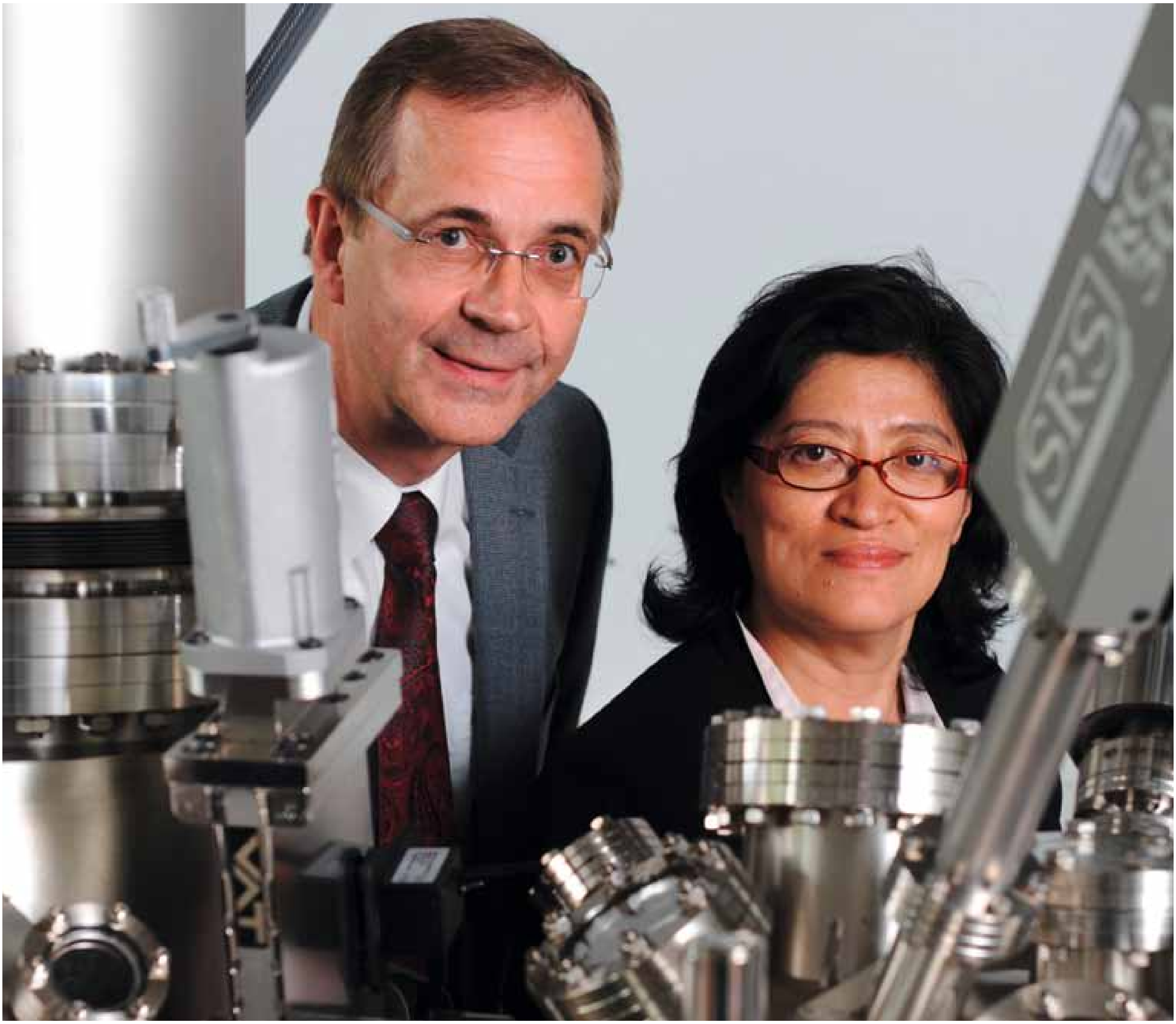
Partners in Research

The DFG Collaborates with China to Promote Science
Ten Years of the Sino-German Center in Beijing



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A Special Edition by the German Research Foundation (DFG)

A Unique Combination

Early beginnings, bright future: The long-term close cooperation between the DFG and its partner organisation, the National Natural Science Foundation, manifests itself especially in the Sino-German Center for Research Promotion.

On 19 April 2010, FOCUS magazine headlined: "China Getting Dangerously Good: The billion people empire is much further along than we think. Will 'Made in Germany' survive?" The title story speaks to an image of China – oscillating between fear, speculation and admiration – that has been cultivated by the German media for years, especially on economic relations. So what does China look like from the vantage point of science, especially basic research?

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) decided in 1996 to enter into a close cooperation with a Chinese partner organisation, the National Natural Science Foundation of China (NSFC), to take advantage of the opportunity arising from this unique combination of two research funding organisations and their expertise. Together with the NSFC, the DFG established in Beijing the Sino-German Center for Research Promotion (SGC), which – after several years of contract negotiations and construction planning, and about one year of actual construction work – was inaugurated in the year 2000. This joint venture was preceded by many years of contractual relations; the first contract was signed as early as 1988, two years after the NSFC had been founded. The SGC was the DFG's first international representation, established even before the DFG liaison offices in Washington, Moscow, New Delhi and Tokyo.

China continues to develop at a breathtaking pace, often taking several steps at a time as it advances from a developing to an industrialised nation. A side effect of this rapid progress is that some steps may be startling to those who don't actively keep up with China's evolution, and that other steps may not be in line with international standards, as evidenced by an occasionally lax observance of good scientific practice. But many of these big steps engender admiration for a people that often needs just one generation to make the kind of development that took today's industrialised countries two or more generations.

I see great opportunities in scientific cooperation between Germany and China. On 19 October 2010 we celebrated the tenth anniversary of our close, successful and – most importantly – trusting collaboration. This collaboration, which manifests itself also in our shared building, works as well as it does also because all the players have known each other for many years and have established, across cultural differences, effective mechanisms to jointly promote bilateral research using a variety of funding instruments.

Content

Together, the DFG and the NSFC have already identified a number of topical areas in which cooperation seems especially worthwhile. For example, we have announced calls for proposals on stem cell research, water management, and inverse problems in mathematics. The first two transregional Collaborative Research Centres deal with nanotechnology and immunology.

Over the next decade, collaboration on energy research – especially solar energy – , biodiversity research, and food safety research seems especially promising. Other areas that come to mind are the combination of traditional Chinese medicine with methods and approaches of conventional Western medicine, as well as joint research into infectious diseases. Many other topics will arise over the next decade of collaboration. Both the DFG and the NSFC are science-driven and quality-oriented research funding organisations. They can respond flexibly to new ideas generated by the scientific community and, having evaluated them positively, support them with the most suitable funding instruments.

One of the many topics that will be the focus of bilateral research funding in the coming years seems especially important and exciting to me: A growing world population with increasing life expectancy uses more and more energy. Scientists expect that our total energy consumption will double by 2050 if the current trend holds. Fossil fuels are not sustainable, which is why we must become independent of them. Solar energy offers a number of promising alternatives. We are in an excellent position to pursue joint endeavours in these highly attractive fields of research with leading experts from China and Germany. Basic research in chemistry, physics and materials science will be key here. We have an enormous amount of research to do together, in these and many other disciplines.

Prof. Dr. Matthias Kleiner
President of the DFG

Statements by Annette Schavan, Federal Minister of Education and Research (p. 6), Michael Schäfer, Ambassador of the Federal Republic of Germany to China (p. 8), and Helmut Schwarz, President of the Alexander von Humboldt Foundation (p. 36)

Cover image: Nanoscientists Harald Fuchs and Chi Lifeng from the University of Münster with a low-temperature atomic force microscope.

From the Field

A Joint Venture for Science

The Sino-German Center in Beijing turned ten

DFG

You have to build nests to lure birds, says a Chinese proverb. Perhaps that is one reason why scientific cooperation between Germany and China has its own address. Right next to the building of the National Natural Science Foundation of China (NSFC), the NSFC and the DFG opened the Sino-German Center for Research Promotion (SGC) as a joint venture in October 2000. The mission of this institution is to increase contacts between German and Chinese researchers, function as a catalyst for joint research projects, and provide funding for them.

At the stroke of a key, the Internet search engine's map feature locates the address: Shuang Qing Lu 83, on the northwest side of the capital. Beida, the world-renowned Beijing University, is close by, and just one block further is the Beijing Forestry University. It's about one kilometre to walk to the east gate of the renowned Tsinghua University. Even in old China, the Haidian neighbourhood was a business centre within the capital, located not far from the imperial summer palace. After the Cultural Revolution ended 30 years ago and the country increasingly opened itself to the world and the West, a young, dynamic high-tech industry developed quite rapidly here amidst numerous academic institutions.

That's why it may have been an obvious choice for the NSFC – the DFG's partner organisation in China, established in 1986 – to set up its head office in this environment, and for both organisations to erect here their joint centre for the intensification of scientific collaboration. The SGC building also houses eleven apartments to accommodate researchers while they visit Beijing, as well as an auditorium for about 350 people, equipped with a simultaneous interpreting system. And modern video conferencing technology shrinks the distance of 7,815 kilometres between Beijing and Bonn, where the DFG is headquartered, to the length of a room.

Shuang Qing Lu 83: Since its inception, the SGC has been seen worldwide as a symbol of successful cooperation on research funding.

This morning, a technician at the DFG Head Office in Bonn is setting up the connection at 8:00 AM. The conference table opens toward the front of the room, where we look at two large wall monitors. On one screen we can see ourselves; the other one shows our discussion partners in Beijing, where it's 2:00 PM right now. If we look straight into the camera, we can make eye contact. On the table, both here and there, are sensitive microphones. And when we talk to each other, we feel the distance only in the slight delays that slow down the conversational flow a bit due to the signal transmission times.

I learn that even now, after a whole decade of successful collaboration, both research organisations still consider this a unique undertaking. "When we decided in 1998 to establish the SGC as a joint venture of the NSFC and the DFG, and that we'd want a dedicated building to promote collaboration between Chinese and German researchers, we knew we were in for an adventure," says Harald von Kalm, who heads the DFG's Central Administration Department. "No one could know whether an administrative body materialised in this manner would actually be able to work successfully. And of course we also had some doubts whether it would be a good idea to invest a lot of money into the infrastructure of a building, on top of actual research funding."

In the mid-1990s, after the plan to establish a joint institution had matured between both research organisations, one thing followed another. On 26 May 1998, Ernst-Ludwig Winnacker and Zhang Cunhao, the presidents of the DFG and the NSFC at the time, already laid the cornerstone for the common building – accompanied by the sounds of the Bavarian Welcome March, a tribute to the German partner. The cost of the new construction was shared evenly, with the German portion of five million deutschmarks provided by the Donors' Association for the Promotion of Sciences and Humanities (Stifterverband für die Deutsche Wissenschaft). On 19 October 2000, the Sino-German Center for Research Promotion opened its

Adventure and tour de force: Cornerstone ceremony in 1998, construction phase, opening ceremony on 19 October 2000 – the Sino-German Center for Research Promotion in Beijing has been a prominent symbol of the increasingly close relations between the Deutsche Forschungsgemeinschaft (DFG) and the National Natural Science Foundation of China (NSFC). These relations are also embodied by the Center's leadership (left to right): Zhao Miaogen (Vice Director on the German side) and Armin Krawisch (German Director), Han Jianguo (Chinese Director) and his deputy Chen Lesheng.

doors – poignantly enough, with a Chinese-German symposium on complex systems.

The experiment was a success. Today the SGC is seen worldwide as a symbol of successful bilateral cooperation on research funding. It has its own funding budget to support activities in Chinese-German scientific collaboration, such as workshops, symposiums, summer schools, cooperation groups, and research projects. "Altogether we've already funded several hundred projects through the SGC," says Han Jianguo, one of the two directors of the SGC. "As we pursue our mission to instigate cooperative research relationships, as well as to deepen them over the long term, we use not only the funding programmes of the SGC but also various other instruments offered by the DFG and the NSFC."

The SGC programmes focus on supporting specific bilateral research projects in the natural, life, management and engineering sciences. Thus they cover about 80 percent of the DFG's more broadly based national funding portfolio, which also includes the social sciences and humanities. "These subject priorities are based on the funding mission of the NSFC in China," explains Han, adding that "in all SGC activities, we focus especially on funding collaboration between Chinese and German researchers who are in the early stages of their careers." Of course the Center is also responsible for providing advice and information on research priorities, funding activities, and suitable partners for scientific collaboration in the other country, as well as for improving the infrastructural framework for research cooperation between China and Germany.

"From the very beginning, the idea was to set up the SGC as a true joint venture and therefore to erect a building that stands for our two organisations as well as for the experiment," says Harald von Kalm. Both sponsoring organisations agreed to establish the Center as an independent legal entity under Chinese law. Its legal representative is the NSFC Vice President in charge of international affairs. "Even today, the SGC is a truly unique institution that could serve as a model for cooperation with other countries as well," notes Armin Krawisch, the German SGC Director. DFG and NSFC each provide one director and one vice director. This four-member internal board of directors leads the Center in organisational terms and works with the sponsoring organisations to handle proposals. There are indeed differences between the German and Chinese funding systems, says Krawisch, but "we decide everything together based on review procedures that involve German and Chinese experts. Finally we make a joint decision to fund or to decline, right here at this table, in this room."

A click of the mouse, and the web browser calls up a satellite image with photorealistic details of the area surrounding Shuang Qing Lu 83. A magnified bird's eye view even shows details of the NSFC and SGC buildings. Especially conspicuous and clear to see is the footpath-crossed roof garden atop the SGC auditorium. "That was something the German side wanted," remembers Ingrid Krüßmann, who has worked for the DFG

"A key institution in Sino-German cooperation"

Successful science and research are based on international networks and dialogue across national borders. Researchers must cooperate across disciplines, countries and continents to find sustainable solutions to the urgent challenges of our times, such as climate change, increasing urbanisation, or secure energy and water supply. For this reason, the German Ministry of Education and Research supports worldwide collaboration between researchers. One of our most important partners is China.

The Sino-German Center for Research Promotion (SGC), which is run jointly by the Deutsche Forschungsgemeinschaft (DFG) und die National Natural Science Foundation of China (NSFC), celebrated its tenth anniversary on 19 October 2010. The SGC is a key institution in Sino-German cooperation and a symbol of the partnership between both countries.

Chinese and German researchers are collaborating successfully on many topics. Their specialties often complement each other. This was also seen in the many different activities during the German-Chinese Year of Science and Education 2009/2010. Under the motto "Together on the road to knowledge", this event further intensified the scientific and academic dialogue between the two countries.


BMBF

Following more than 30 years of modern scientific and technological cooperation, Sino-German cooperation has reached a scope and depth that go beyond project collaboration alone and allow institutional cooperation as well. The SGC is an excellent case in point. Sino-German research cooperation is evolving towards bigger, more long-term, institutionalised forms of collaboration. It thus becomes possible to pool the two countries' respective areas of strength and establish joint centres of excellence. China and Germany will work closely together on key issues of the 21st century as equal and complementary partners. The SGC will continue to play a major role in this endeavour.

Prof. Dr. Annette Schavan, Member of the Bundestag
Federal Minister of Education and Research

Video conferences between participants in Bonn and Beijing are another method – in addition to the usual Internet-based communications – for facilitating close contact between NSFC und DFG.

from the very beginning on developing the SGC, and today, as a DFG Director for International Affairs, provides scientific support to the SGC, in addition to her responsibility for the East Asia region. She admits that there were some disagreements on what should be done and what the building should look like. For example, the German architect wanted to put the entrance in the middle of the building, whereas his Chinese colleague insisted on positioning it on the left side. But with all delays and in spite of a rather lengthy discussion process early on about the rules of cooperation, "in the end we always worked it out somehow."

"This is my third visit to your country," said Johannes Rau, then the President of the Federal Republic of Germany, when he spoke before students at Tsinghua University in September 2003 about the role of Germany and China in the world. His previous visit had been in 1998, and he was curious to experience the rapid processes of change and development in China. "I can say without exaggeration that I've come to a new country," said Rau in 2003 and quoted from a reportage book he had read to prepare for his trip. In it, he had found a dialogue between a foreigner and a Chinese historian, in which the Chinese says this about the pace of reforms and the changes they brought about in the nation: "We used to get maybe two big changes and three small ones in a whole year. But since 1993 or 1994, the wheel has been turning faster and faster. You wake up and you're relieved to see that your bed is still in the bedroom."

Germany's President at the Center

Johannes Rau also visited the SGC, just a few blocks away. "There have been a number of important events over the years here at the Center," says Han Jianguo. "Probably once a week the auditorium fills to the last seat. But I'll never forget the visit by President Johannes Rau." I ask him about his experience of the changes. Well, he says, it starts with traffic conditions in the city, which have become increasingly complicated. "Around midnight, it's maybe 15-minute drive to get here from Tiananmen Square, which is the heart of Beijing. But in the morning during rush hour, it'll take you easily 1½ to 2 hours." "Right

"Germany and China are important centres within the global education system"

In October 2000 the Sino-German Center for Research Promotion (SGC) was established in Beijing jointly by the National Natural Science Foundation of China (NSFC) and the Deutsche Forschungsgemeinschaft (DFG). This made it possible to significantly expand and deepen bilateral cooperation on basic research in the natural, life, engineering and management sciences. The SGC is a symbol of our friendly and forward-looking scientific cooperation.

Germany and China are important centres within the global education system. Both countries can look back on long traditions that highly value the acquisition of new knowledge.

I am especially pleased that the SGC also provides intensive support for the mobility of early-stage researchers, for example through the Lindau Programme. This builds bridges between young talent and leading scientists that expand and ultimately institutionalise international networks in top-level research.

Our bilateral cooperation needs people on both sides who know and understand their counterparts' culture, traditions and language. We have made significant progress in recent years on mutual understanding, and the SGC has been instrumental to it. But we can and must do even more to further expand collaboration among the world's best minds.

I am convinced that if we keep integrating young talent into bilateral research collaboration, we will continue to be able to tap many new areas of cooperation. Germany and China together will be able to make a major contribution to solving urgent economic, social, political and scientific problems. In this spirit, I wish the SGC much continued success. The German embassy will continue to support the Sino-German Center for Research Promotion.

Dr. Michael Schaefer
Ambassador of the Federal Republic of Germany in China

now they're building a metro line to the Sino-German Center. There's a lot of construction going on in general," reports Armin Krawisch, "which unfortunately tends to replace the old, typical Beijing cityscape with a somewhat blandly modern, international style of architecture."

In 2003, more than 13,000 Chinese students were enrolled at German universities – and in Germany, as Johannes Rau noted in his Tsinghua speech, studying in China was already considered an "insider tip and additional qualification" for professional life: "These young people demonstrate the interest that our countries take in each other. At the same time, they ensure that the relationship between our countries will continue to be characterised by understanding and friendship."

So what has the SGC experience been like? For example, do German and Chinese researchers always understand each other right away? "Generally speaking, communication has not been an issue," says Han Jianguo. Besides, scientific exchange between Germany and China harks back to a long tradition. "Consider Johann Adam Schall von Bell, a German Jesuit who garnered great respect as a scientist in the old China. In 1644, Adam Schall was even appointed President of the Imperial Astronomical Bureau by the Emperor." Armin Krawisch agrees that there are no major obstacles to scientific exchange, especially because English serves as the lingua franca of science, also between Germany and China:

"We notice in younger researchers that mutual cultural understanding is improving. Part of the reason is certainly that more and more Chinese researchers have been on visits abroad, and that number continues to grow."

In mid-2005, the Center underwent an evaluation, coordinated on

Evaluation reveals potential.

the German side by the Institute for Research Information and Quality Assurance in Bonn. One of the questions under investigation was whether the original SGC concept had stood the test of the rapidly changing times in China. After all, the nation's research output – starting from a relatively low baseline – had more than tripled since the mid-1990s, while in Germany it had remained stagnant, albeit at a high level. While China increasingly pushed priority topics, research in Germany continued to be topically diverse. The evaluation, by peer review through a panel of experts from China and Germany, came to a generally positive conclusion. "It has helped us realign our funding programmes," says Ingrid Krüßmann. "And even the review process itself brought new light to our mutual understanding," says Armin Krawisch, noting that the two countries come from different traditions of scientific review. For example, criticism in China tends to be formulated in a more restrained and indirect manner.

The powerful potential of the SGC was apparent when the new SARS virus broke out in south China early in 2003. Together, the DFG and the NSFC were able to respond quickly

The SGC in the focus of politics: German President Johannes Rau also paid a visit to the Center when he travelled to China in 2003.

and efficiently. When, shortly after SARS had been introduced to Germany, virologists at the Bernhard Nocht Institute in Hamburg were able to isolate the new coronavirus and to identify it in international collaboration as the cause of the disease, the SGC sponsored a symposium in Beijing in June of 2003. It gave a small delegation of German scientists the opportunity to discuss with Chinese colleagues all aspects of the SARS epidemic and the resulting need for research. "This example of our work clearly points toward the future of our Center," notes Armin Krawisch. "Going forward, we'll provide even more comprehensive information on our website about new scientific developments in both countries. I think the Center will increasingly become also a forum for information and communication."

Han Jianguo is likewise convinced that the SGC is set to play an important part in German-Chinese scientific relations in the years to come. "Our special opportunity is that we're well networked with both the German research organisations and the Chinese funding institutions." And while the humanities are outside of the NSFC's funding spectrum and such research projects can therefore not be funded via the SGC, even this researcher species has been sighted at the SGC – at night, as residential guests. When it comes to accommodations, all disciplines are equal: first come, first served.

Dieter Beste

Shen Wenqing, Vice President of the NSFC, visits DFG President Matthias Kleiner at the DFG Head Office in Bonn.

Paddy Fields in Flux

A German-Chinese Research Unit is studying paddy rice soils in the Yangtze Delta which have been cultivated for different lengths of time to discover the underlying biogeochemical processes.

What happens to soils which have been cultivated by man for very long periods of time? What, for example, takes place within the extremely wet soil in which rice plants, which are particularly thirsty, are grown? In order to thrive, they must stand several centimetres deep in water during their maturing season; this is why the farmers dam their fields to keep the water till harvest time. In Southeast Asia, people have been using this method to grow rice for thousands of years. Noone, however, knows exactly how the soils, which are known as paddy soils, react to this treatment.

By providing a unique soil archive, China's Yangtze Delta provides an opportunity to gain an answer to this question. Because river deltas are constantly being enlarged by the deposition of sediments, the farmers in the Yangtze Delta have kept building new dams and, over the centuries, have gradually added the extra land to their paddy fields. Historical sources enable the dams' origins – and thus the age of the paddy soils – to be precisely pinpointed: they range from 2000 year-old soils at the delta's interior to 50 years young at its edge. This has provided scientists with a well-documented chronological sequence, enabling them to examine paddy soils which have been cultivated for different lengths of time and to compare them with non-irrigated control soils of up to 700 years old.

It was an unusual sight for Chinese eyes when, in summer 2008, a group of German researchers of both genders, clad in sun hats and either barefoot or wearing wellington boots, descended on a rice field in Cixi, in the larger area of the Yangtze Delta, to take soil samples and dig soil profiles. "The Chinese found it incredible that women were carrying out fieldwork", remembers Ingrid Kögel-Knabner, a professor of soil science at the Technische Universität München in Weihenstephan. For her personally, the expedition was also an unusual one, as the geoecologist had no previous experience with paddy soils. Several years ago, however, she was approached by Professor Cao Zhihong. The researcher from the Institute of Soil Science at the Chinese Academy of Sciences in Nanjing was looking for soil science experts in Germany to research paddy soils. Kögel-Knabner was immediately excited at the prospect of a collaboration project.

Rice is the most significant staple food in the world. In 2008, farmers around the world produced 661 million tons of rice on just under 155 million hectares of land, with almost a third of this amount being grown in China alone. The lion's share of rice is cultivated using artificial irrigation in flooded fields or terraces. It is not, however, merely the huge area on which this grain is grown that is impressive. Instead, the length of time for which humans have been cultivating rice is remarkable. According to German ^{14}C analyses, the earliest evidence of domesticated rice cultivation in China dates back around 6000 to 7000 years, with Chinese researchers assuming that it was being cultivated as long ago as 8000 years. "Of course," Kögel-Knabner explains, "every Asian country wants to be the first to have developed rice cultivation." Together with Cao, who is particularly interested in the project's archaeological aspect, she organised a workshop (supported by the Sino-German Center) on prehistoric paddy soils. A further workshop, this time focusing on more recent developments, followed. This resulted in the establishment of the "Biogeochemistry of Paddy Soil Evolution" Research Unit in 2008. This Research Unit is funded by the DFG and involves numerous institutions in Germany and three in Nanjing. The researchers involved are concerned less with the fossil soils and more with the recent paddy soils.

Soils are complex systems of mineral and organic substances whose physical, biological and chemical makeup is constantly changing. One important factor in their development is their reduction potential, which provides information about the availability of oxygen in the soil. In redox reactions, which usually involve microbe catalysts, electrodes are transferred from a donor, the reducing agent, to a recipient, the oxidising agent. Substances which accept the electrons and give off oxygen are reduced; those which donate electrons and absorb oxygen are oxidised. This type of process influences the weathering of minerals, the mobility of nutrients and pollutants, microbial activity and, thus, the conversion of organic soil matter.

Ploughed, or well-aerated, soils in temperate zones are oxic: oxygen is present in sufficient quantities and the reduction potential is high. In relatively dry winters, the sub-tropical Yangtze Delta follows this pattern.

Researchers from Research Unit 995 take soil samples from a 300-year-old rice paddy in the Zhejiang Province of the Yangtze Delta.

This is when the farmers grow wheat and other field crops. The rainy summer, on the other hand, is the season for paddy rice. The water, however, has drastic consequences for the deeper soil layers, as microorganisms accept electrons and very quickly exhaust the available oxygen. While the rice plant in the rhizosphere, the root zone, uses aerenchyma to continue to ensure oxygen supplies, the earth below becomes anoxic, and reduced substances lower the reduction potential. "There's a real redox cascade happening," explains Kögel-Knabner. First, nitrogen is reduced to dinitrogen and nitrous oxide. Manganese, iron and sulphur follow before methane is released.

The periodic redox cycles in paddy soils have a tremendous effect on the dynamics of long-term biogeochemical processes. The water affects what is washed out and what becomes bonded, determining which clay minerals, which iron oxides and how much humus are available to act as ion exchangers for nutrients and pollutants. An oxygen-free environment quickly results in considerable loss of nitrogen, the growth engine for all plants, which evaporates as a gas. In principle, however, the changes for the soil and the yield from the extremely undemanding rice plants are obviously neither good nor bad.

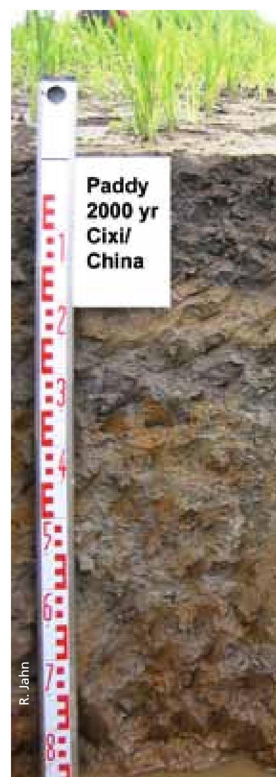
There are, however, relevant ecological effects. Comprehensive studies prove that paddy soils – like swamps – are one of the world's largest sources of methane emissions. They contribute between ten and 25 percent of the greenhouse gases in the atmosphere. The carbon compounds photosynthesised by the plants remain in the soil as field residues, where anaerobic bacteria break down the organic substances under conditions of extreme reduction. They cause fermentation and produce methane. Paddy rice cultivation interspersed with winter wheat cultivation is less damaging to the environment.

For the first time, however, the Research Unit has now used the chronosequence to quantify a reverse process for the climate. Paddy soils accumulate organic substances, and thus carbon. Their concentration in paddy soils is much higher than in unirrigated soils, and it increases with age and depth. Loose organic material transported downwards will stabilise itself, ensuring that microorganisms do not decompose the dead plant material as efficiently due to lack of oxygen. This means that less methane and CO_2 is released into the atmosphere. One of the triggers is the rapid decalcification of the paddy soil; not only does the leaching of calcium mean that the pH buffer is missing, it also accelerates weathering reactions.

In order for the carbon compounds to be stored, they must bind to minerals. According to Kögel-Knabner, it is probably the more intensive weathering which has created these conditions by reducing the stone to tiny particles of clay, thereby releasing iron oxides and increasing the specific surface of the mineral phase.

In continuing to analyse and evaluate the soil samples and profiles in the lab, the Research Unit still has much to do. The German and Chinese researchers anticipate exciting results from the quantitative assessment of the biogeochemical processes in rice soils.

Marion Kälke



Iron renders soil evolution visible: iron oxides dye young paddy soils brown, while reduced iron, which is readily soluble and extremely mobile, leaves the 2,000-year-old soil looking pale.

The Moods of the Monsoon

Using sediment cores from the South China Sea, geoscientists from Kiel and Shanghai discovered how closely the climates of East Asia and Greenland are interconnected.

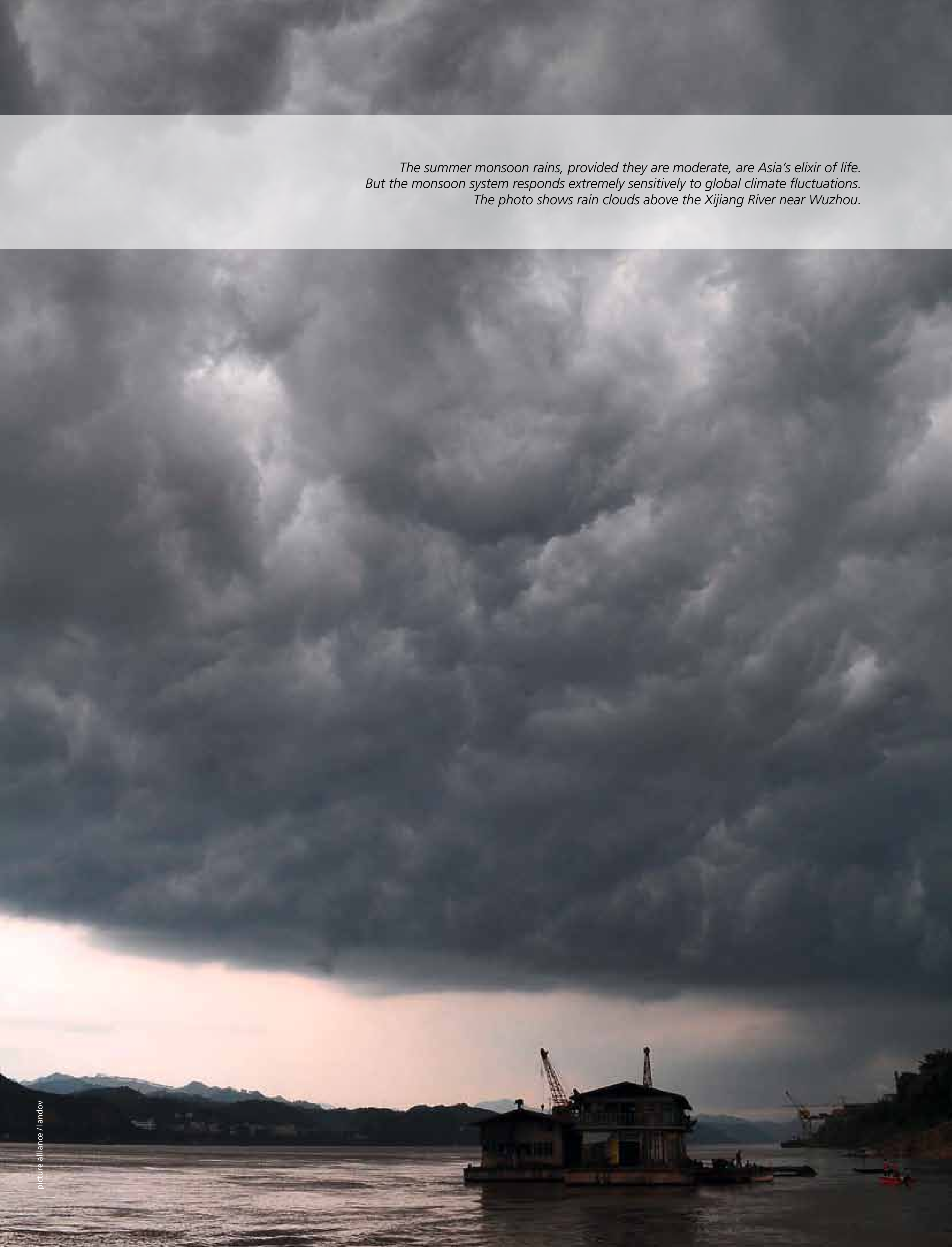
Farmers and fishermen in China and Vietnam would be absolutely astonished if someone tried to explain to them that their monsoon is closely tied to Greenland's ice, located thousands of kilometres away. They are happy if the summer wind brings the right amount of rain and if the fishing grounds off the coast are plentiful. But, over the course of the Earth's history, precisely this has been found to be closely tied to conditions in the high north, a phenomenon that climate researchers call teleconnection: two instruments play in sync in the orchestra of the world's climate. "If it is warm in Greenland, there is a large amount of precipitation in South Asia", says Michael Sarnthein, professor emeritus at the Institute of Geosciences at the University of Kiel. "And, if an extremely cold phase occurs in Greenland, the monsoon collapses here. An atmospheric control by the West Wind Drift is responsible for this."

The first researchers to verify this teleconnection were the teams of Sarnthein and Professor Wang Pinxian from the Department for Marine Geology and Geophysics at Tongji University in Shanghai. The "Monitor Monsun" expedition was the first systematic study in the South China Sea. This work was undertaken using the German research vessel "Sonne" in 1994 and funded by the German Federal Ministry of Education and Research (BMBF) and the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation). The comparison of the sediment cores collected there with the Greenland ice cores showed clear parallels between the monsoon intensities and climate changes in the north. Their results were confirmed a short time later by a research group that studied stalagmites in the Hulu Cave near Nanjing. "Today, it is that study which is always cited. That's the way the world is." Sarnthein smiles shrewdly. "Even though we had previously cleanly linked the data to one another."

The expedition was the first high point of the collaboration and friendship between the two researchers. They met in 1981/82 when Wang was a guest in Kiel as a Humboldt Professor. Living abroad, Wang became acquainted with what was, at the time for him, a foreign way of living and researching in Europe. And Sarnthein, to this day held in high regard above all for his climate reconstruction in the North Atlantic, found great interest in the East Asian monsoon. Following the "Monitor Monsun" project was a cooperation within the framework of the Ocean Drilling Programme and a working group of the IMAGES project (International Marine Past Global Changes Study), of which Sarnthein was the executive director. The researchers met periodically at conventions, conferences and visits, many of which were supported by the Sino-German Center. In 1998 Sarnthein was awarded the honorary professorship of Tongji University. The two remain in close contact to this day. China's government-funded 111 Programme has been in place since 2006 and enables the top institutes to invite foreign researchers. Sarnthein coordinates the guest stays for Tongji University.

"For the Chinese, research of the South China Sea was of national interest", says Sarnthein, because the fate of billions of people is dependent on the monsoon. Normally, its seasonal change of direction, a response to the continental high- and low-pressure cells, brings a cool, dry winter and a warm, wet summer. Depending on the season, these changes affect the current intensities and direction in the sea, the surface temperature of the water as well as its salinity. If this system falls out of sync, droughts or floods may result. The need to understand the driving force behind this is of great importance to everyone who is directly affected. A look back in geologic history, into the diary of the sediments, promises to reveal important clues that may aid in the understanding of today's man-made greenhouse effect.

The researchers concentrated primarily on the Quaternary, which began 2.6 million years ago and which includes the Pleistocene, as well as the current warm period, the Holocene. To obtain the most precise data possible, they opted for a "multi-proxy approach". Among the classic proxies – the signals from the past – are fossil planktonic and benthic foraminifera. These are unicellular organisms that store information about the temperature, salinity and carbon cycle in their lime shells and, thus, about the nutrient conditions, precipitation quantities, wind directions and water circulation as well. In addition, alkenones, which are biomarkers (fatty acids) created by microalgae, indicate how warm or cold it was in the past. From the grain size of the sediments, the researchers can also determine whether they washed up from rivers or were deposited by the wind, i.e. whether the climate was moist or if



The summer monsoon rains, provided they are moderate, are Asia's elixir of life. But the monsoon system responds extremely sensitively to global climate fluctuations. The photo shows rain clouds above the Xijiang River near Wuzhou.

picture alliance / landov

On the "Sonne 95" expedition, researchers, including Wang Pinxian, collect samples from a box corer.

Wang Luejiang leads the transport of a 6-metre sediment core.

drought conditions prevailed. The range of pollen species carried by the wind contains clues as well.

The coarse rhythms of the Earth's climate tick to an astronomic clock: the Earth's orbit around the sun varies in periodic spans of approximately 20,000, 40,000 and 100,000 years, the angle of incidence of the sunrays varies and, thus, so too does their strength. These Milankovitch cycles produce cool and warm phases, glacials and interglacials. A strong winter monsoon and a weak summer monsoon are typical for glacial periods, even more so for other, short cold stages. The

Outliers in the climate cycles

scarce summer rains mean drought for China. Inversely, the summer monsoon strengthens during the warm periods, while the winter winds wane: on land, it becomes moist.

Surprisingly, fish also do well during the interglacials: the summer winds, which blow to the north and are deflected to the right by the Earth's rotation and the Coriolis effect, result in upwelling off the coast of Vietnam, bringing nutrient-rich deepwater towards the surface. A cold or warm climate also determines the sea level: depending how much water is trapped in the polar ice, the level can, in extreme cases, fluctuate by as much as 140 metres. This has considerable impact on marine circulation: during warm periods, warm surface water flowed from the tropical West Pacific through straights near Borneo into the South China Sea. When the sea level is low, however, the straights were closed off. As a result, cool and nutrient-rich surface water flowed in from the northeast.

The high sedimentation rates of the South China Sea and the associated high temporal resolution also provide insight on the abrupt climate changes, the outliers within the large cycles. Even during our relatively homogenous warm period, there were spontaneous cold waves 8200 and 4200 years ago that were in sync with those of the North Atlantic. The history books also include records of sudden periods of warming. At the end of the Younger Dryas, the last severe cold snap prior to the Holocene, monsoon precipitation off the coast of Hong Kong increased greatly in less than 50 to 100 years. "They are very well reflected in the low salinity and in the sludge deposits from the rivers", explains Sarnthein. The sea surface suddenly warmed in all parts of the South China Sea. At this time, the temperature in Greenland had increased by 15 degrees Celsius within just a few years. "Thus, we can say with precision that the Holocene began 11,700 years ago."

During the past 110,000 years, more than 20 massive temperature jumps in Greenland have been documented. The abrupt warming was always followed by a gradual period of cooling that ended in bitter cold. All of this occurred in an interval of 1500 years. Taking their name from the discoverers, these are called the Dansgaard/Oeschger cycles. In each cycle, the climate again reversed; in every fourth to fifth – the so-called "Heinrich events" – the effect was particularly pronounced: giant icebergs broke off from glaciers which then melted in the sea water and added freshwater to the North Atlantic; this settled on top of the more dense sea water, causing the "thermohaline circulation" of the North Atlantic current system – the natural heating system for Europe – to break down, leading to particularly chilly periods. Warm Dansgaard/Oeschger cycles and cold Heinrich events find their counterpart in the fluctuations of the East Asian and Indian monsoons. The system is a highly sensitive instrument in the climate orchestra. It responds delicately to deviating tones in the atmosphere, ice volumes and the dynamics of the thermohaline pipeline pattern of the oceans.

After almost 30 years, the researchers from Kiel and Shanghai have nearly grown into a family. The memory of the young Wang Luejiang, who perished in 1999 while diving in the South China Sea, is a painful one. According to Sarnthein, who co-reviewed Wang Luejiang's doctoral research, he was a brilliant mind. They are all pioneers in palaeomonsoon research. "Wang Pinxian is the emperor in this field in East Asia", says Sarnthein, who has himself won many awards. Together, they have also experienced the change in science culture. When Sarnthein presented a paper for the first time in China in 1985, every single sentence had to be slowly and painstakingly translated. "At that time, the highly motivated Chinese students would devour the knowledge", he reports. Today, he recommends to his grandchildren's generation that "they spend some time in China if they would like to make something of their career".

Marion Kälke

"Enhancing the Bond between Our Countries"

Hand in hand for the future of Sino-German research cooperation

In 2010 the partnership between the National Natural Science Foundation of China (NSFC) and the DFG turned 22, and the Sino-German Center for Research Promotion (SGC) celebrated its tenth birthday. Professor Chen Yiyu, President of the NSFC, thanks all the researchers and contributors who are committed to cooperation between China and Germany.

In the 21st Century, scientific research is becoming increasingly international. We are seeing the growth of transnational and transcontinental scientific programmes and research activities. The global allocation of scientific resources and the flow of scientific talent across borders are also increasing. At the same time, the Earth on which we live is facing a series of global challenges, such as climate change, epidemic diseases, loss of biodiversity, and an energy crisis. These issues have become common concerns of the scientific community and of governments in all countries. The global innovation network has enabled scientists from different countries to work side by side to explore solutions to these issues while sharing their knowledge, findings and experiences as well as enhancing mutual understanding and friendship.

Science has no national borders. Both China and Germany have a long and rich history of scientific research. Scientists from our two countries have made important inventions and discoveries that benefit the whole world. Four centuries ago, the German missionaries Johann Schreck and Johann Adam Schall von Bell and their Chinese partner Wang Zheng edited and translated a number of Western scientific books. They initiated close cooperation between Chinese and German scholars, but more importantly, they bridged the gap between the Chinese and Western cultures to an extent beyond their contemporaries' expectation. Leibniz vividly described the exchange between the Chinese and Germanic peoples by saying that they should "learn from each other's merits, lighting one civilisation's lamp with that of another".

In my own research experience, I learned the significance of communication with international peers and benefited a lot from it. In my study of integrated river-basin management and ecosystem management in China, I drew lessons from the successful management model of the river Rhine. European countries had a twenty-year debate regarding the development of the Rhine. The early Rhine waterway had many bends. To reduce the negative impact, canals were built to straighten the river, but today, the Rhine is being restored to its natural state. Based on international experience as well as the situation in China, I suggested that China should treat rivers as living systems and take an integrated approach to protect their health.

As President of the Chinese National Committee for DIVERSITAS and the National Committee for the International Geosphere-Biosphere Programme, I have been dedicating myself to the mitigation and adaptation studies of climate change. I know very well that to solve global scientific issues, interdisciplinary and cross-border cooperation is indispensable. Research funding organisations

Professor Chen Yiyu is the President of the National Natural Science Foundation of China.


NSFC

Chen Yiyu and Ernst-Ludwig Winnacker, the DFG President at the time, after signing an agreement between the NSFC and the DFG.

should work hard to create a favourable environment for facilitating the cooperation and exchange of scientists and set up an open platform for cooperation and innovation. The formation of a mutually beneficial partnership between the NSFC and the DFG and the joint founding of the Sino-German Center (SGC) not only reflect the trend of international scientific cooperation, but also meet the expectations and needs of scientists in our two countries by strengthening cooperation and exchange.

Since the NSFC was established in 1986, it has been attaching great importance to international cooperation. So far, it has established partnership with 69 foreign research-funding agencies, research institutions and international organisations to jointly fund research, academic workshops and personnel exchanges. We think highly of the cooperation with Germany. The DFG was one of the first funding organisations to establish a formal relationship with the NSFC. It is also one of the NSFC's most important strategic partners. Since 1988, our bilateral relations and cooperation have made steady progress in both scope and depth. The NSFC's joint activities with Germany now include personnel exchanges, joint research projects, major joint research programmes, and SGC projects. From 2001 to 2009, the NSFC funded 600 exchange projects and 41 joint research projects between Chinese and German researchers with a total volume of 15 million RMB (1.7 million euros) and 35.33 million RMB (4 million euros) respectively, which includes, within the framework of the NSFC / DFG agreement, over 20 bilateral workshops, more than 250 exchange programmes, one Sino-German Joint Interdisciplinary Research Programme in 2008, and 11 joint research projects on stem cells and water resources in 2009. All these efforts have served as a bridge and platform for Chinese and German scientists, boosted the development of basic research in our two countries, and benefited the growth of talented researchers. The NSFC's cooperation with Germany has become a main channel and played an irreplaceable role in Sino-German scientific cooperation.

The Sino-German Center is a pioneering endeavour in international cooperation. Through bilateral workshops, joint research, collaborative groups, personnel exchanges, publications etc., the Center has made significant contributions to cooperation between Chinese and German scientists. Over the past decade, the Center has funded 410 programmes with a total volume of 300 million RMB (34.5 million euros) provided by NSFC and DFG, giving financial support to 14,000 Chinese and German scientists. In the spring of 2003, China experienced an outbreak of SARS. At this critical moment, the Center organised the Sino-German Seminar on SARS Prevention and Treatment in Beijing. The former German Federal President Johannes Rau said, during his visit to the Center, that the workshop enabled scientists to support each other in the global fight against this dangerous new virus, and both countries are benefited. Since 2004, the Center has supported 191 outstanding Chinese PhD students to attend the Lindau Nobel Laureate Meeting and visit famous German laboratories, broadening their scientific horizon. In 2008, the Center launched a new programme to support excellent young German scientists to visit and work in China for a short term. These programmes will lay a sound foundation for the sustainable development of future Sino-German cooperation.

With the support of the NSFC, the DFG and the Sino-German Center, Chinese and German scientists have made remarkable achievements in their collaboration on an equal, complementary and mutual beneficial basis. For example, research conducted by the Institute of Tibetan Plateau Research, the Chinese Academy of Sciences, and the University of Göttingen, Germany, made a breakthrough in understanding the geodynamics and environmental change of the Tibetan Plateau. A Collaborative Research Unit by the Hamburg Observatory, the Heidelberg State Observatory and the Chinese National Astronomical Observatories systematically studied the ultra-metal-poor stars in the Milky Way galaxy and their chemical evolution, and their findings contributed to the progress of the LAMOST spectroscopic survey plan. Professor Zhu Maoyan from the Nanjing Institute of Geology and Palaeontology has been collaborating with his German partners since 2000. He discovered the earliest animal embryo fossils on Earth and redated the origin of animals from 580 million years ago to 630 million years ago. The finding was published in Nature and listed as one of the Top Ten News of 2007 in Basic Research and of the Top Ten News of 2007 in Scientific Progress in China.

As mentioned above, we can see that the Sino-German cooperation is mutually beneficial and creates a win-win dynamic. The ten-year journey of the Sino-German Center has been a decade of rapid development supported by the NSFC and the DFG, and of strengthening cooperation and friendship between Chinese and German scientists.

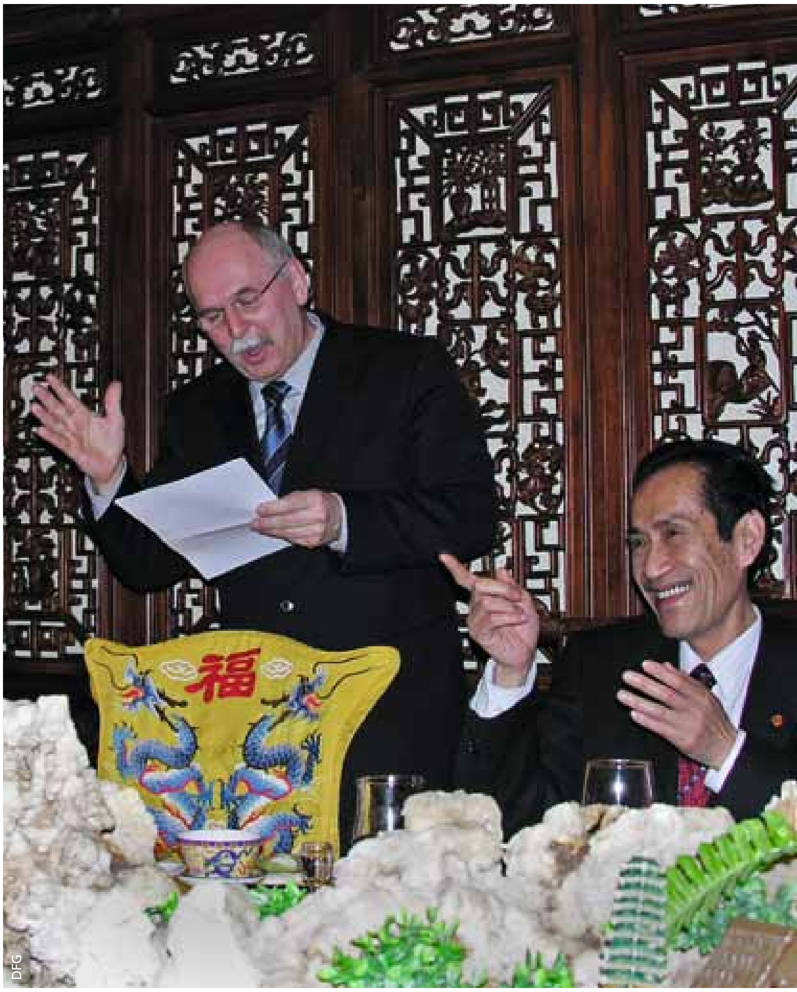
The negative impact of the global financial crisis is still lingering. It will be a wise choice to promote frontier research, seize the opportunity of a new scientific revolution, and maintain a sustainable development of economy and society.

Pursuing a better development in the future, the NSFC has declared its strategic policy of "emphasising more on basic science, more on frontier research and more on talent training", with the objectives of strengthening strategic planning, reinforcing the foundation of the scientific disciplines, driving frontier research, and intensifying the training of innovative talents so as to raise the overall

Promising outlook

quality of basic research. An open and innovative international environment is becoming increasingly crucial for basic research. To accommodate this trend, we need to further promote international cooperation and exchange, upgrade strategic cooperation, and encourage scientists to carry out substantial joint research in order to advance science together.

To enhance and deepen Sino-German cooperation is always an important component of the NSFC's international cooperation strategy. Here I would like to make four suggestions. First, we should continue to support substantial joint research. Based on the development strategy of different disciplines and priority areas, both sides should encourage scientists to carry out substantial cooperation in frontier areas. Second, we should continue to explore new forms of joint funding, and gradually optimise the way we manage joint reviews and performance evaluations. Third, we should make efforts to create a favourable environment for international cooperation and exchange, make full use of the framework provided by the bilateral agreement and the platform of the Sino-German Center, support Chinese and German scientists – especially the early-career researchers – to participate in and organise cooperation and exchange activities, and encourage and support long-term and sustainable cooperative networks between outstanding Chinese and German scientists and research groups in frontier areas and basic disciplines. Fourth, we should strengthen the strategic dialogue between the funding organisations of the two countries as well as broaden and deepen our exchange on policy and management, in order to play a greater role in Sino-German, Sino-European and international scientific cooperation.


DFG President Matthias Kleiner and Chen Yiyu in Beijing

The ancient Chinese Book of Poems says, "A bird sings out to draw a friend's response". Chinese scientists wish to work with all peace-loving researchers in the world and build deep friendship in cooperation. The great German poet Goethe said that friendship can only be bred in practice and be maintained by practice. I firmly believe that, as Sino-German cooperation expands in scope, the practice of cooperation and exchange will become richer and more abundant. It will enhance the friendship and bond between our two countries. I also believe that by strengthening the scientific and technological exchange between China and Germany as well as other countries in the world, and by encouraging Chinese, German and other countries' scientists to work together for innovation, we will make greater contributions to the repository of scientific thoughts and knowledge, to communication and exchange between different cultures, to the world's economic and social development, and to the progress of human civilisation.

Professor Dr. Chen Yiyu
President of the National Natural Science Foundation of China (NSFC)

Ancestors of the Sun

A new kind of telescope at the Xinglong Observatory near Beijing promises to provide astronomers with new insights into the development of the Milky Way.

If there is one thing a researcher like Norbert Christlieb needs, it's patience. The professor at the Zentrum für Astronomie der Universität Heidelberg (ZAH) performs "galactic archaeology": that is, he searches the night sky for the oldest stars, those witnesses to the galaxy's earliest childhood. They are the progenitors of the materials to which, ultimately, the Earth and the human race owe their existence. Cosmic microwave background radiation, which was formed 380,000 years after the Big Bang, enables the deepest insights into the cosmic past; after this, however, a dark era descended, one that was illuminated only by the light of the first stars. In order to discover ancient ancestors of the stars, however, astronomers do not need to look into the farthest reaches of space, as there are a few survivors of the early generations very close by – by astronomical standards – in our Milky Way. Pinpointing such a Methuselah among millions of stars in a section of the heavens is, says Christlieb, "like looking for the metaphorical needle in a haystack."

The astronomer was, therefore, electrified, when, several years ago, he heard of the LAMOST project being carried out at the Chinese Xinglong Station, an observatory north-east of Beijing. LAMOST, the "Large Sky Area Multi-Object Fiber Spectroscopic Telescope", is a telescope that is unique in the world. It will soon begin systematically scanning large tracts of the heavens and capturing even the weak light of distant objects – and doing so faster and more efficiently than any other telescope can. "I knew immediately that I had to be a part of this", Christlieb remembers. In Professor Zhao Gang, deputy director of the National Astronomical Observatories, Chinese Academy of Sciences, he instantly found an ally. The researcher does not just oversee international relationships; instead, he has also devoted his working life to galactic chemical evolution and the ancient stars.

Between 2005 and 2008, a cooperation group funded by the Sino-German Center under the aegis of the two researchers worked to optimise preparations for LAMOST's search for the oldest relics of the Milky Way.

> The older a star is, the fewer "metals" it contains.

The approximate age of a star can be determined by the amount of the heavy elements occurring in its composition. As, shortly after the Big Bang, only hydrogen and helium, plus traces of lithium, existed, these were the substances that clumped together to form the first stars. Through nuclear fusion, which causes heavenly bodies to radiate, heavier elements, right through to iron, were gradually created. Once a gas giant has exhausted its energy supply, it becomes instable and explodes as a supernova; during these monumental events, neutrons are added to the already existing elements to generate the even heavier elements of the periodic table. Hurled into space, these become midwives to new generations of stars. In contrast to common parlance, astronomers use the term "metals" to refer to all elements heavier than hydrogen and helium. The fewer metals found in a particular star, the older it must be.

Our sun is rich in metals, and has an iron/hydrogen ratio of 1 to 31,000. At 4.6 billion years old, it is in the middle of its lifespan and belongs to what is known as the Population I group of younger stars. Older stars, which contain fewer metals, are examples of Population II stars. These are found mainly in the Milky Way's halo. The first Population III stars were probably formed several hundred million years after the Big Bang. Until now it has been impossible to identify any of these, and experts assume that they were so massive that they burned through their nuclear energy reservoir in just a few million years, finally exploding as supernovae. In 2002, Christlieb, who was in Hamburg at the time, caused a sensation when he and his team discovered a low-mass star in the Phoenix constellation that contained just one 200,000th of the metal in our Sun. A short while later, another ancient star was added which, with one 250,000th of the Sun's iron value, is a few million years older still. These are the oldest stars hitherto discovered and, having been classified as "hyper metal-poor", are in seventh place on a scale of eight levels of metal content. The Sun is in second place.

The astronomers detected these two cosmic ancestors after a scan of half of the southern sky performed by the Hamburg Observatory using the 1-metre Schmidt Telescope at the European Southern Observatory (ESO) in Chile. An upstream objective prism split the stars' light into its spectral colours, enabling the photographic plate to provide the first clues to their chemical makeup. Christlieb had developed software that was automatically able to filter metal-poor candidates from the vast multitude. In doing so, he based his calculations on the most obvious line, one of calcium. He then inferred from the strength of that line the abundance of iron. If faint lines, or no lines, of calcium absorption are detected, the star contains very little iron. Due to the limited quality of the data recorded, an additional step was needed. The astronomers observed the selected objects again, at a somewhat higher resolution, before the valuable time at 8-10 metre class telescopes was invested to obtain high-resolution spectra. Then, for the first time, the nature of the two ancient stars was definitively revealed.

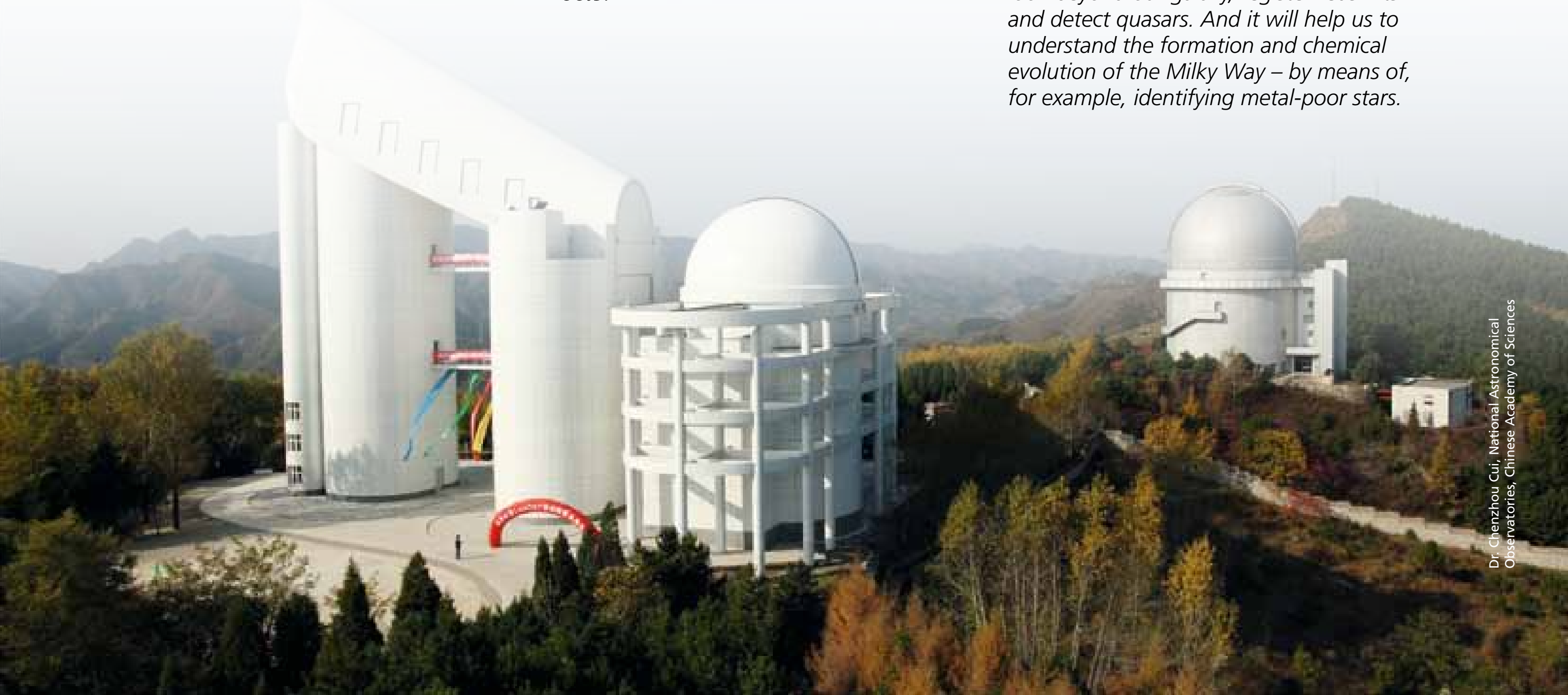
LAMOST is able to simplify this complex procedure considerably. It has a 4-metre main mirror and covers a 5-degree wide field of view, equivalent to the diameter of ten full moons arranged in a row. It can also carry out relatively high-resolution spectroscopy during the survey, measuring 4,000 objects at a time. During a 90-minute exposure, more spectra are gathered than with conventional telescopes over several months. "The concept is revolutionary", says Christlieb. "It is exactly what we need."

The forthcoming LAMOST survey will take five years. The work performed by the Chinese-German cooperation group in preparation for this search for metal-poor stars was, by its very nature, a project for the future. But because the partnership was "so harmonious and fruitful", Christlieb says, it didn't just stop when the funding ran out. "Intercultural collaborations force people to reconsider their own values and behaviours, and I think that is a good thing." Two of Zhao Gang's doctoral students are currently performing research in Christlieb's group in Heidelberg. Ren Jing wants to identify stars that have been enriched through supernovae with high-mass ancestors. Li Haining was involved in the planning of the LAMOST survey and has worked out an input catalogue that provides the coordinates of the stars. This is Ren's first time abroad. "I was nervous," she explains, "but it was very easy to find my way around here." And Li particularly prizes "the opportunity to exchange ideas with researchers from different countries." Both would like to be involved in future Chinese-German collaboration projects.

Astronomers hope that LAMOST will detect additional metal-poor stars, which will also shed some light on the current record holders. Their unusually high proportions of carbon and nitrogen are still a mystery to astronomers. Did the two stars create these elements themselves through nuclear reactions and transport them to the surface? Did they originate from a higher-mass companion, or did, perhaps, the two stars inherit them from an ancestor that exploded in a supernova? What was the role of dust in the formation of the ancient stars? "If we can use LAMOST to identify even more hyper metal-poor stars, we will probably find the answers to these questions", says Christlieb. Even if the stars to be identified do not belong to the first generation, the chemical fingerprint left by the first supernovae will still provide us with clues on the properties of the first generation of stars. The veil over the origin of the chemical elements and our Galaxy would be lifted a little further.

Marion Kälke

LAMOST combines a 4-metre mirror and a 5-degree wide field of view with multiplex spectroscopy. The spectra of 4000 objects can be captured at a time, enabling large areas of the sky to be efficiently scanned in a short time. LAMOST will be able to look beyond our galaxy, register redshifts and detect quasars. And it will help us to understand the formation and chemical evolution of the Milky Way – by means of, for example, identifying metal-poor stars.



Dr. Chenzhou Cui, National Astronomical Observatories, Chinese Academy of Sciences

Negotiating Negotiation

The Sino-German Center supports early-career researchers in summer schools.

What drives our economic decisions? Calculation? Emotion? Tradition or cultural background? What is the decisive factor? "If you follow neoclassical economic theory, this question doesn't even arise," says Professor Reinhard Selten, founder of the Laboratory for Experimental Economics at the University of Bonn (BonnEconLab), who was awarded the 1994 Nobel Prize in Economics (along with Hungarian John Harsanyi and American John Nash) for his pioneering work on game theory. According to the prevailing school of thought, agents in the market behave totally rationally and make decisions to maximise their individual utility. In doing this — neoclassical theory assumes — they are motivated by purely material incentives only.

Mathematician and economist Selten had doubts about this early on. He disliked the belief in the economic decision maker's unlimited ability to reason and calculate, along with the neglect of emotional factors. He was convinced that optimisation of expected utility or of long-term profit were no suitable starting points for theory formation; they should be replaced by behavioural approaches. Therefore, Selten dedicated much of his scientific effort to developing a new discipline, experimental economics, of which he is considered one of the founders. "In cleverly and skilfully designed experiments, we are able to collect data based on real decisions," he says. "We can precisely analyse experimental subjects' behaviour in economically relevant situations. And with the findings from these controlled experiments we can support economic theories — or refute them," adds Heike Hennig-Schmidt, Head of BonnEconLab.

With financial support of the Sino-German Center and in collaboration with Sichuan University and Southwest Jiaotong University in Chengdu, Heike Hennig-Schmidt has organised three Chinese-German summer schools since 2006, two in China and one in Germany. Doctoral researchers and young economists from both countries were invited to experience what experimental economic research can do. In groups composed either intracultural (Chinese-Chinese or German-German) or intercultural (Chinese-German), participants spend the first day negotiating as hard as they can. The summer-school negotiators try to close business deals, and like in real life, they follow strategic considerations and employ tactics to have the other party accept their own goals. Later on in the summer school, participants take part in many other experiments. And finally, the groups

Young researchers from Germany and China can gain intercultural practice during the Sino-German summer schools. And they can experience what experimental economics can do.

Chaoliang Yang

engage in self-reflection, present their results, and incorporate their experience into existing theories. Data collection — which also includes video recordings — and data analysis are discussed with their teachers.

Analysing the text protocols of the negotiations from the Sino-German summer schools, Hennig-Schmidt and her German and Chinese colleagues discovered between the behavioural characteristics of the Chinese versus German participants some important differences, which both support and expand on findings described in the literature. "One potential source of conflict in intercultural bargaining is the different willingness of Germans and Chinese to adjust their demands downward," says Hennig-Schmidt, adding that this willingness is essential to successfully closing a deal. While the German participants in intracultural experiments continually adjust their bargaining goals, negotiations between Chinese are characterised by long periods of stagnation. "In direct negotiations, this kind of behaviour increases the Germans' disposition to break off the negotiation because they're not willing to accept long periods without concessions."

In intracultural negotiations of Germans with Germans or Chinese with Chinese, negotiators always showed great confidence, were aware of their respective cultural norms, and made decisions based on strategy rather than on cultural considerations. "Generally speaking, Chinese negotiations are a lot more calm and relaxed than Germans are," says Hennig-Schmidt. "Quite obviously it's not as important in China how quickly you come to an agreement."

Another observation from the summer-school negotiations: The relationship between the bargaining parties was addressed by both nationalities, but from different points of view. The Chinese always made it a priority to develop friendly relations and seemed to regard the actual negotiation as secondary. This was perfectly in line with the expectations both sides had of each other. The Germans, on the other hand, wanted to keep business and private life separate, which became an issue when this principle was disregarded, leading to discord and stagnation during the negotiations.

Also when it came to coping with conflict, important differences emerged between intracultural bargaining groups. Whereas the Chinese would strive to maintain harmony, German negotiators took a more or less confrontational approach. Different from the Chinese, they were more direct when they bargained among themselves, always ready to clearly articulate their opinions. "For example, when the Germans engaged in intracultural negotiations, anything that violated their own cultural norms would immediately be noticed and discussed, and had a negative impact on the counterpart's mood and reaction," reports Hennig-Schmidt.

"When negotiating you have to consider the cultural background."

The intercultural negotiations played out quite differently. "Both Chinese and Germans made concessions and put aside their own culturally conditioned behavioural patterns," notes Hennig-Schmidt. Still, there are factors of conflict. Germans don't always understand the Chinese desire for harmony, "and then the Germans get impatient." It was also interesting that both sides plan their future steps very precisely but for different reasons. "The Chinese want to avoid risk or uncertainty. The Germans use precise planning to stay on schedule; they want to use their time efficiently."

A big difference between German and Chinese negotiators was also seen in their respective backward and forward orientation. The Chinese side kept emphasising what has already been accomplished, summarised the negotiated outcome so far, and previewed objectives yet to be negotiated. The Germans, on the other hand, were primarily concerned with direct, goal-oriented, fact-based and time-efficient negotiation. "Key points are brought up right at the beginning, and the tactics employed by the Chinese are perceived as dilatory," says Hennig-Schmidt. The Chinese, on the other hand, pursue an indirect strategy and are process-oriented in their negotiation. They are especially concerned with the personal characteristics of the other party. It is the counterpart that takes precedence over the object of negotiation.

Reinhard Selten has himself been trapped by German-Chinese intercultural pitfalls. "The application of a joint research proposal made it necessary that our partners in China answered some questions. But we never received a reply even after we followed up," remembers Selten. It took him a while to realise that the Chinese partners were not able to answer these questions. As is Chinese custom in such situations, they chose not to respond in order not to offend the German partner with their ignorance and to avoid losing face. "So it's really a step forward when we bring together German and Chinese economists in our summer schools. And with the topics we offer, both sides learn two things — first, when negotiating you have to take your partner's cultural background into account; and second, experimental economics can help solve these kind of problems."

Dieter Beste

Hennig-Schmidt, H., H. Geng, M. Reintgen, G. Walkowitz, and Ch. Yang (2009). Strategien in interkulturellen Verhandlungssituationen: Ein Vergleich zwischen Deutschland und China. Working paper, University of Bonn

"A Unique Place"

Interview with Dorothee Dzwonnek: For the Secretary General of the DFG, the setup of the SGC as a joint venture guarantees stability and successful cooperation.

Dorothee Dzwonnek's first encounter with the Sino-German Center for Research Promotion (SGC) occurred long before she became officially responsible for it in her capacity as Secretary General of the DFG. In mid-2001, as the head of a department in the North Rhine-Westphalian Ministry of Science and Research, she visited universities and research institutions in China. The SGC in Beijing was just establishing the first contacts between researchers in both countries, and universities in North Rhine-Westphalia had just launched the first graduate schools in the natural and engineering sciences. Spontaneously the idea came up of recruiting young Chinese scientists to do their doctorates in the Rhine and Ruhr region. These new ways to inform and network appealed to her immediately, remembers Dzwonnek. Today, as a member of the DFG Executive Board and leader of the Head Office, she appreciates the Center especially for its organisational form.

Ms. Dzwonnek, assuming you had been the DFG's Secretary General ten years ago – would you have established the Sino-German Center?

Dorothee Dzwonnek: Of course it's difficult to say today whether I would have had such a great idea back then. But I certainly hope so. Either way, the DFG President at the time, Ernst-Ludwig Winnacker, and all those who were involved recognised very early on the potential of China's scientific community and showed excellent judgement.

What's special about this centre is its setup as a joint venture. Why was it established this way?

This legal and organisational form offers major advantages over other forms, such a liaison office that you open in another country, which is kind of like grafting a tree. This close cooperation between equal partners in the form of a joint venture has been the basis and the guarantor of stable collaboration and of increasingly productive scientific cooperation. This stability is what makes the Center a unique place.

So why hasn't the DFG set up such centres elsewhere? For example, in Washington – why not a joint venture with the National Science Foundation instead of a DFG liaison office?

Because in the US and elsewhere there just hasn't been the opportunity for this kind of close cooperation, which also requires investments. And admittedly the initial situation was different too. Between American and German researchers there has been an enormous amount of cooperation for a long time. The research community in the US is much larger than in Germany. This kind of environment makes us think differently about a joint centre for research promotion than China, where ten years ago it was all about making initial contacts and opening up Chinese research.

Opening up also in terms of research policy and of politics?

We need to cautious when we make judgements from over here. But this was certainly part of what motivated the Chinese side, and it is my sense that things have indeed begun to move. The research policy and also the political framework in China was even more restrictive ten years ago than it is today. The SGC has definitely contributed to an opening here. After all, any cooperation that involves the Center and German partners is also cooperation with a democratic state and research system.

Moving on from research policy to everyday research support: What does this centre, 7,000 kilometres away, mean for the work of the DFG and its Head Office in Bonn?

Most of all, it's a great help. The Center is really well implemented and acts very independently. What's important is not only that it has its own funding budget, but also that there's been great continuity of leadership and staff on both sides. We can absolutely trust them to do good work that is consistent with the intentions of the DFG. And especially when it comes to everyday funding activities, we have relatively little work to do over here for the Chinese market.

But it's a huge market, and the Center is relatively small. Shouldn't it be larger and better equipped?

The equipment has been decided together with our Chinese partners and can only be changed consensually. But it is true – the Center isn't all that big; staff workload is high and has actually gone up over these ten years due to increased responsibilities and higher expectations.

Which of these very diverse responsibilities and high expectations have been met – and which, if any, have not?

Dorothee Dzwonnek with Hao Ping, Vice Minister of the Chinese Ministry of Education, during a visit in Beijing.

All the expectations have definitely been met. But the emphases may have shifted over time. In the beginning it was all about opening doors, even more so for the Chinese side than for us. That's where the Center has made a big difference as a meeting place and platform. In the meantime, other things have become more important, especially for the Chinese researchers – for example, what the Center does to facilitate the administrative aspect of cooperation. Of growing importance, obviously, is collaboration in the DFG's coordinated programmes – in German-Chinese Collaborative Research Centres and Transregios, in International Research Training Groups, and most recently in the joint calls announced by the NSFC and the DFG ...

... which just got off the ground with joint projects on stem cell research ...

Yes, and off to a very good start – just like in water research, where we've been able to respond to a current need, especially in China.

On the Chinese side, many of these collaborations involve universities and scientists based in Beijing and Shanghai. Shouldn't these joint projects, and therefore the Sino-German Centre, be geared more strongly toward China in its entirety?

Going forward, it will indeed be one of our important tasks to reach out to China on an even broader basis. There have been some recent accomplishments in this area, for example through Internet communication. But more could be done.

Looking ahead: When the Center celebrated its tenth anniversary in Beijing last October, it's also about the next ten years. What will the coming decade look like?

The Center will definitely remain a guarantor for great stability in Sino-German cooperation ...

... that sounds almost like stagnation ...

No, this has been and will continue to be the foundation for everything else. As for topics, we have identified, in our 2009 strategy conference, the areas where Chinese and German scientists can collaborate quickly yet at a high level – such as geophysics, but also environment and nutrition, infectious diseases and energy research. And as for funding formats, we'll definitely be launching more multilateral initiatives, as we are doing right now with the first cooperation between China, Germany and Finland in mathematics. But with all that, the Center should remain flexible.

Which means what, specifically?

The most important thing will be to keep our ears open to the needs of researchers in China and Germany, and then to have the flexibility and strength to act accordingly. In other words, to stay in flux. I'm convinced that much of the potential of Sino-German partnership has yet to be tapped, especially when it comes to science and research.

Interview: Marco Finetti

20 Million Sheep Grazing the Steppes

On the grasslands of Inner Mongolia a Chinese-German interdisciplinary Research Unit is taking a closer look at the ecological impacts of overgrazing.

Dr. Carsten Hoffmann, Centre for Agricultural Landscape and Land Use Research, Müncheberg

Each year in spring the city of Beijing is shrouded in a cloud of yellow dust. Images of snarling traffic and pedestrians wearing respiration masks as they go about their business in the dimly lit city have become a regular media fixture. The storms are a visible symptom of the grave ecological changes underway in northern China and Mongolia. The dust storms originate there in the Takla Makan and Gobi deserts. In Inner Mongolia the Gobi desert merges with a landscape of rolling grasslands. Stretching across 90 million hectares, the grasslands were once nourished by fertile sediments carried by the wind, creating a lush and verdant landscape. But overgrazing by sheep has left the grasslands degraded and trampled underfoot. The surface has been stripped almost bare, and the few remaining centimetres of grass have an ineffective "roughness length". The result: the grass is no longer able to trap the fertile wind-borne particles. Instead, the sediments are carried away by the wind together with the grassland's upper soil layer. Particularly fierce storms have been known to carry the dust as far as Korea and Japan, leaving behind impoverished soils that now extend across almost three quarters of the total grassland area. In some areas the damage has led to desertification.

With its harsh climate, the grassland is an extremely sensitive ecosystem: temperatures can range from –40° in winter through to 33° in the brief Mongolian summer. Most of the annual rainfall of just 200 to 340 mm takes place between June and August; the distribution of these sporadic convective downpours can vary across small distances, and a significant amount of water is lost due to transpiration and evaporation. "We wanted to understand the changes that are occurring in this vulnerable ecosystem", explains Professor Klaus Butterbach-Bahl, a researcher at the Institute for Meteorology and Climate Research at Karlsruhe Institute for Technology and the spokesperson for the DFG-Research Unit "Matter fluxes in Grasslands of Inner Mongolia as influenced by stocking rate" (MAGIM). Grasslands, which cover 10,000,000 km² and account for 20% of the Earth's surface, are important ecosystems: healthy grasslands protect against soil erosion and regulate the concentration of greenhouse gases in our atmosphere by storing a significant proportion of the global carbon and nitrogen reserves. Ensuring that grasslands remain intact not only safeguards the fertility of their soils and the economic well-being of their inhabitants, it is an important contribution to global climate stability.

The research project has attracted strong interest from both Chinese and German researchers. Long-standing ties existed between some of the researchers involved, such as Butterbach-Bahl and Professor Zheng Xunhua from the Institute of Atmospheric Physics at the Chinese Academy of Sciences. With the support of the Sino-German Center, the two initiated an exploratory meeting which led to the establishment of the

Dust storms are a common sight in Inner Mongolia. Sheep strip the grasslands bare and compact the soil, leading to increased wind erosion. The result: degraded grasslands and desertification. Grassland degradation has flow-on effects for global CO_2 levels. A reduction in biomass levels inhibits the formation of aggregates, particles which normally bind organic material. Carbon particles, lighter than their mineral counterparts, are simply blown away by the wind.

MAGIM Research Unit in 2004. In a series of eleven interlinking projects, Chinese and German research partners studied erosion, and the material flows between the bio- and atmosphere of water, carbon and nitrogen within the soil-plant system. With the encouragement of Butterbach-Bahl, who spent time in China as a student, the project saw a number of German doctoral researchers working for up to nine months in China, creating lasting friendships and strong working partnerships between the research partners.

But what are the underlying causes of overgrazing in Inner Mongolia? In the 1950s and 1960s, the nomads of the northern Chinese steppes, who had practised sustainable grazing on the grasslands for centuries, were forced to settle in small villages or on farms. The region's population grew as Han Chinese from other provinces were resettled in northern China. Following market reforms in the 1980s, people were allowed to produce meat and wool for profit, further compounding the pressure on this ecosystem. "Livestock levels have risen from 2 to 20 million head within just 60 years", explains Butterbach-Bahl.

The research area extended across the Xilin River Basin, where conditions are typical of those encountered throughout the semi-arid grasslands of China. The Basin is also home to the "Inner Mongolia Grassland Experimental Station (IMGERS)" of the Institute of Botany at the Chinese Academy of Sciences, where the international research team took a closer look at the damage caused by overgrazing. The upper soil layer is eroded by both wind and water. Sheep moving across the ground causes further stress by compacting the soil and impairing its mechanical stability. The effect: what little rainwater there is runs off the land rather than soaking into it, evaporating and eroding the upper soil layer in the process.

In depriving plants of vital moisture and nutrients, wind and water erosion has a severe and detrimental impact on soil fertility. The researchers discovered lower levels of biomass both above and below the surface on intensively grazed land. Overgrazing results in less feed per head of livestock and impairs the flow of atmospheric trace gases, including both carbon and nitrogen (and hence carbon dioxide (CO_2)), methane (CH_4) and nitrous oxide (N_2O), commonly known as laughing gas.

Erosion caused by wind and water

Decaying plant biomass is the most important source of soil nutrients on the grasslands, and helps vegetation to endure periods of drought and adapt rapidly to improved conditions. Plant litter mineralisation also drives flows of carbon and nitrogen throughout the soil system. Particles formed from dead plants adhere to soil particles, forming an aggregate that temporarily stores away organic material which would otherwise be broken down by microbes. As these clumps decay the organic material is released into the soil and broken down. Reductions in biomass levels equate to less litter, which impacts negatively on soil aggregate stability. Instead of nourishing the grasslands, the fine particles of organic matter are literally blown away. "The weaker the aggregate stability, the stronger the erosion", explains Butterbach-Bahl. This change in the ecosystem is transforming the grasslands, once a net carbon sink, into a net carbon source.

Healthy soils are porous. Minute cavities within soil allow plant roots to expand and transport both water and air. Soil bacteria oxidises approximately 10-15% of all atmospheric methane, and well ventilated soils play a significant role in the global atmospheric CH_4 budget. Soils, in particular dry grassland soils, are an important net sink of this greenhouse gas. But the soil's ability to conduct gases is severely diminished if its po-

An ultra-light aircraft from the German Institute for Meteorology and Climate Research takes off at the IMGERS research station. The ultra-light aircraft is used to measure regional patterns in water and carbon dioxide flows, turbulence and radiation levels, complementing localised data collected by monitoring stations at ground level.

Stefan Metzger, Institute for Meteorology and Climate Research, Garmisch-Partenkirchen rous structure is compacted by grazing sheep. "Overgrazing reduces methane absorption by 50 to 60%", explains Butterbach-Bahl.

Researchers were astonished when they took a closer look at the emission rate of nitrous oxide. Laughing gas attacks the stratospheric ozone layer and accounts for approximately 5% of the overall additional greenhouse effect; the lion's share of nitrous oxide emissions originates in agriculture, in particular from fertilisers and livestock. Clearly, the world's grasslands have an important role to play. "Nobody had bothered to track the rate of emissions across an entire year until now, however", notes Butterbach-Bahl. Filling this gap in the research, Butterbach-Bahl and his colleagues discovered that 80% of all emissions originating within the research area occurred on ungrazed land in the spring.

Micro-organisms react adversely to cold temperatures, and the harsh grassland winter inhibits their activities. The rough texture of the natural grasses retains both sediments and snow, creating an insulating layer of snow and mild soil temperatures which enable microbial populations to survive the winter relatively intact. Surviving soil bacteria become active as soon as temperatures begin to rise again with the thaw in March, metabolising nitrogen and releasing laughing gas. According to the findings of Butterbach-Bahl's task force, while N_2O outputs also increase on grazing pastures, they are significantly higher on ungrazed land. "The report of the UN Climate Council IPCC (Intergovernmental Panel on Climate Change) overestimated the levels of livestock emissions on unfertilised semi-arid grasslands by approximately 70 %", concludes the scientist.

World Climate Council estimates on laughing gas emissions flawed.

In spite of these findings, the damage caused by large numbers of sheep grazing on the grasslands remains a problem for which the researchers would like to find solutions. "The focus of this project was on scientific fact-finding, and while the Chinese government is keen to develop sustainable practices, they don't like to have outsiders telling them what to do", explains Butterbach-Bahl. Convincing farmers of the advantages of softer and more sustainable grazing practices is not an easy task. As the director of the IMGERS research station, Professor Han Xingguo, explained, 86% of the 40 million people inhabiting the North Chinese grasslands live in poverty.

People primarily concerned with satisfying their immediate needs are often unwilling to heed warnings of the ecological costs of their actions. Even warnings that intensive grazing will lead to undernourished livestock and poorer returns fall on deaf ears. In the absence of alternatives, local populations use livestock droppings, which emit all three greenhouse gases when burnt, as fuel rather than leaving it to fertilise the grasslands; a seemingly intractable problem about which Han is particularly concerned, says Butterbach-Bahl. The MAGIM researchers were especially pleased when they received the go-ahead for a 200-hectare grazing experiment. Begun in 2005, the experiment has been continued beyond its funding period by the Chinese research partners. The experiment is as simple as it is ingenious. To study the effects of various levels of grazing intensity the research area is divided into six areas; sheep graze on half of the plots for six months, while the remaining plots are left fallow to grow hay for the winter. The system is then reversed in the following year. The data collected in this rotational grazing experiment enables researchers to calculate the critical number of livestock head per hectare, which can vary from year to year depending on the meteorological conditions. Researchers hope that the results will strengthen the case for the introduction of more sustainable pasture management practices.

Marion Kälke

Research conducted in Inner Mongolia demonstrates that overgrazing impairs soil fertility: the control plot at left is home to 9 sheep per hectare, while just 1.5 sheep are grazed per hectare on the right. The damage caused by overgrazing is not limited to the ecosystem; farmers suffer when their undernourished sheep lose weight.

Prof. Dr. Andreas Susenbeth, Institute of Animal Nutrition and Metabolic Physiology, Kiel

Copper Rain

A German-Chinese Research Training Group explores materials and concepts for advanced metallisation systems in microelectronics.

The rapidly progressing miniaturisation in microelectronics has made it possible to mount up to a billion transistors on a chip. Though the physical limits are far from being reached here, researchers working in the nano-cosmos must develop increasingly refined technologies in order to further reduce the size of these chips and make them even faster. "Ultimately, it is a question of how to wire millions and millions of transistors on just a few square centimetres in such a way that they interact with one another without error – and this is exactly where the expertise in our Research Training Group lies", says Professor Thomas Gessner from the Chemnitz University of Technology and director of the Fraunhofer Institute for Electronic Nano Systems ENAS. Gessner is the spokesperson on the German side of the International Research Training Group 1215 "Materials and Concepts for Advanced Interconnects".

It was determined, for example, that the conductive tracks between the transistors in highly integrated electronic circuits – which, in refined metallisation processes, are mounted on the chip – can no longer be made of aluminium, as was possible just a few years ago. This is because aluminium generates too much heat at structure sizes less than 250 nanometres due to its comparatively high electrical resistance. For this reason, primarily copper has been used since the mid 90s. However, this metal has issues as well. The physical vapour deposition process, which is the accepted method in the semiconductor industry for this purpose, is expected to no longer meet the requirements at structure sizes less than 30 nanometres that have been attained over the course of miniaturisation. With this method, copper atoms are simply "showered" onto the wafer surface using, for instance, a sputtering process.

From Training Group to patent office

"In my doctoral research, I therefore further developed the atomic layer deposition method and made it suitable for the needs of copper metallisation in semiconductor manufacturing", says Thomas Waechtler, who completed his doctorate following three years of funding in the Research Training Group.

A patent application was then immediately filed for Waechtler's innovative approach. Unlike with traditional coating processes in the nanometre range, he is able to use his atomic layer deposition (ALD) method to obtain very uniform copper deposits even on larger surfaces

As the wafers from semiconductor material for chip production continue to increase in size — several hundred microchips fit on this 300-mm wafer — the structures in the chips themselves are becoming smaller and smaller. The reliable wiring of up to a billion transistors on a single chip is the subject of the International Research Training Group 1215.

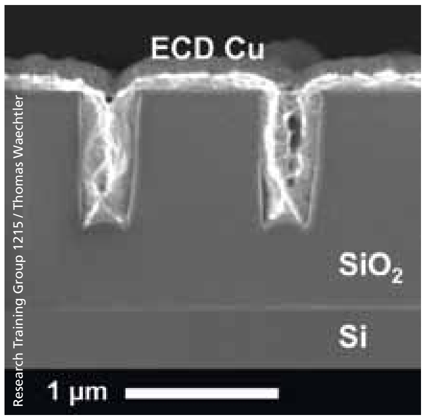
where the surface tension makes the thin copper layer prone to clumping or in cases where the substrate is rutted with pits.

On the Chinese side, the International Research Training Group is funded by the two universities in Shanghai: Fudan University and Shanghai Jiao Tong University. In Germany, an important foothold in addition to the Chemnitz University of Technology, is the recently established Fraunhofer ENAS, located at the nearby Smart Systems Campus Chemnitz. Also participating are the TU Berlin and the Fraunhofer Institute of Reliability and Microintegration (IZM), which is situated at the TU Berlin.

"When we founded the International Research Training Group four years ago, we could already look back on years of cooperation with our colleagues in China", Thomas Gessner reports. "The Chinese spokesperson, Professor Liu Ran, is extremely committed to the development of microelectronics in the Shanghai region. I think that it is important for us here in Germany to strategically strengthen and further expand this link to our similarly strong microelectronic sector here in Saxony with our Research Training Group." During the now-approved second funding phase, which runs until 2015, Gessner and Liu would like to see the Research Training Group place increased emphasis on nanotechnology, "the future technology", as Gessner succinctly notes.

And, to ensure that the German and Chinese graduates do not only learn with one another, but learn from one another as well, research visits in the respective foreign country are mandatory during the course of the three year doctoral programme. "I put large parts of my doctoral dissertation to paper in Shanghai", says Thomas Waechtler, who learned a great deal more from this experience than if he had merely taken a short holiday trip there. "The hierarchies are different and take some time getting used to for us. And in daily research, quite a bit might seem chaotic there for us Germans. But surprisingly, everything still works out in the end."

Dieter Beste



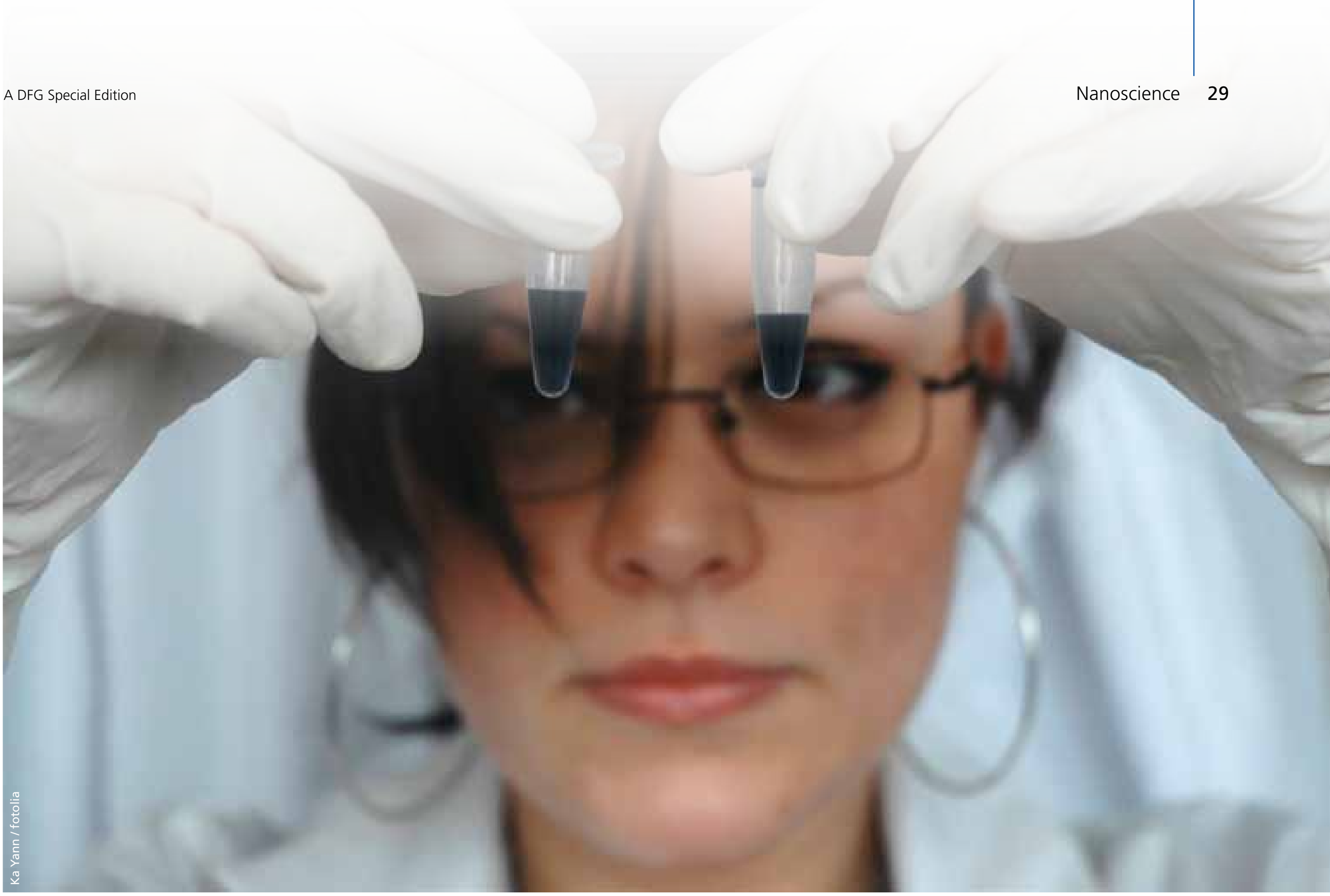
Using the ALD process, uniform copper metallisation is possible, even on a three-dimensional chip surface.

Deceitful Reflections

Met and locked into their hearts: Researchers from Cologne and Chengdu develop highly selective metal-free catalysts.

The professors Albrecht Berkessel of the University of Cologne and Chen Yingchun of Sichuan University in Chengdu, Western China, first met at the beginning of April 2006 at a conference in Hangzhou on the east coast of China. The Sino-German Center had invited scientists from Germany and China to a bilateral symposium on organocatalysis and aspects of "green chemistry". "I started talking to Yingchun and we soon realised that we were working on similar issues," says Albrecht Berkessel.

Although Justus von Liebig discovered that acetaldehyde could be used as an organic catalyst in the mid 19th century and the first asymmetric organocatalytic reactions were described at the beginning of the 20th century, organocatalysis has only become the focus of worldwide research interest in the last ten years. The fact that in 2001 the Nobel Prize for Chemistry was awarded to the Japanese Ryoji Noyori and the two Americans William S. Knowles and K. Barry Sharpless certainly contributed to this new awareness. They had managed to develop enantioselective transition metal catalysts that are capable of controlling chemical reactions in a way that only the one of the two mirror-symmetric molecules of the end product is formed. As is generally known, many molecules occur in two mirror-inverted forms. This chirality in the structure of otherwise identical products – they have the same chemical formula and the same number of atoms and are linked together in the same way – shows its downsides especially in the development of pharmaceuticals. While the one form de-



Identical mirror image. Chiral molecules are as alike as two hands. In medicine, however, their differing effects have their downsides. With organocatalysts, reactions can be controlled enantioselectively, which guarantees that only one or the other form occurs.

velops its beneficial medicinal effects in the body, the other is often downright harmful.

With the help of catalysts, chemical reactions can be accelerated and controlled. The remarkable thing is that the catalyst is involved in the reaction but not consumed. A single molecule can thus produce millions of molecules of the desired form. “In addition to metal catalysts, as developed by the Nobel Prize winners of 2001, and biocatalysts such as enzymes, organocatalysis can now be regarded as the third pillar of asymmetric catalysis,” says Albrecht Berkessel. For this, he and his colleague scientists from around the world use small, organic molecules, which are mostly composed of carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus atoms, “for example amino acids such as proline or phenylalanine.” The decisive advantage of organocatalysts over the large number of metal-based catalysts known today is not only their good commercial availability and thus relatively low cost, but also their lower-level toxicity: “Because organocatalysts are usually non-toxic, easily manufactured and disposed of, they now trade under the label ’green chemistry’ and are particularly suitable for the production of pharmaceuticals and also agrochemicals,” says Berkessel.

While still in Hangzhou, Berkessel met Chen to discuss their joint research. It was soon clear to them how they could successfully combine their individual expertise in a mutually beneficial way: “Here in Cologne we have, for example, in situ infrared spectroscopy and also infrared thermography,” says Berkessel “in order to measure the reaction kinetics directly.” A joint project application was submitted to the Sino-German Center and approved. Since February 2008, a doctoral student of Chen Yingchun together with chemists in Cologne have been able to test some of the organocatalysts newly developed in China at a high-throughput of possible reaction substances. “Conversely, I was a visiting professor in Chengdu where I gave lectures on selected topics of organocatalysis”, says Berkessel, who has published an internationally acclaimed reference book on the state of affairs in organocatalysis together with this colleague Harald Gröger. “The book has also been translated into Chinese,” says Berkessel with satisfaction who hopes to maintain contact with Chen Yingchun even after the two-year project funding comes to an end. “I was particularly impressed by the commitment and discipline of the students in China. For me as a lecturer, this really spurred me on. It is therefore important to me to help our people here at the institute to experience the atmosphere there so that they can perhaps gain a new impetus for their work at home”.

Dieter Beste

Wedding in the Nano-Cosmos

In the first Sino-German Collaborative Research Centre, researchers from Münster and Beijing are fusing organic and inorganic materials into functional systems.

The approximately 0.6 micron thick and 2 to 3 microns long, widespread rot bacterium *Bacillus subtilis*, also called hay bacillus, is making a teaching career in nanoscience and technology. "Natural systems give us clues as to how we can combine organic and inorganic materials to form new functional molecular systems – *Bacillus subtilis* is our model for molecular rotary motors," says Harald Fuchs, director of the Physics Institute of the University of Münster and the Center for Nanotechnology (CeNTech). Fuchs is the German speaker of the Sino-German DFG Collaborative Research Centre TRR 61 focusing on "Multi-level molecular assemblies: structure, dynamics and function".

The constituents of a cell or organism organise themselves independently into hierarchical structures. But also in the world of inorganic materials researchers have been able to synthesise self-organising systems in recent years. Although these assemblies are still much simpler than their natural counter-parts, these functional molecules can already perform

Zillmann

quite complicated tasks. In fact, researchers are becoming increasingly more successful in encouraging small molecules to self-organise into supramolecular systems and in discovering the often surprising and unique properties that emerge in these assemblies in analogy to natural systems as a result of multiple, collective interactions. The research in the field of self-organising molecular systems is also stimulated by the observation that their properties and behaviour emerge in a completely unpredictable way. The behaviour emerges without being influenced from outside. And in general it cannot be derived from the known properties of the individual constituents or assemblies. Examples include independent replication, auto-repair or information-driven processes, such as those observed in plant photosynthesis.

Fuchs points out that in contrast to traditional synthesising chemistry, the emphasis in nanoscience and technology is less on being able "to make" a specific molecule. The focus of the researcher is always on the new function – be it conductivity, light emission or sensory function. "The additional step we take compared to traditional chemical synthesis has a name that has only been used as a concept in biology so far: self-organisation."

In a total of 20 joint research projects, Chinese and German scientists in TRR 61 are researching the properties of molecular and nano objects. The Chinese partners of the University of Münster are the world renowned Tsinghua University and the Chemical Institute of the Chinese Academy of Sciences (CAS), both in Beijing. The Collaborative Research Centre co-financed by the DFG and its Chinese partner organisation (NSFC), combines a total of approximately 150 scientists – half in Münster and half in Beijing. Their common goal is to produce molecular materials with tailored electronic, optical and sensory properties and to describe their particular organisation and their collective behaviour in contrast to single molecules or single molecular groups.

During the maximum project duration of twelve years, the scientists in Beijing and Münster seek to take small steps towards their big goal to utilise the self-organising forces of nature for the assembly of bio-hybrid

Research goal bio-hybrid system

systems in which cells and inorganic materials fuse into functional objects in the nano-cosmos. Their first objective is to assemble functional molecules in dissolved state.

The next step is to connect these systems to solid substrates and to exploit the self-organisation potential of these structures to let them grow into larger, more complex structures and finally into hierarchically structured bio-hybrid systems.

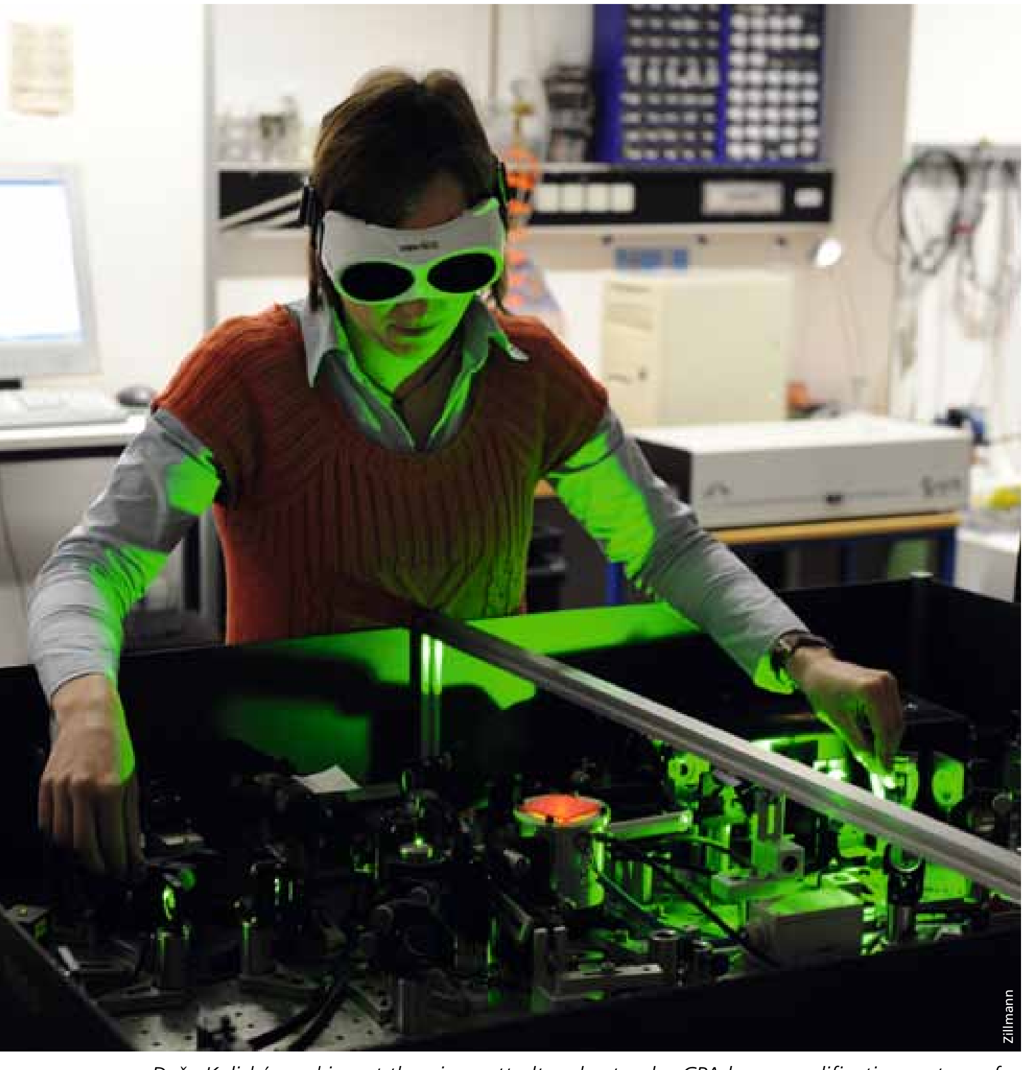
But imitating nature is not as easy as it may sound: "So far, we have rarely been able to connect abiotic materials with organisms without destroying them or altering their behaviour," says Chi Lifeng, also a professor at the Physics Institute of the University of Münster and deputy speaker of TRR 61 for the German side. In addition, self-organisation processes and coupling phenomena in large functional structures are still poorly understood from a theoretical point of view. "Some of our research groups are pioneering in this field," says Fuchs and lists the groups involved: applied physics, biophysics, interface physics, organic chemistry, physical chemistry, theoretical and experimental physics, material physics and business chemistry. They deal with topics such as dynamics at interfaces, nanoanalysis and nano-photonics.

For about 30 years, self-organisation and assembly formation have been on the agenda of nanoscience, "but we are still far from being able to use these processes routinely," says Fuchs, "because unlike natural self-organisation that takes place in a natural environment, we are generally only able to achieve this in the lab under very special conditions." "Self-organisation is a mechanism that creates patterns, processes and structures on a higher level through multiple interactions of the individual constituents on a lower level," explains Chi. The driving force behind this are usually weak attractive forces such as hydrogen bonds that have played no significant role in technical chemistry so far. "It is difficult to control the fine balance between these weak interactions and dynamics of self-assembly," says Fuchs.

Chi and Fuchs met almost twenty years ago during a project on ultra thin layers. At the time, the physicist Fuchs was working in the research division at BASF. Chi, after finishing her studies in chemistry in China and completing her Ph.D at the University of Göttingen and the Max Planck Institute located there, joined the project while working as a postdoc at the University of Mainz. When in 1993 vacancies in Boston, Seattle and Münster opened up for her, Fuchs was a professor in Münster and in the process of setting up a professorship for nano-analysis and interface physics and the Center for Nanotechnology. The excellent working conditions associated with this were something Chi found very tempting. "Actually, I didn't think I would stay that long in Germany."

In 2000 – after several years of successful preparation work with various Chinese partner groups – the official go-ahead was given for closer cooperation with scientists in China: "At the time, we assumed the coordination role of a cooperation in the area of nanosciences between the State of North Rhine-Westphalia and the Chinese Academy of Sciences in Beijing," recalls Fuchs, "and were able to col-

Lars Jansen and Wang Wenchong working hand in hand in Münster while preparing a test with the ultra-high vacuum scanning tunnelling microscope.



Daša Kaliská working at the gigawatt ultra-short pulse CPA laser amplification system of the TRR 61 in Münster with which, for example, time-resolved X-ray diffraction of functional molecular systems is possible.

laborate with, amongst others, Professor Zhu Daoben who, by then, was one of the vice presidents in the NSFC". "And at the time we were already able to cooperate with Professor Zhang Xi, who was part of the team from the beginning when we applied for a Transregio-CRC at the DFG three years ago," says Chi. Zhang Xi is the speaker of TRR 61 on the Chinese side.

It was the first time that German and Chinese scientists wanted to put together such an extensive research collaboration in the form of a Collaborative Research Centre. "The evaluators had some doubts at first whether this rather complex cooperation between German and Chinese institutions would work," says Fuchs. "But we could already point to joint publications in prestigious scientific journals and show how fruitful the cooperation with our Chinese colleagues had already been on a smaller scale."

Two years have passed and the cooperation is starting to bear fruit: "We already have several pending patents," says Chi Lifeng and refers to the statute of TRR 61 which lays down the rules of dealing with intellectual property in a way that ensures that disputes cannot arise. In one of the publications, which is the result of the work of their group, a strategy to attach molecular rotors to a surface and propel them is discussed. The core of the invention is a variable-length linkage which connects the rotation anchor with the functional molecule. And since each of the three elements represents a different function, it is possible to obtain molecular rotors in different sizes, with different anchors and varying functional groups by simply replacing the molecular components.

To study the self-organisation processes during epitaxial growth of organic molecules in atomic resolution, a low-temperature atomic force microscope was acquired at the University of Münster. TRR 61 researchers can now not only examine the position of molecules in complete

Rotation starts at 20 Kelvin.

layers, but also individual molecules. For this, however, the substrate surface must be considerably cooled, because otherwise the mobility of the surface molecules would prevent imaging.

In such an arrangement it is possible, for example, to measure the forces that occur when single molecules shift on the atomically smooth surface.

"What we are able to see in the nano-cosmos is truly fantastic," says Chi. "We now know the impact that temperature has on our rotation molecules. At 4 Kelvin nothing happens, but at 20 Kelvin things start to move." "We are now asking ourselves what we must do to make all the molecules rotate in one direction, "says Fuchs, "because if we succeeded in harmonising millions of such small rotors, we would also have a useful effect in the macro-cosmos." Perhaps one day one could use them to make a pump or something similar, he thinks aloud.

Dieter Beste

"Strengthening Our Relations with China also Strengthens Ourselves"

Ernst-Ludwig Winnacker on China's race to catch up with the top research nations

Professor Ernst-Ludwig Winnacker, now Secretary General of the International Human Frontier Science Program Organization in Strasbourg, has always been a proponent of Sino-German research cooperation. Under his tenure as DFG President from 1998 to 2006, the Sino-German Center for Research Promotion was established.

In January 2010 you were awarded the Medal for International Cooperation in Science and Technology in Beijing. What does this award mean to you?

Ernst-Ludwig Winnacker: I have long held the greatest respect for the intellectual, artistic and scientific potential of the Chinese people. Perhaps I've been inspired by an early reading of Leibniz's Novissima Sinica, where in the preface he already mentions the peculiarity that "human cultivation and refinement should today [1697] be concentrated, as it were, in the two extremes of our continent," and argues that both cultures should be brought closer together. Three hundred years later, this seems just as interesting and just as necessary. The possibility of such a collaboration is something I've been able to experience over the last 20 years, as China has risen from a scientifically developing country to an equal partner in research and technology. My own contribution to this has included close cooperation with the National Natural Science Foundation of China. We even constructed a building together, and we still run it today, thanks to our excellent staff on both sides.

How have you been experiencing the rapid changes in China?

In the early eighties, when I was in China for the first time, there were hardly any cars, just bicycles. And almost all the cyclists wore these dark-blue uniforms. Today, it's the complete opposite. The streets look colourful, just like in the West. The few remaining cyclists have to fear for their lives because of the car traffic. And air pollution has gotten better as well. That terrible smog hasn't disappeared entirely, but to a large extent. Finally, I'm very impressed by the gigantic endeavour of trying to lure Chinese researchers back from other countries, especially the US, and creating an adequate environment for them in China. I've never envied the Chinese government for its task of leading a nation of 1.3 billion people into a globalised world. Even for us, this is not exactly easy. So I'm not surprised that sometimes they take different approaches in China than we would.

What can Chinese and German researchers learn from each other, and how can they work together even better?

Science is and always has been international. The internationalisation of science is therefore essential, not least because the problems we face as societies – as defined by the UN millennium goals, for instance – don't stop at our borders. You can't have too many resources to study them. So it does worry me that the number of Chinese students in Germany has been flat for years, albeit at a high level. In Humboldt Research Fellowships, China is also at the top. But the actual number has barely increased over the years. That's why I think that we need new instruments for doctoral and postdoctoral funding that go far beyond what Research Training Groups can do.

A major role in this exchange is played by the research funding organisations. The Max Planck Society was a pioneer in this area, establishing contacts with the Chinese Academy of Sciences as early as 1974. Hundreds of Chinese researchers now work at Max Planck Institutes. The other research organisations are also engaged in this issue. We can't overstate the importance of such contacts, because they add value. When we strengthen our relations with China, we strengthen ourselves.

Interview: Dieter Beste

Science Connects

In Lindau, early-career researchers from China meet Nobel Prize winners and young colleagues from all over the world.

Transparent larger-than-life portraits of Nobel laureates greet all those about to cross the bridge to Lindau Island in Lake Constance. The pictures set the tone for an event that brings together two generations of excellent scientists for the 60th time this summer. 675 handpicked early-career researchers from all over the world get the chance to listen to 59 Nobel Prize winners in physics, chemistry, as well as medicine and physiology, and to seek dialogue with them as well as their up-and-coming peers.

Life-sized and real, the laureates saunter through the crowd in the Inselhalle. Those unfamiliar with their faces can identify them by the blue colour of their name-badge lanyards; grey is the colour for doctoral and postdoctoral researchers. The two cohorts also differ in age, experience and success. But this event is about what they all have in common: a passion for science. Depending on personal temperament, the laureates may convey their own enthusiasm with seriousness, with a twinkle in their eyes, or by skipping the formalities. Matter-of-factly, cancer researcher Harald zur Hausen reports on cancer and infections; humorous and peppered with anecdotes is chemist Martin Chalfie's presentation on the tortuous paths of basic research; while physicist Robert B. Laughlin strays from his specialty and challenges his young audience with quite provocative questions on the future of energy. Most of them are regulars in Lindau. They all seem to have a teacher's heart beating in their chest, equally committed as they are to motivating and supporting the next generation as to doing research. Their own gain is in the curious questions asked by clever young researchers.

Full of expectation, the early-career scientists push their way into the plenary hall in the morning and into

Marion Kälke

Pictures of Nobel laureates greet arrivals on the side of the street to Lindau Island.

breakout rooms for more intimate discussions with their role models in the afternoon. One of them is Yun Chenxia, a doctoral researcher in optical physics at the Chinese Academy of Sciences (CAS). In March she did a two-week internship at the Max Planck Institute of Quantum Optics in Garching near Munich. Now she looks forward to meeting Theodor Hänsch, laser spectroscopy expert and inventor of the frequency comb. Ge Liang, a postdoc who investigates the molecular mechanisms of cholesterol absorption at the CAS's Shanghai Institutes for Biological Sciences, hopes that the interdisciplinary aspects of the speeches, panel discussions and dialogues will give him food for thought. The pervasiveness of chemical and physical factors especially in biomedicine is one of this year's hot topics in Lindau.

In all modesty, the young researchers from China are proud to be here. And for good reason – competition is stiff in the world's most populous country. "Every doctoral researcher would like to receive this honour," explains Chen Lesheng, Vice Director of the Sino-German Center (SGC), which awards grants to enable young scientists to attend the conference. 8,000 to 9,000 candidates, who had been invited by the SGC to submit applications, were hopeful and anxious. 173 of them were nominated by the CAS and Project 985, a governmental funding programme for research at China's top 40 universities. A Chinese-German review panel ranked their applications and then invited 76 young researchers for interviews. At the end of a selection marathon lasting about eight months altogether, the 30 brightest minds received invitations to Lindau.

It came as a surprise to the large, prestigious universities that some of the fellowships went to researchers from smaller institutions, notes SGC Director Armin Krawisch – a clear indication that it was the candidate's qualification, not the university's reputation, that determined who made the cut. This is why the procedure has been widely acknowledged. "In India it's considered best practice. And Princess Maha Chakri Sirindhorn from Thailand, who is being honoured this year in Lindau for her commitment to research promotion, wanted to learn more about our system," says Zhao Miaogen, Vice Director of the SGC.

Exemplary evaluation

Praise also comes from Lindau itself. "The SGC evaluation procedure is exemplary," says Wolfgang Schürer, Chairman of the Board of the Lindau Foundation, which organises the conference together with the Council. In contrast to its usual practice, the foundation accepts the selection without further review.

"We were told we'd be able to make contacts here," says Xiang Tingting, who is half a year from finishing her doctoral thesis – on the interaction between host and microbes in plants – at China Agricultural University, Beijing. "Well – here I am!" she adds with a confident laugh. The young researchers from Africa, America, Asia, Australia and Europe show no signs of timidity. A glance at the badge with the foreign looking name quickly leads to conversations on research topics and to feedback on the lectures. In Lindau, the world has no barriers. How this exchange of ideas brings people together, across nations, cultures and religions, is being documented on the Internet in video blogs by participants like Lei Kai from the Institute of Developmental Biology and Molecular Medicine at Fudan University. And whatever self-consciousness the up-and-coming researchers may experience opposite the greats of science disappears quickly. By the second evening, with food, music and party dances, the ice is broken.

It's especially personal questions about the future that are on the

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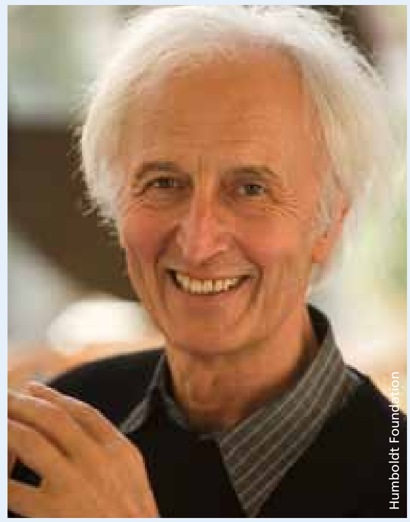
Chinese researchers with DFG President Matthias Kleiner and SGC Director Armin Krawisch (center) as well as Vice Directors Chen Lesheng (front left) and Zhao Miaogen (third from right).

young participants' minds. Lei Kai, who is particularly interested in meeting the luminaries of his discipline, wants to know where developmental biology and especially stem cell research might be headed. He receives answers from no fewer than six of them, including Robert H. Horvitz, expert on apoptosis (programmed cell death), and Roger Y. Tsien, molecule designer in the service of biomedicine. Agronomist Xiang Tingting, on the other hand, is more curious about research careers than scientific input. But they both point out that the interaction with their generational peers has been just as productive as making contact with Nobel laureates.

Even after the conference in Lindau, the group of Chinese scientists continues to get new career-planning ideas. For a week they visit research institutions in Munich, Dresden, Berlin, Münster and Bonn. At the DFG Head Office they learn how to apply for a six-month research visit in Germany. Zhao Wei, Lindau attendee in 2006, talks about how this opportunity opened doors for her in Germany. Today she works for the Department of Surface Chemistry and Catalysis at the University of Ulm on the Sino-German Fuel Cell Initiative, which is funded by the DFG and the NSFC. Furthermore, the SGC offers Lindau alumni the option of proposing a three-year research project in Germany through their professor. "Visiting the Nobel Laureate Meeting and German research institutions has helped improve mutual understanding and showed us how we can make collaborative projects happen," says Yue Rui. The young biologist quotes a German saying: "You always meet twice in life." Having been to Germany once before, as an intern in Bonn, he adds with a smile: "I definitely hope there will be a third time."

Marion Kälke

"I was impressed by the high level of the Chinese candidates."


Humboldt Foundation

I very much appreciate the Lindau Meeting as a place of scientific and intercultural exchange. During my term as DFG Vice President from 2001 to 2007, it was therefore my honour to be involved twice in selecting those early-career researchers from China who would get the chance to attend the conference. I was particularly impressed by the high level of the young Chinese candidates. When I became President of the Alexander von Humboldt Foundation, it was therefore a special pleasure that this position gave me more opportunities to be in contact with Lindau fellows from China. Each year, the Humboldt Foundation enables over 2,000 excellent scientists and academics from all over the world to visit Germany for research. It also actively recruits Chinese Lindau alumni to return to Germany as visiting researchers. A number of them have already done so with the help of Humboldt Research Fellowships. This makes me especially happy because I look at these young researchers as opinion leaders on German-Chinese cooperation.

Prof. Dr. Helmut Schwarz
President of the Alexander von Humboldt Foundation

Catalyst SGC

Run by scientists for scientists: Internationalisation as a driving force

The close partnership between the DFG and the NSFC materialised about ten years ago in the Sino-German Center for Research Promotion (SGC) in Beijing, an institution that is still peerless in the world. It operates according to guidelines set by a Joint Commission that includes four NSFC members and four DFG members and is co-chaired by two Vice Presidents of the NSFC and the DFG, respectively — currently Shen Wenqing for the Chinese side and Ferdi Schüth for the Germans. Professor Ferdi Schüth, Director at the Max-Planck-Institut für Kohlenforschung, and commission member Dorothea Wagner, professor of computer science at the Institute of Theoretical Informatics of the Karlsruhe Institute of Technology, talk about their experience.

It is one of the core tasks of the Joint Commission to decide what the overarching strategic guidelines and objectives should be for the activities of the SGC. How do you work with your Chinese colleagues?

Schüth: There is absolute parity when we work within the Joint Commission. And to my knowledge there has never been any real disagreement on what course the SGC should be.

Wagner: I've been a member of the Joint Commission for almost four years now. During this time I've always experienced the atmosphere as very harmonious and uncomplicated.

Schüth: What does occasionally cause minor problems is the fact that the NSFC, according to its mission, funds primarily the natural, life and engineering sciences. The humanities fall through the cracks. The DFG, on the other hand, supports a broader range of disciplines.

Wagner: But apart from this one difference in funding philosophy I don't see any conflicting goals. The work of the commission is characterised by mutual interest and the desire to accomplish a common goal, the intensification of research cooperation. For example, one of the things we discussed at our last meeting was how early-stage researchers could be included even more in the SGC's funding activities. The DFG has a lot of experience in this area, and the Chinese are very interested in it.

Schüth: Your example, Ms. Wagner, illustrates very nicely how we decide the course of the SGC by consensus. At virtually every meeting we talk about exciting new developments in research, and we always find that our views are largely in sync.

Now, it is DFG funding policy to support exciting impulses coming from the scientific community, whereas the NSFC's programmes tend to define topics more specifically …

Schüth: These different approaches to funding, even though they do exist, aren't really problematic for the SGC in actual practice. For example, China too pursues with a great sense of responsibility the question of how we should handle the greenhouse gas carbon dioxide in the future, and the NSFC has research programmes for this. At the SGC we were recently able to approve a funding proposal by an initiative at the Clausthal University of Technology concerning a joint project with Chinese partners to investigate the subterranean storage of carbon dioxide from power plant emissions.

Wagner: In my field of algorithm engineering we also see very clearly how over the last ten years Chinese science has rapidly caught up with the global top tier, not just quantitatively but also qualitatively. Across all issues, we cooperate on equal footing. And this, I think, is also why the SGC has become such a successful model. We've been working together as equal partners from the very beginning, and now it's really paying off. Going forward we may even be able to expand this successful bilateral cooperation on research and include other European partners as well.

Schüth: I would sum it up this way: The DFG drives internationalisation in research wherever doing so is important for science and where researchers need our support. For ten years now, the SGC has been functioning as an important catalyst in this regard.

Interview: Dieter Beste

"We've been working together as equal partners from the very beginning."

The Joint Commission met in 2009 for a working session in Freiburg. Included in the photo: DFG Vice Presidents Ferdi Schüth (front right) and Dorothea Wagner (centre).

West-Eastern Normalcy

The Chinese think and act differently than Germans sometimes – but not to worry: science, more than anything, is practiced in the international arena. A conversation with Ingrid Krüßmann, China expert at the DFG Head Office.

Ms. Krüßmann, 15 years ago the DFG and the NSFC began planning the Sino-German Center. How has the relationship between the Chinese and the Germans changed since then?

Ingrid Krüßmann: In the beginning there was still a certain formality to our cooperation. The sequence of events for delegation visits would be precisely choreographed. We would sit on opposite sides of the table in a strict hierarchic order. It's still like that today during official delegation visits, but we have a very trusting relationship now. We often communicate informally, address problems and solve them. By now we all know each others' mentalities, but also the constraints under which we all operate.

There are seminars that teach how to deal with Chinese business partners. Do scientists also need a Chinese etiquette primer?

Communication among scientists is less complicated than among businesspeople, if only because the scientists all research the same topics and work in similar environments. They often meet at international conferences, get acquainted more quickly, and become closer. For example, many Germans know that in China the last name goes first. But then on the English side of a Chinese business card, nowadays we may actually see first and last names in the Western order. Many Chinese try to adapt to Western customs, and the Germans have read so much about China already that they behave in ways that are perceived as Chinese. Sometimes this can lead to funny misunderstandings.

What was the primary impetus behind the mutual approach?

Aside from the internationalisation of research culture in general, a big help in formal terms was obviously the opening of China. Our bilateral funding instruments can be used to hold workshops, symposiums and conferences.

Do German researchers today communicate with their Chinese colleagues as they would with Europeans?

Not quite – there still are some differences. For example, the Chinese are relatively spontaneous in the way they organise a visit by a foreign delegation. When Europeans want to see a precise programme schedule weeks before they actually travel to China, they meet with little understanding there. It's considered entirely sufficient to hand the guests a programme when they arrive. But by then it's also very detailed and so meticulously done that you can rely on it completely. This Chinese flexibility when it comes to planning takes some getting used to for us Westerners, and it's something that has changed surprisingly little. The Germans, on the other hand, are often perceived as inflexible by the Chinese.

German penchant for planning meets Chinese spontaneity.

Was this Chinese spontaneity also apparent during the construction of the SGC building?

Oh yes. The Germans would always try hard to follow through exactly according to plan, whereas the Chinese kept changing things around. After we'd negotiated the details of the construction, we were presented with new plans when we were already at the airport, getting ready to fly home. The Chinese construction manager wanted to decide on site and on the fly how to do the electrical installations, for which the Germans had already worked out a plan. So there were some interesting intercultural experiences, especially between the German architect and the Chinese one, who designed much of the building together.

What are some of the sensitivities one has to be aware of?

When the Chinese reject something they tend to express it indirectly. Often they'll respond by saying "We're going to review it" or "We're going to think about it". They may want to buy time to discuss it among themselves, but it may already indicate a possible no. Germans also need to learn how to voice criticism respectfully and gently. Chinese colleagues often use phrases like "We would like to learn from you", which are often misinterpreted by the Germans as gestures of submission. They're actually a polite way of asking the other person's opinion.

And how do the Chinese voice criticism, for example when they act as reviewers of a project?

In the sessions that I've attended, I've noticed big differences in the willingness to express criticism. The German reviewers were a lot more direct and the Chinese much more cautious and reserved in their opinions. But this is another area where behaviours are changing. Chinese reviewers are adopting international practices.

Is there a culture of critical discourse as there is here? Do students and doctoral researchers dare question a professor's theory?

We often hear from International Research Training Groups, for example, that particularly doctoral researchers who go to China on a DFG grant run into strict hierarchies there, and that the discourse in China's university departments is less confrontational than it would be in Germany. But I expect the cultures of discourse to become much more alike over the next few years, especially because of bilateral Research Training Groups and young researchers' experiences in them.

Do hierarchical structures also come into play when a Chinese delegation visits Germany?

Yes, and that's why it makes sense, for example, to think about the seating arrangement ahead of time and put up name plates. We shouldn't throw our Chinese guests off by seating discussion participants in a deliberately random order. Some Chinese partners, when they feel like they're "in the wrong place", may actually switch seats in order to restore the proper hierarchy in the seating arrangement. But even this habit is changing. Then again, our Chinese guests are sometimes taken aback when the host pours the tea or coffee. In China such a task would be considered subordinate and done by service staff.

Because of our preconceptions, the term "Chinese delegation" conjures up the notion of a collective that acts in uniformity.

A Chinese proverb says, "When a group of birds sit on a perch, the one that sticks out its head may lose it." That's how members of a Chinese delegation explained their behaviour to me in a humorous way. The first delegation visits, which I was in charge of, were indeed very formal, and the members would always submit to the wishes of the delegation leader, without showing any emotional response. He would also be the one to decide how and when the next point on the agenda should be addressed. But these days, individual personalities are coming to the fore more, and sometimes we even get requests for individual programmes.

Lichtenscheidt

Dr. Ingrid Krüßmann is the DFG Director of International Affairs in East Asia and Mongolia. A sinologist, she studied at the University of Nanjing already in the early 1980s, on a fellowship from the German Academic Exchange Service (DAAD). She was involved in the planning and construction of the Sino-German Center from the very beginning.

Chinese researchers go abroad with wind in their backs. German researchers, on the other hand, especially young ones, tend to be more cautious. How can this reluctance to research visits in China be overcome?

There's a lot of support from research funding organisations, be it the DFG, for example in bilateral Research Training Groups, or the DAAD for predoctoral students and younger researchers. The benefit of Research Training Groups is that doctoral researchers go abroad in groups and work on their doctorates within structures created especially for this purpose. Chinese universities are also increasingly better prepared to accept students from other countries. They're already offering courses taught in English as well as comprehensive advice by the foreign affairs offices, called waiban in Chinese. We also see the first young German professors teaching and researching in China, thanks to support from our partner organisation NSFC. It's surprising that not more researchers embark on a China adventure. Having this formative intercultural experience early on in your life will open many doors down the line in your career.

Interview: Marion Kälke

Sino-German Center for Research Promotion (SGC)
Facts and Figures

The SGC is a unique Chinese-German joint venture in research promotion. The SGC administers its own funding budget, which it uses to support specific activities relating to Chinese-German scientific cooperation.

The SGC mission

- To initiate and intensify long-term Chinese-German cooperative relationships in research
- To promote specific bilateral research collaboration in the natural, life, management and engineering sciences within the framework of SGC funding programmes
- To promote cooperation between Chinese and German early career researchers
- To provide advice and information, particularly on core research areas, funding activities and suitable partners for research cooperation in the respective partner countries
- To improve the infrastructural conditions for scientific collaboration between China and Germany

SGC funding programmes

Chinese-German symposia and workshops: The funding of multi-day workshops and meetings is the SGC's primary funding instrument. The workshops bring together a representative selection of especially qualified researchers from China and Germany to discuss a specific topic in their respective research area.

Chinese-German cooperation groups: The SGC provides funding for infrastructural projects of up to three years in duration to support a concentrated joint research effort in a specific field. Cooperation groups consist of a network of complementary working groups at a limited number of locations that are engaged in a collaborative and international research endeavour.

Project funding: Chinese-German research projects offer the opportunity for long-term bilateral co-operative ventures (up to three years) involving one or more research groups from both countries. Within this funding scheme the Sino-German Center provides financial support for consumables and smaller items of scientific equipment, as well as travel and accommodation costs. German applicants may also apply for funding for staff. The approval of an application in another funding programme of the Sino-German Center is a prerequisite for applications to this funding programme.

Early career grant programmes and support: The Center endeavours to bring together early career researchers from China and Germany as early as possible through the funding of Sino-German summer schools, where trainers from both countries instruct doctoral researchers, post-docs and especially talented students in advanced techniques and methods in their respective research areas. The Center also stages forums in which early career researchers have the opportunity to meet and discuss with leading figures in their research areas from both countries. The SGC also provides funding for researchers from China to participate in the annual Nobel Laureate Meeting in Lindau, and for heads of independent junior research groups to visit and work in China.

Infrastructure: The facilities at the Sino-German Center include several seminar rooms and eleven guest rooms, which are available for up to two months to scientists staying in Beijing in connection with Sino-German joint research projects. Researchers from all disciplines are welcome to make use of the SGC's infrastructure.

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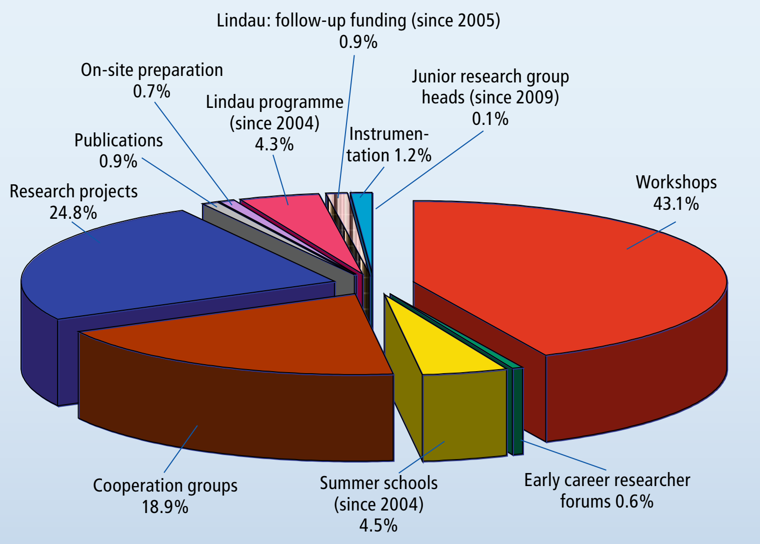
Total expenditure of SGC funding programmes 2001-2009



Further information on the SGC and its funding programmes is available on the SGC homepage:

www.sinogermanscience.org.cn

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