International collaboration and science in China: a Western perspective

By Jane Qiu

As China is making great strides in economic development and innovative capacity, it has become an increasingly important player in major international scientific projects. But its role largely depends on the areas of research and can vary greatly—from being mainly a supplier of raw data to having genuine intellectual input. Last year, a panel of Chinese scientists had a heated debate over how China can get the most out of international collaboration, what government’s role should be, and how Chinese scientists could go beyond the mainstream science (National Science Review 2014, 1: 318–21). In the second of a series of forums organized by NSR on the topic, its executive associate editor Mu-ming Poo discusses these issues with four leading scientists in Europe and the United States.

**LONG-TERM COLLABORATION WITH CHINA**

**Poo:** International collaboration is crucial for boosting Chinese science and increasing China’s role in the world stage. As long-term collaborators, your perspectives are very important. Perhaps you could provide a brief overview of your experience in working with China.

**Farrar:** My background is infectious diseases and global health. Before moving back to the UK last year, I had lived in Vietnam for 18 years and began to collaborate with China extensively since 2004, around the time of SARS and bird flu.

**Fuchs:** I’ve been collaborating with China in the areas of materials science and nanotechnology since 1990s. I’m part of several major international projects with institutions in places like Beijing, Nanjing, Suzhou and Heifei. Since 2008 I co-chair a pivoting Sino-German collaborative project in nanoscience comprising 23 scientific groups commonly supported by the German Research Foundation (DFG) and the National Natural Science Foundation of China (NSFC).

**Lin:** I was born in China and went to the USA 33 years ago as a graduate student. My research is on the global ocean. In 2007, I was the co-chief scientist of a Chinese research cruise in the Indian Ocean. I also led an expedition last year of the International Ocean Discovery Programme to drill the South China Sea, which involved over 30 scientists from 10 countries and regions (about half of whom were from China) as well as a 90-person drilling team and crew.

**White:** I’ve been working closely with Chinese scientists since 2005 in two ways. I am a project manager for the Daya Bay Reactor Neutrino Experiment that involves over 200 scientists from China, Europe and North America. It is a very successful project. The first set of findings, released in 2012, was listed by *Science* as one of the top 10 breakthroughs of the year. As the institute’s
AN IMPORTANT PLAYER IN THE WORLD STAGE

Poo: So why is it important to work with China in your area of research?

Farrar: Infectious diseases can move globally very fast when not properly controlled at the start. Because of the density of population—as well as the migration of people within China and its connectivity with the rest of the world—China is hugely important and has becoming increasingly important in the last decade. China has come a very long way: its public-health system was not fit for purpose a decade ago, at the time of the SARS outbreak. By promoting outstanding young people and working with the international community, it has become the model of how to transform a public-health system from one that was keen to suppress information to one that is open and transparent and able to rapidly react to emergent infection—as we can see from the way it handled recent outbreaks of influenza. The next step for China is to play a bigger role in the world stage. It has started doing that in tackling Ebola in Africa and could play a very important and positive global role.

By partnering with China, we have a great opportunity to do breakthrough scientific research that might not otherwise get done.

—Christopher White

Fuchs: When we first worked with China in 1990s, it was about complementary strengths and interest. At that time, Europe has cutting-edge analytical tools, whereas China had a whole suit of interesting materials but did not have the capability to study them in detail. Moreover, we focused more on basic research, but our Chinese partners were very eager to go very quickly to practical applications. So it was a perfect basis for coming together. Now China too has the most advanced instruments currently available, and the complementary equipment and research styles in China and Europe made our collaboration extremely fruitful. Based on our success, DFG and its Chinese counterpart NSFC started their first major collaborative project in nanoscience in 2008 to explore new possibilities for cooperation in basic science areas on a much bigger scale than ever before. The approach turned out to be very successful, with an intense exchange of scientists, many common scientific publications and also common patents.

White: It’s quite straightforward in my research community: China provides resources and a large pool of talents, that would not necessarily be available in the West. It’s an opportunity to make discoveries. By partnering with China, we have a greater chance to conduct breakthrough scientific research that might not otherwise get done. In my mind, it’s the number one reason to work with China.

Lin: I’d like to add a new angle to this question. Ocean science is fundamentally global science. We have many countries but only one ocean. China is a big ocean country, so we would not be able to solve major ocean issues without China. Moreover, I think scientists could contribute to regional peace and stability through international collaboration. As you may know, there has been increasing tension in some of the Asian marginal seas, such as the South China Sea where I co-led a two-month international drilling expedition last year. In my view, scientific collaboration at the sea is a win-win solution for all. So I see ocean scientists can not only advance science but could act as an agent of peace.

Farrar: I entirely agree, but I do think there are challenges which should not be denied or ignored, particularly in relation to territorial disputes in the South China Sea—which are not trivial and have the potential for major future problems. Yes, scientists should collaborate, but we should have our feet on the ground about the fact that, ultimately, it’s the politicians who will determine whether things are going in a peaceful manner which takes everybody’s interest to heart. But we can and do influence that politics by showing that international cooperation and collaboration is a better way forward.

Fuchs: I fully agree: science should or has to contribute to peaceful living together and in understanding mutual interest. But politics is quite a different matter, and there are many incidents in which politicians reach completely different decisions to what scientists believe should be done.

THE ROLE OF CHINESE SCIENTISTS

Poo: Some Chinese scientists think they are not always on an equal footing with their Western peers in international collaboration. In some cases, they are merely providers of raw data and have little benefits; in others, they don’t normally get sufficient recognition in international projects even when they do have significant intellectual input. What’s your view on this?

Farrar: I think it’s a vexed issue that bedevils academic research globally. There are many discussions about who contributed to what in all sorts of research fields at all levels—from the first papers of graduate students to Nobel Prize winners. In my own experience working with China, I’ve not had such experiences any more than I have with other collaborators internationally.

White: In the Daya Bay project, the first physics publication was released in a USA journal, and the second was published in a Chinese journal. Yes, it’s an issue, but given the size of the collaboration, it’s mainly an internal struggle between groups using different analytical techniques to get the same results. A main
issue is to decide which technique should get highlighted in the publication and show up in the abstract, with the others as supportive and complementary results.

Lin: In many areas of research, Chinese scientists have changed from being a raw-data exporter to the source of creative ideas. This is partly because many leading scientists in China were educated and worked in the West so they are familiar with at least some of the international practices. They are totally capable of publishing good papers in leading journals. It’s becoming much more so in ocean sciences.

Fuchs: This is also the case in our nanoscience collaboration. Twenty years ago, Chinese scientists provided new materials and the analyses were done in Germany. Now it’s a much more equal partnership. Research centers in Beijing, Suzhou and Hefei have the state-of-the-art equipments and very talented people. We see more and more papers with first authors from China in very high-ranking journals. Chinese scientists in my field are getting very good at coming up with fresh ideas.

Poo: I think the situation may depend on the maturity of the field in China. In clinical research, for instance, many international projects involve China providing patient samples and the analyses are done elsewhere by Western scientists.

COLLABORATION VERSUS COMPETITION

Poo: Another issue is about the potential conflict between collaboration and competition. My impression is that many young scientists in China are very reluctant to collaborate with foreign scientists for fear that they would lose an edge when discussing their new ideas. What’s your perspective on this?

Farrar: I think the issue at the heart of it is trust. And trust is something that is built up over many years and can be lost in a few days. In the field of infectious diseases, based on my experience of working with Chinese scientists for over a decade, the level of trust has grown—even though there was a sense of mistrust, in both directions, at the beginning. Until people work together, the sense of mistrust will not disappear. This is the only way to change that dynamic. Trust is built up gradually over time: you can’t expect it to be suddenly in place or over a few years or even a decade. It takes longer than that.

Fuchs: This is why our projects require German students to spend at least a few months working in partner institutions in China during their Ph.D programme. It has turned out to be very useful. When young people get together, they not only exchange scientific ideas but learn about each other’s culture and language. This may contribute significantly to building a solid basis for mutual trust and collaboration for our future scientific leaders or industrial managers in the two nations.

White: Indeed. From my own experience working with China, it’s very important for me to develop a personal relationship with my colleagues. Only then could we really truly work closely together. I simply had to spend a lot of time in China, not only discussing science with my Chinese colleagues but participating in cultural events. It made a whole world of difference. It opened up many doors because I was willing to open myself up to them.

Farrar: At the heart of most successful collaboration is a personal chemistry between individual scientists involved and a shared interest and mutual respect. The best way to achieve that is to spend time together. This is the same whether you are working with Germans, Americans or Chinese. Academic exchange, at all levels from undergraduates to senior scientists, is absolutely crucial. There has always been a large flow of students and scientists from China to the West. More recently, an increasing number of people in the West are looking to opportunities in China—either through exchange programmes or because China offers attractive career opportunities. This bi-directional flow is, in my view, the future of globalization of science.

Lin: Competition is always there. But there are some big important sciences that just cannot be done without working with the others. I think we should educate young scientists at an early stage to look at the bigger picture and to recognize that, by working with other people, they will not be losing their small ideas but will gain much bigger ideas. It’s one of the ways to be competitive. Institution leaderships should implement mechanisms to foster collaboration—both internally and internationally—and to create a win-win situation that makes everybody more competitive.

“Scientists could contribute to regional peace and stability through international collaboration.
—Jian Lin”

Fuchs: I fully agree: working together is always fruitful, especially when dealing with global challenges. But we must consider two issues. First, it’s quite easy for us—as established scientists and institute directors—to engage in big international projects. The situation for young scientists at the beginning of their career may be quite different. In some cases, they may have to be very competitive and sometimes quiet about their own ideas in order to make the first shot and get the faculty position they want before they could open up. Second, major scientific discoveries in most research fields, except for example particle physics, were made by a small number of scientists working on their own. So I think the question really depends on the area of research and scientists’ career stage, and we should have a healthy mixture of lone scientists and people who work more collaboratively.

TOP-DOWN INITIATIVES AND NON-GOVERNMENTAL FUNDING FOR RESEARCH

Poo: What’s the role of top-down approach in international collaboration? Have you experienced any political interference?

Lin: There is room for the top-down approach. In fact, some large programmes would not be possible without strong support from the government. Last year’s ocean drilling programme
in the South China Sea, for instance, worked for two reasons. First, the International Ocean Discovery Programme provides a fantastic platform that has successfully fostered international collaboration for decades. Second, there were a lot of behind-the-scenes supports from various government agencies to make it happen.

Fuchs: It’s important to have both top-down and bottom-up approaches. The DFG runs big programmes that scientists can create from the bottom up with several partner institutions. Meanwhile, anybody can submit proposals at any time of the year to explore new ideas. At a different level, the German science ministry also has focused programmes on applied research, such as new energy storage concepts, sustainable energy and environmental challenges. If you want to get funding there, your project has to fit into the respective funding schemes. This mixture is quite useful, which provides a way to meet practical challenges while allowing individual scientists the freedom to explore fresh, new ideas a bit away from mainstream science.

Farrar: I agree. I think the USA leads the world on this. It’s the benefit of having reasonable access to non-governmental funding for research. In Germany, you have the Max Planck Institutes; in UK, we have the Wellcome Trust; in the USA, there are an enormous number of private foundations and philanthropic and charity groups that can fund research in different ways to that which the federal government can provide. It’s a very important part of the research landscape.

Poo: This is exactly what’s lacking in China. There are virtually no non-governmental funding sources. The majority of science in China is conceived through top-down strategic planning by government officials—often with little input from scientists.

International collaboration is about trust, which is built up over many years and can be lost in a few days.

—Jeremy Farrar

White: In some cases, funding is political in origin, but science is actually done from the ground up rather than from the top down. We really need to make sure that we separate political outcomes from scientific outcomes. Sometimes politicians want scientists to produce results that will benefit them, but you rarely achieve good science in that way. We really need to give young scientists the space to choose the best and the most exciting scientific topics and to explore them in ways they feel best.

THE CHALLENGES OF DATA SHARING

Poo: Have there been any problems with data sharing in your experience?

Lin: This is one of the biggest challenges in international collaboration when we work across national boundaries, not unique to China. Earth science is global science, and we will have a problem if we don’t share data. Right now, scientists in many nations are somewhat unclear about what data can be made open and what cannot—which is hindering the progress in international projects. Collectively we need to make a stronger case of why data-sharing is to the best interest of scientists in the long run. Data-sharing polices need to be made more transparent, so scientists would know where they stand. I’d say the USA National Science Foundation has really set a good example on this, which requires principal investigators to share data after a proprietary period of a couple of years. Some leading USA journals now require the authors to specify a contact person for data sources before a paper is accepted for publication.

Fuchs: In our collaboration with China, we drafted rules to govern intellectual-property issues like publications and patents. But it’s about trust at the end of the day: people can still get around those rules if they really want to. The key issue is that if we discover something new, we’d publish papers together; if the findings lead to potential patents, we’d include each other as co-inventors and file patent applications in our respective countries in parallel.

White: In particle physics, data-sharing issues are addressed well in advance of any data being created. As data come along, multiple copies are generated and made available to all scientists involved in the project. As far as intellectual properties are concerned, it’s mainly about scientific publications in my field. We have a committee, with representatives from both China and the USA, that oversees any publications before they are released.

Farrar: From the perspective of infectious diseases, it was very problematic in China a decade ago. But it has been exemplary in the past few years in sharing data and viral strains of influenza with international agencies, such as the World Health Organization, without problems. Like many countries, China has very strict rules on human genetic materials leaving the country and being analyzed elsewhere. Again, this goes back to trust. The open sharing of that sort of information and samples is not quite there yet.

THE WAY FORWARD

Poo: What kind of changes you’d like to see at the institutional and government policy level?

White: It’s a matter of gaining more experience in working together. We will understand each other better as we continue to collaborate, and some of the differences and problems will be resolved. The Daya Bay Reactor Neutrino Experiment was not plain sailing at all: there were a lot of conflicts and we had fights. Scientists from both China and the USA were extremely frustrated and said that they would never work with each other again because it was just too difficult. But five years on, not only are we still working together, also we are proposing new collaborative projects. I think there is definitely a learning curve and it takes time to figure out how to work together effectively.
Lin: I totally agree. In addition to data-sharing policies mentioned above, I’d like to see two things happening. One is that I hope the Chinese government continues to regard international collaboration as a top priority in building the country’s scientific prowess and send young people to the West to study science and learn about the culture. The other is that I hope the USA will send more American scientists to China to get to know Chinese science and culture—which hasn’t happened as much as one would like to see. It’s the only way to build a long-lasting understanding and trust between the two nations.

We should have a healthy mixture of lone scientists and people who work more collaboratively.

—Harald Fuchs

Farrar: Having been very closely associated with SARS and Bird Flu, what we must not go back to is the era of a decade ago when the government is not open enough to share information in infectious diseases. China has become very open and I think it is very difficult for that to go back to the old ways. One of the things that do worry me is the absolute focus of the Chinese academic system on publications, which has generated incredible pressure for young scientists to do whatever it takes to publish in so-called high-impact journals. This is much more severe than anything I’ve witnessed in Europe and North America. This is a worrying trend that doesn’t lend itself to collaborative ventures. I’d not like to see that develop further more. Finally, I hope more Chinese institutions will involve foreign scientists in their peer-review and funding processes. Nationalism and an insular approach towards science are damaging. China has improved dramatically in this aspect and I hope this continues.

Fuchs: I totally agree. Young scientists in China are under tremendous pressure to make a career in fields that are ‘fashionable’ and they have to publish high-ranking papers. If you invest a lot of monetary and human resources in a particular field, you will make some discoveries sooner or later, but this might not necessarily lead to scientific breakthroughs. We should give young people the freedom to choose what interests them most and to explore new ideas—even if they are not in the mainstream and come from a completely different perspective. This is usually how great discoveries come about.

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