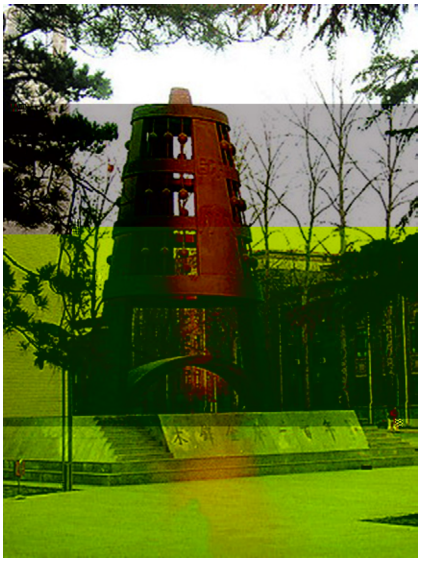

Chiming in: The Mu Duo Gilded Bell of Beijing Normal University.

in Chinese. Foreign collaborations have also been funded by western agencies, including the Royal Society, but in these cases the funding is paid out to her foreign collaborators.

A decade after what must have appeared as a very brave move at the time, Perrett is still enthusiastic about the opportunities she enjoys in Beijing. "It's an exciting time for science in China!" she says. "The fact that there has been a huge reverse-brain-drain in the last few years, and the comparative funding situation in China compared to the West, means that there is some really ambitious and exciting science going on here that most Western institutions would struggle to support," Perrett concludes.

International relations

One of the first western organisations to establish scientific contacts was Germany's Max Planck Society (MPG), which already sent a delegation to China in 1974, and has maintained lively exchange programs ever since. "The Max Planck Institutes that work in the field of neurosciences usually have doctoral students and post-docs from the leading universities in China and from the CAS institutes," says Barbara Spielmann from the society.

In 2005, MPG and CAS set up the Partner Institute of Computational Biology in Shanghai, with a truly international staff, including directors both from China and from Germany.

In 2009–2010, Germany and China held a joint bilateral year of science and education, involving over 150 events in both countries and culminating in a final celebration at the Expo 2010 at Shanghai. Nearly 50 German universities held 'Chinese weeks' in the summer of 2010.

Nikos Logothetis, director of the department 'Physiology of Cognitive Processes' at the Max Planck Institute for Biological Cybernetics in Tübingen, has visited Chinese neuroscience laboratories on several occasions. "It's very, very impressive what they try to do, and how fanatically they support science. Really amazing!" he enthuses. He also praises the international spirit in China's neuroscience community: "They are strongly welcoming interactions with other nations; in fact they try to get as many of them as possible for scientific advisory boards, for guest professorships and so on."

Stopping the brain-drain

All in all, as both Chinese and foreign researchers are finding the prospect of working in China increasingly attractive, it looks like China is claiming its place among the leading research nations. This appears to be true for neuroscience as much as for other fields, e.g. genomics.

After decades of severe brain-drain, it looks as though the drain can be stopped. "I think the brain-drain has been diminished significantly, at least in biology," says Fang Fang. "With the development of economy and the improvement of scientific evaluation systems in China, the brain-drain can be stopped." Fang also points to a 2008 government plan, the Recruitment Program of Global Experts (also called the one-thousand talents plan), which aims to recruit established scientists working in well-known research universities and institutes.

Modern institutes, like the Kavli Institute at Peking University and the McGovern Institutes of Brain Research soon to be established at Peking University and Tsinghua University, are actively recruiting non-Chinese scientists. "I expect some non-Chinese world-class scientists will take PI positions in these institutes," says Fang.

Sarah Perrett agrees: "Science in China is gradually becoming more internationalized. At the moment, the majority of scientists in China are of Chinese origin, but that is already changing."

Michael Gross is a science writer based at Oxford. He can be contacted via his web page at www.michaelgross.co.uk

Q & A

Fang Fang

Fang Fang is professor of Psychology at Peking University. He grew up in Anhui, China, and earned his B.S. in psychology and M.E. in signal and information processing at Peking University. From 2001 to 2007, he did his Ph.D. and postdoctoral training in cognitive and biological psychology at the University of Minnesota with Sheng He, Daniel Kersten and Gordon Legge. He then moved back to Peking University and started his own lab as principal investigator. His research has focused on human visual perception, attention and awareness, using functional brain imaging, psychophysics and [illegible]

tional
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[illegible]

league of Marr; Marr
[illegible]

career in vision and brain research. Otherwise, I would probably be a computer programmer somewhere.

Do you have a favorite scientific paper? I have many favorite papers, but two come immediately to my mind. One is David Field's 1987 paper "*Relations between the statistics of natural images and the response properties of cortical cells*" (J. Opt. Soc. Am. A, *4*, 2379–2394). It describes a novel attempt to show that the receptive-field properties of mammalian cortical cells are well suited to efficiently representing the information contained in natural images. It provides insightful suggestions for how to relate the statistics of the natural environment to cortical cell behavior. The other is a 1997 paper by Stephen Engel and colleagues "*Retinotopic organization in human visual cortex and the spatial precision of functional MRI*" (Cereb. Cortex, 7, 181–192). The work reported in this paper demonstrated that functional magnetic resonance imaging (fMRI) can go beyond being just a cortical localizer and can be used to characterize the computational properties of neural populations within functionally and anatomically meaningful visual areas. It has been an inspiration to numerous quantitative fMRI studies.

Do you have a scientific hero? David Marr, as you have probably guessed from my answer to the first question. A second hero is Sherlock Holmes, from Conan Doyle's fiction! I am extremely impressed by his astute logical reasoning and his ability to draw important conclusions from what others consider minor details. I tend to believe that excellent scientists, especially cognitive neuroscientists, should have the same great capabilities as Holmes. Human cognitive neuroscientists (and vision scientists) cannot directly measure neural activities inside the brain. They have to rely on indirect measurements with brain-imaging techniques and psychophysics, and then make inferences about what is going on in the brain and the mind.

What is the best advice you have ever been given? Don't follow fashion and do work on what you are truly excited about. Hot topics come and go. It is not easy to predict what topics will be hot even in just five years. More specific to my own area, although I spent a lot of time and energy learning brain-imaging techniques, I was advised to master more traditional skills of designing strictly controlled experiments to test well-developed theories and hypotheses — these skills have turned out to be critical for my career development.

If you knew what you now know earlier on, would you still pursue the same career? Yes, I think so, though I would like to spend more time learning high-level mathematics and doing computational modeling research.

What is your greatest ambition in research? That would be to completely understand our ability to recognize visual scenes with such high accuracy and speed and to duplicate this human ability in an artificial visual system. This artificial system would perform just as well as our visual system, even make the same 'mistakes' that we do; for example, it would even 'see' the motion aftereffect!

What do you think are the big questions to be answered next in your field? In the short term, as far as I can see, it is to understand cortical plasticity, especially plasticity in visual cortical areas. Visual experience, including priming, adaptation and perceptual learning, can significantly change our visual functions (for example, improve our ability to detect features and recognize objects). How does visual experience shape our visual system at the levels of single neurons, neuronal circuits and cortical connections? Answering this question might provide a key to understand our extraordinary abilities of visual perception. In the long term, it is the nature of consciousness. Though doubtful whether I have enough courage to tackle the problem, I am often interested in touching on the most difficult aspect of consciousness, the so-called 'hard problem' of qualia — the greenness of green, the happiness of happy, and so on.

Why did you move back to China? First of all, I feel extremely privileged to be educated and trained at the University of Minnesota. There are many superb scientists studying vision and brain imaging there. My collaboration with them led to some intriguing findings on visual adaptation, unconscious visual processing, and contextual modulation in early visual cortical areas. From them I learned not just experimental skills, but also various distinct perspectives on these same scientific questions.

Career-wise, working in China is very attractive to me. Government research funds in China have been growing at an annual rate of more than 20%. Ample funding allows me to explore and carry out much larger and more risky projects. At Peking University, I have been enjoying working with the country's most intelligent and hardworking students. In addition, I am a big ping-pong and soccer fan, and living in China gives me a lot more opportunity to enjoy these sports.

Tell us something about neuroscience in China? Neuroscience in China has a tradition of excellence. I would like to mention the founders of modern Chinese neuroscience — Robert Kho-Seng Lim, Te-Pei Feng and Hsiang-Tung Chang. Lim and Feng were members of the US National Academy of Sciences. Lim carried out pioneering work on the physiology of neuromuscular junction and synaptic plasticity. Interested readers might want to read a chapter published in the *Annual Review of Neuroscience* in 1988 (*11*, 1–12) about Lim's career development and the early history of neuroscience in China. Chang was one of the pioneers of studying dendritic potentials and among the first to recognize the functional significance of dendrites in the central nervous system.

Neuroscience in China has grown steadily since the 1920s, and started to flourish in the 1990s. In 1995, the Chinese Neuroscience Society was founded and it now has more than 2500 members. Major neuroscience research programs are located in the Chinese Academy of Sciences, Peking University, Fudan University, Beijing Normal University, University of Science and Technology of China, many medical universities and institutes, and many more places. Research areas include molecular, cellular and developmental neurobiology, systems and computational neuroscience, as well as cognitive and behavioral neuroscience. Chinese neuroscientists are making their contribution to the development of this field *on a par* with their peers in the international arena, as demonstrated by their frequent publications in almost all prestigious journals (including *Current Biology*).

And what about psychology in China? Psychology, on the other hand, took a slightly different turn. In 1917, the first psychology laboratory in China was set up at Peking University, under the guidance of the university president Yuen-Pei Tsai. Tsai studied psychology with Wilhelm Wundt when he was in Germany. Unfortunately, the development of psychology was suppressed for a long time, even halted during the Cultural Revolution from 1966 to 1976. This is because psychology was criticized as a pseudo-science. In 1981, only four universities had a psychology department. Interestingly, the turning point for the development of psychology was also in the 1990s, almost in parallel with the time when neuroscience started to thrive. Up to now, there are more than two hundred psychology departments/institutes in China. Founded in 1921, the Chinese Psychological Society now has about 8000 members. Psychological research in China covers almost all basic and applied fields. Brain and cognitive science has been identified as one of the eight research frontiers by the central government in 2006 and two national key laboratories have been set up targeting fundamental issues in this area. The rapid development of psychology (and neuroscience) in China is partly due to the nation's economic boom and thus a rapid growth in research funds. I feel honored to live in this era and to experience the dramatic (positive) changes of science and research in China.

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Quick guides

Argonaute proteins

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What are Argonaute proteins? Argonaute proteins form an evolutionarily conserved family whose members silence gene expression in pathways such as RNA interference (RNAi). Argonaute family proteins can be divided into AGO and PIWI proteins (Figure 1). Both types of Argonaute proteins bind 21–35 nt long small RNA guides whose sequence identifies the genes to be silenced. Argonaute–small-RNA complexes can repress the transcription of genes, target mRNAs for site-specific cleavage or general degradation, or block mRNA translation into protein. AGO proteins bind ~21 nt small interfering RNAs (siRNAs) and 21–23 nt microRNAs (miRNAs). Both siRNAs and miRNAs are cut from double-stranded RNA precursors by RNase III enzymes such as Dicer. AGO proteins are essential for development and differentiation, and in most plants and animals, defend cells against viral infection. In contrast, PIWI proteins bind 23–30 nt PIWI-interacting RNAs (piRNAs), whose production does not appear to involve double-stranded RNA or Dicer. piRNAs are unique to animals, where they repress transposon expression and ensure the successful production of sperm and eggs.

How do Argonautes function? An Argonaute protein plus its small RNA guide compose the RNA-induced silencing complex (RISC). RISC complexes can also contain additional proteins thought to extend the functions of Argonautes or to direct RISC to specific sub-cellular locations. The simplest, and likely ancestral, Argonaute function is endonucleolytic cleavage of its RNA target at a single phosphodiester bond. The structure of Argonaute ensures that the bond cleaved always lies between the target nucleotides paired to the tenth and eleventh nucleotides of the guide RNA. Increasingly, Argonaute aficionados refer to these nucleotides as g10 and g11 for the small RNA and t10 and t11 for the target, viewing both the guide (g) and the target (t) from