《Nature》杂志展示大气环境中心中美合作成果

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Chinese–US research partnerships outnumber all other international pairings. That trend, spurred by a long history of collaboration between the two countries, presents challenges, but the outcomes are a major boon for science.

BY SUJATA GUPTA

In 2014, Lei Zhao, a Chinese student doing two years of his doctorate at Yale University in New Haven, Connecticut, developed a model to clarify the causes of the heat-island effect. Such heat islands, or regional pockets of warm air, occur due to human activity and tend to be most pronounced in urban areas.

"Generally speaking, in a large city, you have a stronger heat island," says Xuhui Lee, a climate scientist at Yale who oversaw the project.

Zhao calculated the average temperature difference between the downtown and outskirts of 65 cities across the United States and Canada. Despite some anomalies, his model confirmed the principle that the urban heat-island effect intensifies as tree cover and vegetation diminishes. As expected, bigger cities generally had more acute heat islands.

Zhao's team then decided to test the model in China by applying it to 40 medium to large cities and found that the heat-island effect was stronger in smaller, midwestern cities than megalopolises like Shanghai and Beijing. The team wondered what was going on.

The goal of any climate modeller, says Lee, is to develop a program that will work anywhere in the world. But, were it not for Yale's collaborative program with China, known as the Yale–NUIST (Nanjing University of Information Science & Technology) Center on Atmospheric Environment, the shortcomings of Zhao's models would never have been discovered.

International research collaborations are on the rise. In 2013, 19.2% of research papers included authors from more than one country, up from 13.2% in 2000, according to the National Science Foundation's Science and Engineering Indicators 2016. This increase is probably due to improvements in communications technology, a growing number of qualified researchers, and problems, such as climate change and food insecurity, that need global solutions.

Partnerships between the largest producers of publications, the US and China, are particularly prolific. Analysis of 68 high-quality natural science journals included in the Nature Index shows Chinese and American researchers have collaborated in top journals more than other international pairings. In the last four years, Chinese–American partnerships in the physical and life sciences have more than doubled.

"IT'S EASIER TO PUBLISH IN A CHINESE JOURNAL."

The research relationship between China and the US has a long history, says Richard Suttmeier, an expert on Chinese science policy and professor emeritus at Oregon State University in Eugene. Suttmeier has conducted several studies of papers with Chinese and American authors to determine the authors' identities. He found that many partnerships were between the large diaspora of Chinese researchers in the US and their compatriots in China — a phenomenon he refers to as "co-ethnic cooperation", and to which he attributes China's stronger links with the US than with other English-speaking countries.

Almost a quarter of close to 400,000 foreign-born holders of a science or engineering doctorate in the US come from China, according to the National Science Foundation's Science and Engineering Indicators 2016.

Chinese graduate students began coming to study in the US in the 1940s, but the modern-day relationship began in the late 1970s. The Cultural Revolution, which effectively froze scholarly activity for a decade, ended with the death of Mao Zedong in 1976. The leader's successor, Deng Xiaoping began opening China's markets and accelerating the pace of scientific research. In 1979, Xiaoping and US President Jimmy Carter signed the landmark US-China Science and Technology Cooperation Agreement, setting the stage for long-term collaboration.

Political tensions between the two countries had stemmed the flow of students from China to the US in the previous decades, but the two leaders signed an agreement on the exchange of students and scholars, reopening the path for Chinese students to study in the US. Today, graduates from China in the US outnumber all other nationalities, comprising more than 30% of the US's foreign student population.

Since 1979, the Chinese government has continued its push to become a world leader in research and development. In just the last four years funding for the National Natural Science Foundation of China, the country's equivalent to the US National Science Foundation, has quadrupled. Chinese faculty are encouraged to study and conduct research overseas to gain the skills and experience of world-class scientists. Chinese researchers also report intense pressure to publish in English language journals. "It's much easier to publish in a normal Chinese journal but I don't want to invest a lot of time on that," says Wei Xiao, China-based co-director of the Yale-NUIST center. "If you want to be a research professor, you have to publish in a good English journal."

Collaborating with international partners also increases access to funding, say Lee and others. That can be beneficial for US-based researchers, where competition is increasing

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近日，《Nature》杂志发表题为《Science superpowers find common ground》的文章，以我校和耶鲁大学共建的大气环境中心近些年的中美合作成果为例，深入探讨了国际科研合作的现状、重要意义以及面临的挑战。

《Nature》编委发现，近年来中美科学家的合作比其他任何双边合作都要多。为了寻找文化背景、政策导向等方面的原因，文章作者采访了大气环境中心的李旭辉教授、肖薇副教授、曹畅博士，以及大气环境中心合作伙伴明尼苏达大学Tim Griffis 教授等人。

报道指出，中美两国之间的科研交流合作已有很长的历史。中国科学政策专家、美国俄勒冈州立大学教授Richard Suttmeier 指出，这种合作尤其体现在美国和中国科研人之间，是共赢互利的关系。一方面，中国科研人员普遍面临着发表高质量英文论文的压力；另一方面，美国课题申请竞争激烈，项目经费逐年缩减，很多非常优秀的申请书得不到支持，中美合作恰好能够互相弥补。文章引用李旭辉教授举的例子：“在美国申请大型野外实验的经费非常困难，而中国政府对科学研究尤其是尖端科学研究的重视，以及在科研方面投入的增加，使得科学家研究中国问题可以获得充足的经费支持”。美国明尼苏达大学生物气象学家Tim Griffis教授曾经到访过一些中国的实验室，这些实验室拥有很多国际上最新研发的先进设备，给他留下了深刻的印象，因为在美国，只有当大学需要建立新的实验室时，才有机会获得购买大型实验设备的经费。同时，在中美科研合作的大潮下，越来越多的中国研究生、科研人员到美国和一流的科学家合作，并把积累研究经验带回国内，用

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美国科学家的严谨模式管理国内的实验室，提升英文文章质量。高质量的科研产出进一步加强了中美科研合作，形成一个良性循环。

文章以大气环境中心的城市热岛研究为个例，分析了这种双赢合作关系。最初，大气环境中心成员、耶鲁大学博士生赵磊建立了一个城市热岛气候模型，分析了北美城市热岛的空间变化特征及其主要驱动因子，该结果发表在2014年的《Nature》杂志上。之后，受中国国家基金委资助到耶鲁大学进行联合培养的曹畅博士把该模式应用到中国，效果却差强人意，他通过发掘模型的不足从而进一步发现雾霾对于中国城市热岛的影响，这一结果于今年8月发表在《Nature Communications》上。如果没有来自中国的人力和资源支持，该项城市热岛研究不会如此深入。

《Nature》原文链接：http://www.nature.com/nature/journal/v539/n7629_supp/full/539S6a.html

大气环境中心网站：http://yncenter.sites.yale.edu/

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