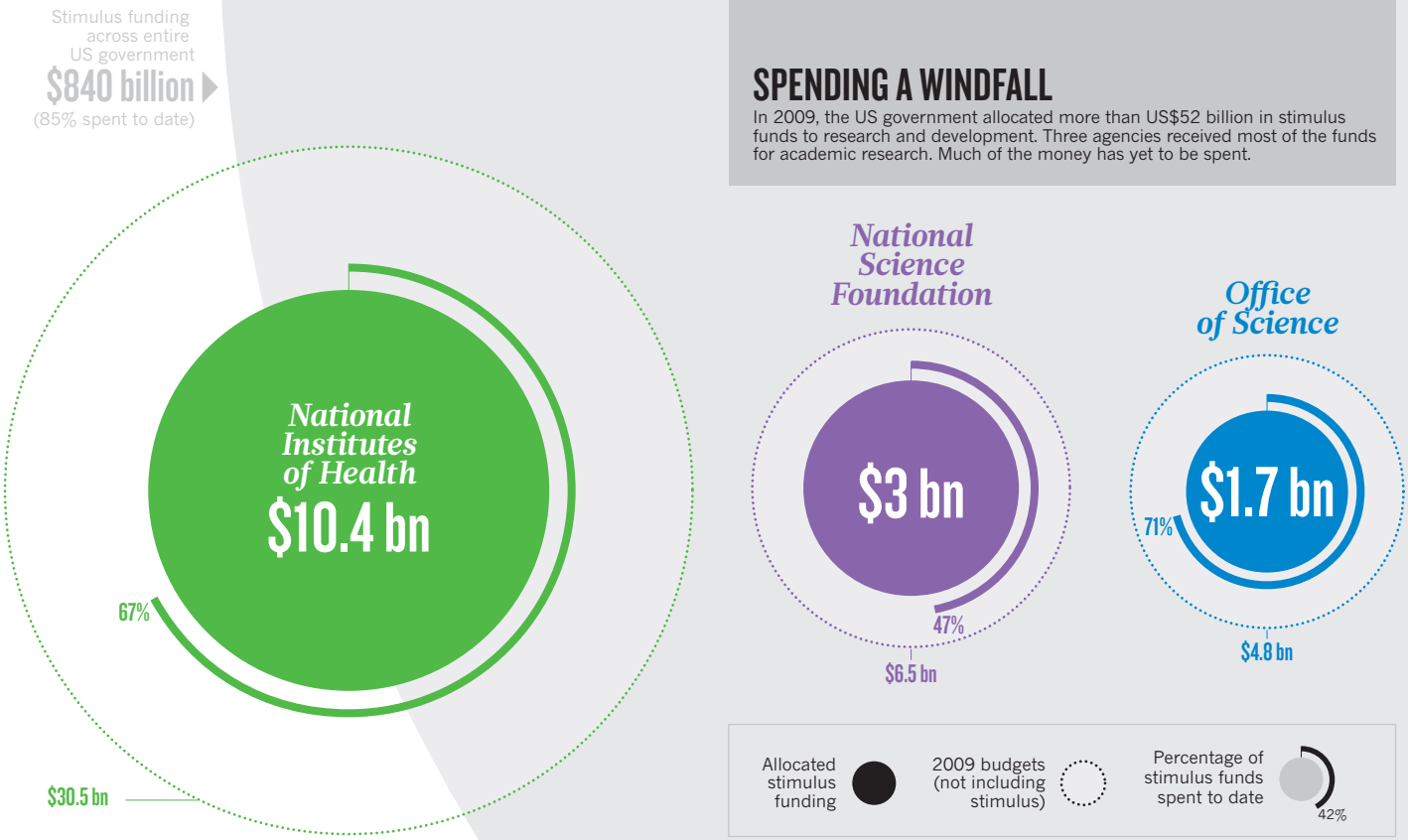

SPENDING A WINDFALL

In 2009, the US government allocated more than US$52 billion in stimulus funds to research and development. Three agencies received most of the funds for academic research. Much of the money has yet to be spent.

STIMULUS–RESPONSE

The United States' 2009 financial stimulus bill has provided research with breathing space, rather than the sharp shot in the arm that many anticipated.

BY COLIN MACILWAIN

When Cathy Lord arrived in New York last month, her US$1.2-million grant was about to run out. The autism researcher had won the funding from the National Institutes of Health (NIH) under the American Recovery and Reinvestment Act (ARRA), better known as the stimulus bill, and the money had helped to support her 15-strong team at the University of Michigan in Ann Arbor for two years.

But the expiry of such a major grant didn't leave Lord's team in the lurch — far from it. The grant was not like a standard NIH award. Instead of paying for experiments to test a hypothesis for publication — something that usually takes at least three years — the money allowed Lord's team to compile its existing knowledge, preparing a kit that other researchers can use to screen people for social and behavioural indicators of autism. In that sense, the grant was more of a bonus than a lifeline. Now, Lord is about to open an autism clinic and research centre at NewYork-Presbyterian Hospital in White Plains, and about half of her team have followed her there. For them, she says, the end of the ARRA money is no different from the usual rough and tumble that results from the coming and going of research grants. "If you find good people you just try and keep the ball rolling," she says.

Such a smooth transition is not what many expected for scientists facing the end of a stimulus grant. When the bill — now estimated to be worth $840 billion — was signed into law by President Barack Obama in February 2009, it contained more than $52 billion for research and development (see 'Spending a windfall'), of which $15 billion was expressly for scientific research at the NIH, the National Science Foundation and the Department of Energy's Office of Science (see *Nature* **461,** 856–857; 2009). The stimulus package as a whole was designed to create jobs and ease the pain of the recession, and at first the administration pledged to get this money distributed and spent as quickly as possible — the NIH, for example, devoted much of its allocation to two-year grants that were meant to run from October 2009 to this month. So even as scientists scrambled to get a share of the windfall, some universities and science lobby groups were warning of a 'funding cliff' when the money — which would have boosted total NIH funding by about one-sixth if it was spent over two years — came to an abrupt end.

THE CLIFF THAT WASN'T

From the beginning, however, the funding pulse didn't have quite the anticipated effects. Duke University in Durham, North Carolina, for example, expected a hiring rush after it attracted $210 million in ARRA funds, making it one of the ten most successful universities in the country in this regard, says Jim Siedow, Duke's vice-provost for research. But

staffing barely budged. "We gave a party that nobody came to," he says. "A lot of people used the money to keep the people they already had."

And despite the early political pressure to get the money out of the door quickly, agencies have allowed funds to be released gradually, to avoid waste. The NIH quietly relented earlier this year and is permitting 'no-cost extensions' that allow team leaders, including Lord, to defer spending and wind down their projects neatly. The agency has now spent $7 billion of its $10.4-billion allocation, and Sally Rockey, the NIH's deputy director of extramural research, says that "a big chunk of it will still be ongoing" until 2013.

The result, at Duke as elsewhere, has been that the ARRA funding will help to sustain research departments for at least another two years. Siedow says that a detailed internal analysis suggests that Duke will lose only "a very small number" of academic positions as the funding winds down. "We'd been concerned that funding would fall off a cliff; but so far, it hasn't happened," he says.

MEASURED RECOVERY

Other research funding agencies report a similarly gradual tail-off. The Department of Energy's Office of Science says that it expects substantial spending to continue for some time — it expects to disburse about $260 million in fiscal year 2012 and $170 million in fiscal year 2013. The NSF, which was under less pressure than the NIH to rush the money out, has so far distributed most of it to previously unsuccessful applicants for standard 3–5-year NSF grants. Only $1.4 billion of the agency's ARRA allocation has been spent so far.

Despite this stretching out and morphing, the ARRA is set to leave a distinct legacy in a few areas. One of these is metrics. Kei Koizumi, assistant director for federal research and development at the White House Office of Science and Technology Policy, says that ARRA funding is "the most extensively documented set of research investments we've ever seen".

Because of the initial expectation that stimulus funding would generate jobs, its recipients are required to report regularly on the employment impact of their funding. Their returns are compiled and posted immediately on a public website (www.recovery.gov); these responses suggest that the NIH ARRA funding, for example, is currently supporting the equivalent of about 20,000 full-time postions. However, such self-reported data are not always accurate.

The passage of the stimulus bill also gave birth to Star Metrics, an ambitious cross-government programme set up to monitor research inputs and outputs including, in its first phase, jobs (see *Nature* **465,** 682–684; 2010). Star Metrics started off tracking the employment impact of ARRA and non-ARRA research spending at about 70 volunteer research universities, representing an estimated 40% of the US university research system. The results of this analysis, which takes its data directly from university payroll systems, are set to be published shortly.

But further detail about the impact of ARRA research spending may be slow to emerge. Congressional committees have shown little interest so far in raking over the data, according to research lobbyists and university leaders. "Priorities change very rapidly now," says Chris King, a staff member with the House of Representatives science committee. Formal programme evaluation, as envisaged by Star Metrics, is just "not very critical for people on Capital Hill", he says.

In the meantime, Star Metrics has shifted its focus away from the ARRA, towards the impacts of all research. "What has happened is that the notion of accountability has spread out much more broadly," says Julia Lane, an economist and the NSF official who leads Star Metrics. The programme is planning a second stage, in which every researcher in the United States who receives federal funds is assigned an 'identifier', opening the road to a national database that keeps tabs on everything from total federal funding and employment to publications, citations and patent applications.

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For a breakdown of the 2009 stimulus spending, see:
go.nature.com/xlxee1

Although much of the ARRA research money has gone on grants, assumed to be the fastest way to spend the money, some of it is building a concrete legacy in the shape of investment in bricks, mortar and instrumentation. These include a handful of stand-alone projects — such as a $16-million lab-animal facility at Duke — and many injections into projects already under way.

One of the largest such investments is the $150 million being spent by the Department of Energy to speed up construction of the $1-billion National Synchrotron Light Source II: a high-energy photon source at Brookhaven National Laboratory on Long Island, New York, that will enable materials scientists and structural biologists to look at molecules and crystals at the nanoscale. The project was approved in 2005, but the energy department lacked the funds to build it quickly; the facility is now expected to be finished in 2014. "ARRA enabled us to pull forward the construction work, and we'll have a more fully outfitted facility, with better beamlines and laboratories," says Steve Dierker, head of photon science at Brookhaven. The facility will be 10,000 times brighter than the light source that it replaces, says Dierker.

The stimulus has also funded experiments in approaches to research funding. Some of these set out specifically to support 'high-risk' research projects that might struggle to attract support through the normal grant peer-review process — most notably at the Department of Energy's new branch, the Advanced Research Projects Agency—Energy (ARPA-E), which was conceived in 2004 but got funded, to the tune of $400 million, only under ARRA. ARPA-E has been backing research in untested areas, such as the development of microbes engineered to produce biofuels.

More commonly, as at the NIH, ARRA has forced a compression of the peer-review process, and resulted in grants that last for less time than normal. Some of these, such as Lord's, allow research groups to expand or wrap up projects, but not necessarily test a new hypothesis. "We did an experiment with two-year grants, and we'll follow up to see how that worked," says Rockey.

One of the biggest legacies of the science stimulus, however, will be that thousands of students have stayed in science longer than they might otherwise have done.

"WE GAVE A PARTY THAT NOBODY CAME TO."

"ARRA has provided postdocs and graduate students with great training that'll help them with the rest of their careers," says Rockey. "These people will move on to do productive and wonderful things."

Another legacy will be the ideas, large and small, that have been germinated by ARRA funding — even if their creators are uncertain that they can bring them to fruition. Dan Gauthier, a physicist at Duke, used his three-year, $480,000 NSF grant to study the interaction of laser light with very cold rubidium atoms. Gauthier is delighted to have had the chance to pursue a project that would otherwise have been out of reach; he thinks that his findings could eventually help in the development of quantum communication networks.

At the same time, he worries about next summer, when the grant supporting him and his two research assistants will end. To keep his team intact, he will have to win normal funding from the NSF. "If we don't get funded, it'll just be devastating," he says. "This was all predicated on the idea that the economy would get better after two or three years: now we don't know that it will." ■

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