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Independently wealthy

Communist China is 70 this week, and its academy of sciences has become one of the world's richest. Could its financial autonomy be a model for others?

The story of the number theorist Jingrun Chen will be familiar to most readers in China. Chen, a prodigious talent, spent a lifetime working on Goldbach's conjecture — the still unsolved theory that every even integer greater than two is the sum of two prime numbers. But during the Cultural Revolution in the 1960s, Chen, in common with thousands of university researchers and members of the Chinese Academy of Sciences (CAS), was led away for re-education on a farm, beaten and tortured. The academy was later rehabilitated, and Chen would become a national role model until his death in 1996.

Communist China turns 70 this week, marking an ideal time to reflect on the turnaround in Chinese scientists' fortunes. Although CAS was also established in 1949, in the early years, Communist-party leaders never fully trusted scientists, thinking that they were not completely on board with the project.

Scientists' international connections and their need for freedom to think were seen as evidence of disloyalty to the new state. And, as Shellen Wu writes in one of two essays on what the past can teach us about the present, CAS became a target of two waves of attacks by the government on intellectuals (see page 25).

The first wave was a response to the 'Hundred Flowers' campaign of the 1950s, when party chairman Mao Zedong invited academics to speak freely about Communism. It was a trap, because it led to critical scholars being identified and punished. They were smeared by the Communist leadership as 'rightists' — supporters of capitalism who needed to be re-educated in the new doctrine.

This was followed in the 1960s by the decade-long Cultural Revolution, when numerous universities and CAS institutes were closed, research was stopped and science books burned. Many researchers were redeployed to work on defence projects. Torture was commonplace and, according to CAS's own records, 229 scientists were either killed or took their own lives in this time.

"The Cultural Revolution devastated China's science and technological undertakings," wrote Chunli Bai, the current president of CAS, in *China's Creations and Progress in Science and Technology*, which was published last year. And Bai should know, because he, too, was one of its victims.

Ever since China's opening up to the world — and to the world economy as it embraced a form of capitalism — CAS's leadership has been careful to stay in lock-step with the government while simultaneously expanding its more than 100 institutions, developing international collaborations and cultivating independent sources of income.

In 2013, when China's leader Xi Jinping announced the Belt and Road Initiative — a trillion-dollar infrastructure-building plan for developing countries — Bai positioned CAS as the project's scientific arm. CAS institutes are involved in rice genomics in Pakistan, water purification in Sri Lanka and astronomy in Uzbekistan. Hundreds of PhD students are being trained. Such a move also enabled Bai (and the CAS leadership) to have direct access to China's top decision-makers, without needing to ask permission from the Ministry of Science and Technology.

Bai also oversaw CAS's expansion into international finance — its overseas investments are estimated to exceed US\$700 million. This phase in CAS's evolution began in the early 1980s with the creation of a spin-out company from the CAS Institute of Computing Technology. That company, Legend, became Lenovo, which today is one of the big-three PC manufacturers, and CAS is its biggest share-

holder. The academy additionally owns or holds shares in more than 30 conglomerates and companies employing tens of thousands of people in food and agriculture, life sciences, chemicals, banking and insurance.

Such financial autonomy is an unusual arrangement for a science academy, but it makes sense for the institution to diversify its income in this way, given China's

centralized political system with its history of problematic relations between science and government.

It has taken more than 30 years for CAS to achieve this level of autonomy, but it means that China's leadership cannot control scientists in quite the same way it was able to do in the 1950s and 1960s. It is a model that science academies in other countries — especially one-party states or states with authoritarian leadership systems — should also consider.

As the unfolding events in Hong Kong and the mass disappearances in Xinjiang show, China's leadership is all too capable of taking harsh measures against its people, especially those who do not share its politics or ideology. But the relative autonomy that CAS has carved out for itself, along with its expansive international collaborations and networks, means that the government will need to think twice and think hard before it decides to turn against scholars such as Chen and Bai — as it did to devastating effect all those years ago. ■

Excellent problem

Other funders must join Wellcome's mission to create a kinder research culture.

Wellcome's director Jeremy Farrar didn't hold back. "The emphasis on excellence in the research system is stifling diverse thinking and positive behaviours," he wrote in a blog post last month. "The relentless drive for research excellence has created a culture in modern science that cares exclusively about what is achieved and not about how it is achieved." These are strong words, not least because Farrar acknowledges that the UK biomedical funding

charity that he leads helped to create such a focus on excellence.

Wellcome is not alone — excellence is everywhere. Germany plans to spend €533 million (US\$581 million) a year on its Excellence Strategy. In the United Kingdom, £2 billion (US\$2.5 billion) of public funding is allocated annually to universities through a suite of funds that support “excellence wherever it is found”. Australia’s research-evaluation system is called Excellence in Research for Australia. Worldwide, research facilities are being named centres of excellence, and excellence is scattered generously in the pages of universities’ strategic plans.

But, in line with what has been said before, Farrar concedes that a focus on excellence also contributes to “destructive hyper-competition, toxic power dynamics and poor leadership behaviour” — the latter echoing the findings from *Nature*’s comprehensive survey on research-group culture last year.

Wellcome has launched its own survey on attitudes to research culture, the findings of which it says will be used to support environments where researchers want to work. Earlier this week, the charity also hosted the launch of the Research on Research Institute (RoRI), a new venture that will investigate research policy, systems and cultures. Wellcome is working in partnership with the University of Sheffield, UK, Leiden University in the Netherlands and the company Digital Science (which is part of Holtzbrinck, the majority shareholder in *Nature*’s publisher, Springer Nature).

Both initiatives are overdue. But equally important will be what happens next — and whether other funding agencies accept that a kinder research culture is needed. They are aware of what the RoRI partners are doing, but they are taking their time to respond. This is understandable to an extent, because they need to grasp the causes of the problems before they can act. This is where RoRI will be valuable, and there are several strands of research that it could start to investigate.

The first question to tackle is what funders mean when they say ‘excellence’. Many have backed excellence partly to ensure that funding is awarded to the best research, and partly because such a focus tells governments and taxpayers that their hard-earned money is being spent responsibly. We know that definitions tend to include some combination of research quality, along with impact. But there will be variations, and investigation could help to unpack how different funders define it.

An equally important question is to explore the relationship between excellence and inclusion. The funder focus on excellence presupposes that research of the highest quality benefits from competitiveness. The

extent to which this is true needs further examination.

Second, our 2018 survey revealed that senior staff have a more positive view of their lab environments than do less-senior colleagues. There is evidently a mismatch of views, which further exploration — both qualitative and quantitative — could help to dissect.

Third is the question of performance metrics and research-evaluation systems. Scientists observe that performance metrics contribute to work environments that are more competitive. But how metrics create such environments could be better understood.

In June, Research England, the UK funding agency responsible for university assessment through the Research Excellence Framework (REF), published a review of attitudes to the REF in four universities. This revealed both positive and negative attitudes, the main negatives being that the exercise encouraged game playing and affected creativity. The funder plans to extend the pilot to more universities; RoRI, too, has an opportunity to explore this work in universities in other countries.

Fourth, there are questions to be asked about how university rankings affect research culture. The task of improving a university’s position in the rankings is sometimes given to performance-management units that are attached to an institution’s senior leadership. Instructions are cascaded downwards. Heads of faculty, for example, need to meet targets for research income and for research outputs. This creates pressure on individuals and on teams to report new findings, and it is this pressure that, in some cases, can lead to negative results going unreported.

Examining how funders can recognize or incentivize researchers to use a wider range of publishing formats in addition to the conventional research paper — such as data sets, registered reports and evidence reviews — could constitute part of these questions.

Wellcome and its partners in RoRI should be commended for taking an important first step. They have recognized that there are problems in research culture and that these need to be fixed. RoRI will help to probe some of the causes of distress, and suggest solutions. Now, other funders and research-management societies must join the mission: ultimately, strength in numbers is what will compel universities to take action. The task of achieving a kinder, more welcoming research environment — one that rewards diverse approaches and embraces failure — is not something that Wellcome can achieve on its own. ■

Let fishers share

There’s a way to provide children in Africa and Asia with enough essential micronutrients.

Economic stability was the great promise of industrial farming in replacing subsistence agriculture. Farming on a larger scale meant that families could produce enough both to feed their families and to sell on to local and international markets.

But as Christina Hicks at the University of Lancaster, UK, and her colleagues show in a paper in this week’s *Nature*, families — especially children — of artisanal fishers across Africa and Asia are suffering because of the demands of the aquaculture industry (C. C. Hicks *et al.* *Nature* 574, 95–98; 2019).

The problem, which is widely recognized, is that coastal communities are selling increasing amounts of their catch to aquaculture corporations. These fish are ground down to produce fishmeal, which is fed to farmed fish that are bought by wealthier consumers. But owing to expanding demand for farmed fish, more catches of fresh fish are being diverted away from local markets — and from the diets of children in coastal communities.

Globally, two billion people are deficient in essential micronutrients,

such as iron, zinc, selenium, vitamin A and omega-3 fatty acids. There are one million premature deaths every year because people are not getting the right micronutrients. A lack of calcium, iron and zinc, for example, can cause stunted growth and anaemia. And yet just 100 grams of fish a day could provide half the recommended dietary allowance of iron and zinc for a child under five years of age.

Hicks and her team worked out the quantity of micronutrients obtained from catches of 367 species of fish in 43 countries, and then compared this with the prevalence of nutrition-linked diseases in communities within 100 kilometres of a coastline. They found that, in some countries, if fishers could hold back just a fraction of what they catch, that would be enough to provide families with healthier diets.

In Namibia, for example, 9% of fish caught in the country’s Exclusive Economic Zone would be sufficient to provide the iron needs of the entire coastal population. In Kiribati, 1% of catches would cover the necessary calcium for all of the country’s under-fives. In another 22 countries in Asia and West Africa, one-fifth or less of catches would fulfil the dietary needs of all under-fives.

These are troubling data, but producers and consumers can make a difference. Consumers of farmed fish especially can demand that producers find ways to improve the health and nutrition of coastal communities — for example by ensuring that fishers get to keep more of their catches. This isn’t a difficult request, and it could make the difference between a child’s life and her untimely death. ■