CHINA – A PARTNER IN TRANSITION

The Max Planck Society has maintained close relations with China for almost 50 years. The country has undergone a rapid development in recent years and is currently on a par with Europe and the U.S. in terms of research. As the Max Planck Society's Vice President Klaus Blaum explains, this poses entirely new challenges for collaborative research.

A black and white photo shows two men sitting side by side on a sofa below an image of Mao Zedong, the "Great Chairman" of the Chinese Communist Party. Taken in Beijing in April 1974, the photo shows Reimar Lüst, the then President of the Max Planck Society, in conversation with Wu Youxun, Vice President of the Chinese Academy of Sciences (CAS). That meeting laid the groundwork for an extraordinarily successful collaboration during the following decades, which undoubtedly contributed to China's scientific rise.

In the beginning, the collaboration primarily involved educating and providing advanced training for scholarship holders, who initially came to Germany in small numbers. By the early 1980s, the Max Planck Society already had its own guest laboratory at the CAS' Institute of Cell Biology in Shanghai, which gave numerous German researchers an opportunity to collaborate with their Chinese colleagues and to teach young Chinese researchers. The first independent junior research groups were then established in 1995 and were modeled on Max Planck research groups. Their purpose was to encourage young Chinese researchers living abroad to return to China. The program introduced a range of important elements such as international calls for tenders and independent peer reviews by

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VIEW POINT

KLAUS BLAUM

ILLUSTRATION: SOPHIE KETTERER FOR MPG

Klaus Blaum studied physics at the University of Mainz, where he received his doctorate in 2000. He then went on to conduct research at CERN, where he was project leader for "Mass Spectrometry of Exotic Nuclei" between 2002 and 2004. In 2004 he took over a Helmholtz Research Group for Young Investigators at the University of Mainz and habilitated in 2006 with a study on high-precision mass spectrometry with Penning traps and storage rings. Blaum was appointed Director and Scientific Member at the Max Planck Institute for Nuclear Physics in Heidelberg in October 2007. He has been Vice President of the Max Planck Society since July 2020 and is responsible for collaborations with China among other things. For many years, Klaus Blaum has personally maintained close scientific collaborations in the Asiatic region.

international scientific advisory boards. Young Chinese researchers were then willing to forgo promising career prospects in the U.S. in favor of management roles in these groups. About a third of all Chinese research and development management positions are currently held by people who received their scientific training in Germany.

At the celebrations held to mark the 40th anniversary of the Max Planck Society's collaboration with China, Peter Gruss, then President of the Max Planck Society, said that: "Conditions were anything but stable in the early days of our collaboration, because it began in the middle of the Cold War and at a time when Chinese life was dominated by the Cultural Revolution. It took a great deal of courage and foresight to build a partnership between Germany and China at that time." Later, I would like to say more about the courage and foresight we need once again in the present, as the political framework conditions are changing once again. But first I would like to review the changes China has undergone during the past decade, particularly in the field of research.

China now has the second biggest economy in the world after the U.S. Whilst China's share of world trade only totaled 2.3 percent in 1995, it had already risen to 10 percent by 2019 (UN estimates). According to Bloomberg, China invested $377 billion – or 2.4 percent of its GDP – in research and development in 2020, which puts them on a par with the eurozone. And this development is set to accelerate in the coming years.

CHINA IS INCREASING ITS SPENDING BY ALMOST ELEVEN PERCENT ON BASIC RESEARCH ALONE

According to the five-year plan for 2021 to 2026, which was recently signed off in Beijing, China will increase its research and development budget to match that of the U.S., thus establishing the course for coming scientific developments. This year, spending will rise by almost eleven percent in basic research alone, with the primary focus on future technological innovations in fields such as quantum information technology and artificial intelligence. They will also be focusing on information and communication technologies, semiconductor technology, biotechnology particularly in relation to brain and genetic research, space, deep-sea and polar exploration, as well as novel and raw materials.

This major research investment is also reflected in other figures: there are currently 1.82 million active researchers in China, which is more than any other country. However, this only equates to about 0.1 percent of the overall population. In comparison, the number of researchers in Germany equates to 0.5 percent of the population. Moreover, the level of education is not uniform throughout China, being extremely low in large swathes of the country (in the hinterland in the west and north of China), which is why the government is concerned that the backwardness of the rural regions could have a negative effect on China's rise in the near

future. China has also caught up in terms of the number of scientific publications: the country produced 19 percent of all scientific publications worldwide in 2017 – more than the U.S. However, the EU member states, which together account for 26 percent of scientific publications worldwide, continue to lead the field. More importantly though, China's output has long since ceased to be a question of volume alone: for example, the CAS now ranks first – ahead of both Harvard University and the Max Planck Society – in the renowned Nature Index, which evaluates the number of top scientific publications. According to the Index, nine out of the ten most improved universities are in China, in addition to which, China already accounts for the majority of the most cited scientific publications. This applies to computer science and cybernetics (80 percent) and to automation control, nanoscience, nanotechnology and electrochemistry (50 percent).

So there is no longer any doubt about it: from a scientific perspective, China is on par with the U.S. and Europe. For decades, Chinese governments have been promoting science by looking extremely closely at the factors that have made the West and other parts of the world successful – by observing, adopting, and adapting them to Chinese conditions, and by doing so with a very long-term perspective. Whereas only 20 percent of Chinese studying abroad returned home after completing their studies in the year 2000, the figure now stands at 80 percent. China is attractive to its own people. Both the CAS' 100 Talents Program, which primarily recruits highly promising young people from China and abroad, and the Chinese government's 1000 Talents Program, which provides resources to permanently recruit top talents to Chinese universities, as well as to temporarily appoint international experts from leading universities or research facilities abroad, have also contributed to this development.

Every year, the Max Planck Society welcomes around 1400 research fellows from China, which represents the largest contingent of foreign researchers out of a total of 9000 research fellows per annum. Fifteen percent of our postdoctoral researchers and PhD candidates are from China. Many postdocs return to China and, in the case of particularly distinguished young researchers, continue their association with the Max Planck Institute at which they carried out their research for a further five years via a partner group. To date, 32 of the current 36 former partner group leaders have been appointed to senior scientific positions in China. These researchers form part of a network in China, established over many years, upon which we can draw. We are also currently participating in almost 200 collaborative research projects with China, which include research by the Max Planck Institute for Chemistry on the impact of air pollution and climate change in the Yangtze River Delta, the Max Planck Institute for Solid State Research's joint search for new materials with novel properties, and projects being carried out by the Max Planck

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Institute for Psycholinguistics involving the synthesis of mechanistic and neurobiological language models. The CAS continues to be our most important collaboration partner. Teams from the Max Planck Society enjoy privileged access to the CAS' excellent infrastructures, some of which are globally unique, in such fields as radio astronomy and gravitational wave research, biophysical chemistry, ecology and behavioral sciences. Both sides benefit from these collaborations.

CHINA IS INCREASINGLY INVESTING IN ITS SOPHISTICATED SCIENTIFIC INFRASTRUCTURE

China is increasingly investing in its own sophisticated scientific infrastructure, such as a high-energy synchrotron radiation source for materials science, which is roughly equivalent to what will be achieved at the Deutsches Elektronen-Synchrotron (DESY) in Hamburg by the mid-2020s, which the state has been constructing for around two years. In astrophysics and astronomy, China has already put the world's largest radio telescope into operation, with a primary reflector measuring 500 meters in diameter. In comparison, the diameter of our radio telescope's reflector in Effelsberg is about 100 meters, although ours is fully steerable. A new interferometer facility for gravitational wave detection, based on a completely new technique, and a heavy ion accelerator facility to generate radionuclides for basic research and medical applications, similar to the Facility for Antiproton and Ion Research (FAIR) in Darmstadt, are also under construction. And in the field of particle physics, a Circular Electron Positron Collider, with an acceleration length of 50 to 70 kilometers, is being planned in Hebei Province. Again, to put that into perspective, the Large Hadron Collider at the European Organization for Nuclear Research (CERN) in Geneva is 27 kilometers long.

It is evident that China is pushing for the global lead in numerous fields of research with large-scale research facilities whose developers frequently received their training in the West, many at Max Planck Institutes. But China is also aware that scientific progress requires transnational collaboration and is therefore dependent on acceptance by the global science community. Nor must we ever lose sight of the fact that we are facing many global challenges that we will only be able to overcome together, with the aid of international scientific collaboration, a fact that the global pandemic has recently brought into sharp relief. Knowledge has rarely been shared so rapidly and comprehensively among the international scientific community, as occurred in the development of solutions to contain the pandemic. The other major challenge that we will only be able to meet by joining forces on a global scale is climate change and the problems involved in supplying the world's burgeoning population with CO_2-neutral power. Against this background, a strategic collaboration with China in certain research fields is essential. Yet, as fruitful as the collaboration with China in the natural sciences may be, especially in those fields covered by the Chemical-Physical-Technical Section, for which I am responsible as

Vice President, collaborations in other research areas, such as the social sciences, is more challenging and we have witnessed a considerable worsening in recent years. For example, research into the living conditions of Uyghurs in Xinjiang, which began in the 1990s, has been increasingly restricted; virtually no research has been possible on the ground since 2016, since which time our researchers have been denied research permits for this region. We will, however, continue to publish the research results, even if the Chinese government does not like it: we at the Max Planck Society will not submit to any kind of self-censorship. So we are not optimistic about every development in China. Whilst the emphasis in the natural sciences is on excellence in compliance with international standards – which is very much in line with Max Planck Society principles – researchers in other disciplines, such as the social sciences, are encouraged to work on "Chinese theories" and to carry out applied research primarily aimed at solving national problems, which makes it difficult to find any common ground internationally. It has also become more difficult for some of our colleagues in the arts, social sciences, and humanities to carry out effective field research, because their counterparts in China have become more cautious about researching subjects such as political processes, as a result of which the number of contact partners is decreasing as are opportunities for on-site discussion and for accessing data and materials.

The tightening of the European Union's foreign trade legislation and sanctions imposed against China by the U.S., which have resulted in a ban on supplying certain technologies from the U.S. to China without approval, may also significantly restrict collaboration opportunities for German researchers in China. China's legislative processes on research and development are another issue we are closely monitoring: the People's Republic is planning a raft of legislation, for example on the use of research data generated in joint projects carried out in China, that could potentially have a direct impact on research collaborations. Research collaborations with our Chinese partners would certainly become much more difficult were such laws actually to come into force in their present form.

SO WE ARE NOT OPTIMISTIC ABOUT EVERY DEVELOPMENT IN CHINA

So how should we engage with this emerging China at this point? First, we will have to accept the ambivalence and, in spite of everything, seek collaboration in all those areas in which it makes sense and is mutually beneficial. As was the case in 1974, we need courage and foresight – the courage to defend our own values and standards, and the foresight required to pursue the partnership with China in a prudent and fair manner. We need transparency in terms of the organization and management of our partnership. We must avoid any unilateral knowledge transfer. And we need to ensure that we share a common understanding of "good scientific practice," especially as it pertains to research ethics

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(for example, in relation to the collection of personal research data), dual use risks, and the protection of intellectual property. Nor should we be afraid to repeatedly stand up for our concept of academic freedom. It was not for nothing that the campaign carried out by the German science organizations to mark the 70th anniversary of the principle of academic freedom was conducted under the maxim "freedom is our system!", as is instituted in the Basic Law of Germany.

The Max Planck Society Senate adopted a set of guidelines to shape international collaboration in a meeting held in March 2021. These are intended to provide our researchers with guidance in relation to foreign collaborations where conflicts arise between academic freedom and legal and ethical responsibilities. Two of the Max Planck Society's in-house governing bodies – the Ethics Council and the Committee for Ethics in Security-Relevant Research – provide advice to all Max Planck researchers. We need to address dual use issues, i.e., research that could produce results or technologies that could be misused by third parties, such as research that could contribute to surveillance technologies. The purpose of these guidelines is to sensitize people not to naively enter into collaborations and to think carefully about what they want to achieve through a given collaboration and, if necessary, to say no if the conditions are not appropriate or if too many compromises would be required.

WE NEED TO FURTHER STRENGTHEN AND CONCENTRATE OUR CHINA EXPERTISE AT ALL LEVELS

We also need to further strengthen and concentrate our China expertise within the Max Planck Society at all levels and to ensure that we communicate about the current state of play of our collaboration with China. This would involve discussing our experiences and evaluating current developments. To this end, the Max Planck Society has established a "China Round Table" under my chairmanship, an internal council of experts, which, among other things, assesses best practice examples for collaborations with China. Starting in summer 2021, we will also be offering lectures and workshops for all of the Max Planck Society's scientific staff aimed at boosting their China expertise. Additionally we intend to put more effort into motivating our young researchers to spend time in China for research purposes. After all, far more young Chinese are familiar with Europe and the U.S. than young Europeans with China. All too often we only set our sights on the U.S. We need to increase interest in China as well as collaborating with China and familiarize ourselves with China's cultural idiosyncrasies. Over around 50 years, our collaboration with China has seen some very good times but also more difficult periods. While the events in Tienanmen Square in June 1989, for example, placed a strain on relations, that did not lead us to suspend our contacts with China, in contrast to certain other international organizations. We were guided by the idea that the sanctions imposed by the international community were

having a negative impact on precisely those people who were already suffering from what was happening in China at the time. We initially avoided official contacts but continued our involvement in scientific programs and projects as far as possible. This created trust, which is an important social basis for collaboration, especially in China.

Moreover, the only way in which we will be able to influence further developments in China will be through collaborative endeavors. Scientific contacts can keep doors open that, for good reasons, have to remain closed in other areas, or which are completely locked. The Max Planck Society has gained a great deal of experience in this area, and I am optimistic that individual contacts among researchers in particular will continue to serve as a driving force for German-Chinese collaboration.