‘Kicking the can’: science, Congress and a Ponzi scheme

Even if US Congress finally approved a tentative budget, scientists worry that the ongoing budget fights will damage US research in the longer term

Howard Wolinsky & Rita Rubin

AIDS researcher Yuntao Wu, Professor of microbiology and infectious diseases at George Mason University (Manassas, VA USA), is finding imaginative ways to maintain his cell lines, not to mention his life’s work on developing therapeutics against HIV infection. As his funding from the US National Institutes of Health (NIH) has dried up, Wu has become dependent on the kindness of strangers and friends to cover the US \$3,000 a month he needs to keep his lab running. To help repay a US\$35,000 loan from his university, he has so far raised more than US\$21,000 on CrowdRise, a crowd-sourced fundraising website.

In previous years, Wu had little trouble funding his research the ‘usual’ way. He received more than US\$1 million in grant money from NIH over the past 4 years, and his lab published 18 papers in that period. But his application to renew the grant for another 5 years was rejected this past spring. Wu blames the tight NIH budget. Desperate for funds, he is now applying to other sections of the US National Institute for Allergy and Infectious Diseases to see whether they will be more forthcoming than the molecular biology section that did not renew his grant. He expects to hear this month whether he will receive any NIH money, as the 16-day government shutdown in October last year delayed the grant review process.

Wu’s grant applications are not the only ones to be affected by the shutdown: The closure of the government temporarily delayed the assessment of 300,000 extramural research groups for funding. Another 14,000 NIH scientists—designated as ‘non-essential’ federal employees—were sent home, virtually closing some laboratories.

Though the obvious effects of the shutdown were temporary, there are concerns about the longer-term consequences of the unstable funding environment. In an 11th hour deal, leaders from the conservative-dominated House of Representatives and US President Barack Obama and his Democratic colleagues agreed to ‘kick the can further down the road’ by funding the government until later this month and extending the debt ceiling to February 7, 2014. But many scientists worry that Congress will just keep postponing a permanent resolution, leaving the US research enterprise indefinitely in crisis mode with potentially long-term damage.

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These are just the latest developments in the roller-coaster ride of government funding that began in January 2013. Each crisis has had a made-for-headlines name, from the ‘fiscal cliff’ to ‘sequestration’, and each has had a damaging effect on the research community’s confidence and funding. The sequestration, the across-the-board cut of government spending that went into effect on March 1, reduced the NIH budget by US\$1.55 billion, or 5.5% in 2013, and the agency funded 640 fewer

competitive research grants in 2013 than it did in 2012. Wu’s work on AIDS is just one example of research that has been jeopardized because Republicans and Democrats refuse to work together.

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But the pernicious effects of lack of funding get worse: Sequestration combined with a decade of essentially flat budgets ground down by inflation means the NIH’s purchasing power is nearly a quarter less than it was 10 years ago, according to NIH Director Francis Collins. Among the grants that did not get funded because of sequestration, 150 were renewals of previous awards for work on some of the country’s leading causes of suffering and death, Collins noted. He can be found on YouTube singing and strumming a song he penned called *Sequester Blues*. (<http://www.youtube.com/watch?v=XbJ8wEhlsvc>) “I wish we could push harder on Alzheimer’s disease than we are right now,” Collins commented. He also lamented the inability to adequately fund research on a universal flu vaccine, which he called “an incredibly intense public health need”. Of the 150 applications that were denied last year, he noted that reviewers scored them “at a very impressive level,” but

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6:48pm - 1 Oct 13

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sequestration has raised the bar for funding. “We had already invested 4 or 5 years in those projects, and yet, we’re shutting them down,” Collins said.

About half of the respondents to a survey of more than 3,700 frontline scientists in all 50 states said that they have had multiple grant applications remain unfunded. The

survey was conducted last summer by 16 scientific societies representing a variety of disciplines, and the results were released last September in a report, *Unlimited Potential, Vanishing Opportunity*, produced by the American Society for Biochemistry and Molecular Biology (ASBMB).

Overall, only about 16% of NIH grant applications were funded in the fiscal year 2013, and in some institutes, such as the NIH’s Eunice Kennedy Shriver National Institute of Child Health and Human Development, that proportion was down to around 10%, Collins said. Fifteen years ago, when President Clinton initiated the doubling of the NIH’s budget over a 5-year period, a third of applications were funded, according to the agency. “I’m deeply concerned about that,” Collins commented. “Young investigators in particular are in a vulnerable position. They are counting on the current granting operation to give them a chance to pursue their best and brightest ideas. They are getting increasingly demoralized.” Compared with years past, Collins said that “the average investigator spends more time writing and submitting grants, hoping that they’ll actually hit on one of them.”

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Eric Green, director of the National Human Genome Research Institute (NHGRI), said that the funding situation requires NIH leaders to “spend the bulk of their time dealing with fiscal crises instead of dealing with the science.” In September, at the most recent meeting of the National Advisory Council for Human Genome Research, Green showed a slide listing the consequences of sequestration at his institute. Among them: Funding for a request for applications (RFA) for genomic sequencing and newborn screening disorders was cut in half; funding for an RFA for genomic medicine pilot demonstration projects was reduced by 20%; and the institute’s bioinformatics resources and analysis research portfolio was trimmed by US\$5 million. “We have way too many incredibly

important things to do,” Green said. “Just saying you have to prioritize is a very painful process, especially for a field like genetics, which has so much momentum.”

To stretch dollars further, the NHGRI is collaborating more frequently with other institutes, including the National Cancer Institute, the National Heart, Lung, and Blood Institute and the Child Health Institute. “The individual institutes bring their areas of expertise,” Green commented. “It is a natural thing to come together scientifically, but it is particularly compelling [in this era of budget uncertainty].”

Because the majority of NIH grant funding goes to extramural research, the sequester affects scientists reliant on NIH money across the USA and even abroad. As such, the funding problems of the NIH are having knock-on effects. At the Boston University School of Medicine (MA, USA), for example, the section of general internal medicine has been spurred to create a new position, Associate Director for Research, to try to retain faculty. Michael Paasche-Orlow, the associate professor who holds the post, said that one of his responsibilities is to urge faculty to “spend even more of your life searching for money.” He does not necessarily relish the role: “I want to help people stay in research, but if the structural integrity is not there, I’m worried that I’m going to be like the deck captain when the ship goes down.”

Physician-investigators, at least, can still see patients. “They can go back to being a doctor, although I think a lot of them are going to be dissatisfied with that,” Paasche-Orlow said. “The people who are at the highest risk are PhDs who don’t have another job to fall back on.” In Paasche-Orlow’s view, the ideal workload is 80% research and 20% patient care, which he has been able to maintain. But some of his physician colleagues have had to increase patient care to the point that it occupies half their time.

Even for those who can maintain their research/patient care balance, more and more time is being spent writing grant applications that ultimately fail because competition is so high. “The pool of proposals is so much bigger. It seems to me that the review process is much more capricious than it used to be,” Paasche-Orlow said. “How are you supposed to differentiate between the fifth percentile and the sixth percentile? Is

there really a quality difference?” Wu is similarly frustrated. “A vast majority of the reviewers need to be excited about your proposal,” he said. “If you are working on something relatively cold, uncertain or emerging, you will likely be in trouble.”

Cell biologist Karl Matlin, Vice Chairman of Research in the Department of Surgery at the University of Chicago, said that the NIH cuts this year resulted in his university losing US\$300,000 in funding to study treatments for renal ischemia. Three small labs were shuttered and six researchers were given notice. Matlin said that the research ranked in the top 20% of grant proposals reviewed, but that even this level of quality was not good enough to achieve funding because of the sequester. He added that the US funding system has fundamental flaws in addition to the current budget cuts: “Funding of biomedical research by the government in the US is a kind of Ponzi scheme developed during the Cold War. What happens is that government awards a research grant to an institution and the institution will in addition receive indirect costs.” As such, universities then leverage this funding to grow their research enterprises by adding buildings and research staff, which increases indirect costs. “The system was devised as a way of growing basic research, but like any Ponzi scheme, when you cut off the source of funds, the whole thing starts to collapse. There’s no major research university in the US that has the money to support the number of faculty that it has.”

Matlin, who trained at the European Molecular Biology Laboratory in Heidelberg, Germany, in the 1980s, said that the sequester has exposed the underbelly of the long-decaying research funding infrastructure. “There are immediate impacts, where people have lost their jobs and labs have shut down, but the big problem is going to be that nobody will go into this business. Why would anybody who is a student, who sees their lab director doing nothing but writing and rewriting grants, go into this profession? What’s happening is that the lower levels of funding and the unpredictable nature of funding will destroy the research enterprise of the United States.”

Cardiologist Thomas Michel, Professor of Medicine at Harvard Medical School (Boston, MA, USA), leads a basic research laboratory exploring signal transduction

pathways in the cardiovascular system. He expects that promising young people will shun academia and research in the USA for more stable options, such as patent law or teaching. Others may pursue careers elsewhere, following the money to greener pastures. “If you look at the percentage of Gross Domestic Product devoted to research in the US, it is declining,” he explained. “If you look at that same parameter in China, in Singapore, in Germany, it’s much higher. And it’s rapidly increasing. So American leadership in biomedical science, which used to be taken for granted, is now very seriously threatened.”

As a young girl in Syria, Huda Akil looked on two-time Nobel Prize winner Marie Curie as a role model. She noted how Curie was born in Poland but went to France to seek her education and career. Akil’s own family challenged her to pursue a career in the USA and she is now Co-Director of the Molecular and Behavioral Neuroscience Institute at the University of Michigan (Ann Arbor, MI, USA). “America had clearly become the place where science was booming,” she said of her childhood decision. “The space program showed the spirit of adventure and discovery in the country. And it was clearly the best place to go for me—a huge honour, thrill, opportunity, excitement, adventure. And of course it was scary because you don’t know if you are going to be as good as all the Americans, but it’s fantastic. [...] One of the great assets of this country is that it’s been able to attract people who are willing to take risks in a good way.”

Now a US citizen, Akil said that if she were that young Syrian girl today, she might have second thoughts about pursuing a science career in the USA. “I don’t know if I would advise her to come here because it is really unclear, uncharted and plain hard. This country still spends a lot of money on science, but I think that part of the problem is the uncertainty. It’s not just the amount of money, it’s how we go about it; not just the shutdown, the sequestration, but the fact that everybody is always constantly struggling to maintain the research program.”

For Michael Hendricks, the writing about the situation in the USA was on the wall. Last year, as he finished his postdoc at Harvard University studying the nervous system of *Caenorhabditis elegans*, he decided to find a faculty job away from the financial fray in

the USA. Having already spent time abroad in Singapore to undertake his PhD, he decided to become an expat again, taking a faculty post at McGill University in Montreal, Canada. He said that Canada has funding issues as well, but that it is easier to receive and maintain funding there. Hendricks did comment that the USA remains a good place to pursue a PhD or a postdoc, but that it is no longer the best place to stay for a career. "I see a lot of people who want to go back to their home country or go somewhere else. There are lots of other places where higher education and research are growing instead of contracting as they seem to be in the US."

According to the ASBMB's *Unlimited Potential, Vanishing Opportunity* report, 18% of respondents said that they were considering continuing their research career in another country. "At a time when you want to be pressing the accelerator, the US is cutting back. Other countries are taking advantage of this. It's easy to understand why some US scientists would be looking to other countries," Green said.

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Wu was born in China, earned his doctorate at Queen's University in Kingston, Canada, and moved to the USA in 1999 to work at the NIH. Friends and colleagues outside the USA are urging him to consider relocating to "wherever has the money to keep the research going." He concedes that the idea is tempting, given that he cannot

fund his lab for much longer than a year if none of his pending applications for NIH money are approved. But if he moved to another country, he would have to build up his lab all over again, a process that would take 1 or 2 years and set back his research into HIV. "I know our research is very important. It will help us find a cure," he said. "My lab has to survive [...] The research has to continue." He has been trying to identify and determine the function of cytoskeletal factors that play key roles in HIV replication.

Yet the financial woes of the US research community are not unique. German native Hermann Kalwa joined Michel's lab at Harvard four and a half years ago to do research on vascular physiology and endothelial signaling. He pointed out that the funding environment is worse for his colleagues in Spain and Portugal for example. Kalwa expects to move back to a German-speaking country eventually, but in the USA he has not been too disturbed by the financial issues. "I think at the moment we are experiencing a severe system hack. I don't think that it can get any worse, but I don't think that it's part of the system at its design. So the moment when this problem is resolved, it will be okay."

His boss is not so sanguine. "About 95% of my funding is from the NIH. I am trying to step up funding from private foundations, but so is everyone else, so the competition for grants from private sources has gotten extremely keen to the point that these grants are as competitive as NIH grants. There's no way that private foundations can make up the shortfall of funding from the NIH," Michel said. According to the ASBMB report, only 2% of survey respondents had been able to find private funds to make up for lost federal grants.

Matland commented that a one-in-ten chance of getting a grant "just makes life

impossible. In the longer term I think there has to be a re-examination of how the whole system is organized." He said the USA could learn from some European countries, where researchers generally receive a guaranteed salary and basic funding for their research once they win a position.

Michel said that the US leadership may need a wake-up call to change course: "It may take a biomedical Sputnik moment: perhaps if the Chinese find a cure for Alzheimer's disease as a consequence of China's investment and commitment to biomedical research, even as America cuts back its support. Maybe this might make the American leadership renew their commitment to sustaining and growing biomedical research efforts, which the US has led since the 1940s, with our future leadership increasingly in doubt."

Green called on Congress to protect the NIH: "We obviously live in very unique times. The notion of the sequester is new to our lexicon, certainly new to science and to the government. I really do think the priorities of the nation and the priorities of the federal government have to elevate NIH to a higher level than many other parts of the federal government. The center of biomedical research for the world is the National Institutes of Health. Doesn't that deserve immunity from budget squabbles?"

Conflict of interest

The authors declare that they have no conflict of interest.

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