

Issue Brief

Gao Huajian and the China Talent Returnee Question

A Contrarian View on the Impact
of Returning Chinese Scientists

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Executive Summary

The relocation to China of high-profile scientists is seen as a loss to the host country and the institutions to which they were affiliated. Media commentary, however, tends to focus on the reasons why these senior figures relocate to China, leaving unanswered the question of how serious these losses to the former host actually are.

This study adopts the contrarian view that a “reverse brain drain” to China may not be the unmitigated disaster to U.S. interests that many imagine and may not be in China’s own best interest, given alternative venues by which China can benefit from its diaspora scientists working abroad. We use the term “diaspora” in the sense of “PRC-born, PRC nationality scientists who come to work and reside in the United States for some time.”

Although the loss of top talent in the United States is a cause of concern, data suggest that—celebrity cases aside—the upper strata of diaspora scientists is less likely to relocate and those who do return to China may, on average, become less productive.

Overshadowing the question is the issue of technology transfer that potentially occurs when diaspora scientists interact with PRC colleagues through previously established professional relationships, venues promoted by China, or from a natural inclination to collaborate with the scientific community of a rising nation. These circumstances are evidenced in the career of Gao Huajian, a recent returnee to China, whose interactions with China while living abroad are described here.

The study concludes with proposals meant to encourage foreign talent to remain in the United States, while hedging against the practical reality that these losses are likely to continue.

Introduction

A recent slate of media articles has drawn attention to high-profile Chinese scientists who are leaving their academic posts in the United States to return to China.¹ Positive reasons cited for their return, in the Chinese media especially, include patriotism, improved working conditions, China's ascendancy to the ranks of peer competitor in multiple fields of science and technology, as well as personal inducements like dual-hatted appointments, directorship of research institutions, and in some cases access to China's leadership cadre.² On the negative side are claims made by departing scientists—conveyed by some U.S. media outlets and rights advocacy groups—that racial animus and government persecution made their situations in the United States untenable.³

Beyond the important ethical issues, a frequent, if not always explicit, assumption reflected in much of this reporting is that the departure of diaspora scientists to China represents a loss to the host country and a major net gain for China. This report suggests an alternate way of viewing the matter that takes into account the advantages China gains by its diaspora scientists staying abroad, such as greater productivity and the ability to promote China's science and technology development remotely “through multiple means (以多种方式).” A recent example of the latter is provided by China returnee GAO Huajian (高华建), a physicist with expertise in mechanics and materials engineering, whose career, among others, are described in this study.

Prominent China Returnees

Former UCLA scientist ZHU Songchun (朱松纯) made headlines in 2020 when he returned to China to lead a consortium building artificial general intelligence (AGI),⁴ and later when the import of his career decision was recognized by U.S. authorities.⁵ Notwithstanding the attention he received, Zhu's circumstance is not atypical. Within his own artificial intelligence (AI) field, other high-profile cases include:

- Harry SHUM (沈向洋), a former Microsoft executive, who left the company in February 2020 to join Tsinghua University and its Institute for Advanced Study a month later.⁶
- PU Muming (蒲慕明), another leading scientist and AGI proponent, who renounced his U.S. citizenship in 2017 to focus on his work at the Chinese Academy of Sciences (CAS) Institute of Neuroscience.⁷

- YAO Chi-chih (姚期智, also known as, Andrew Chi-Chih YAO), the Turing Award winner, who renounced U.S. citizenship in 2016 while dean at Tsinghua University's Institute for Interdisciplinary Information Sciences.⁸

The phenomenon is not confined to AI scientists but occurs across all disciplines.⁹ YAN Nieng (颜宁), a prominent structural biologist, resigned her Princeton professorship in 2022 for a post in Tsinghua's School of Life Sciences and to found the Shenzhen Medical Academy of Research and Translation (深圳医学科学院), built at a cost of \$1.2 billion.¹⁰ A year later she was voted into the CAS. Yan's entire training and academic career from 1996 is marked by transitions back and forth between U.S. and Chinese institutions.¹¹

DUAN Luming (段路明), a famous quantum scientist, resigned his chair at the University of Michigan, where he had been since 2003, also to take up a post at Tsinghua in 2018.¹² In 2001, while a postdoctoral researcher at the California Institute of Technology, Duan was inducted into a CAS "talent" program,¹³ one of many such operations run by China to attract overseas scientists' support. In 2010, while still at Michigan, Duan helped establish Tsinghua's Quantum Information Center, which became a focal point for Chinese scholars. In 2011 Duan was appointed "C.C. Yao Professor" at Tsinghua coterminous with his Michigan post, and advised students at Tsinghua during this period.¹⁴

Duan's, Yan's, and multiple other examples presage that of Gao Huajian, whose case is described in detail below. In January 2024, Gao, a highly decorated physicist, left his posts at Brown University and Singapore's Institute of High Performance Computing to return to China's Tsinghua University ending a career abroad that lasted some 40 years.¹⁵ During this time Gao authored 533 academic papers, chiefly in nanotechnology and solid mechanics, which have been cited more than 50,000 times, and received more international awards than we have space here to list.¹⁶ What Gao and the others have in common, besides relocating to China, is that their returns were preceded by prolonged interactions with Chinese institutions while abroad, including dual appointments at universities and hands-on support for China's research initiatives.

Who Gains and Loses from Returned Scientists?

The return to China of highly-acclaimed PRC-born scientists, who built up their skills abroad, together with the immigration of other scientists from abroad, is, for good reasons, viewed by many observers as a loss to the United States and a boost to China's competitiveness, as these returnees settle into their new positions in China.

Impassioned calls to retain these scientists have figured into U.S. government policy proposals,¹⁷ and appeals to end possibly biased enforcement of espionage laws—cited by some returnees as a reason for their departure—are made by concerned and sympathetic Americans.¹⁸

While the loss to the United States of scientists returning or emigrating to the PRC is a matter of concern, this study argues that the matter is less cut-and-dried than is typically understood.

For example, a recent paper in *Science* examining China’s talent plans shows that the caliber of scientists willing to vacate their overseas posts to return to China falls short of the caliber of those preferring to stay, as measured in publication output. The study, which focused on “Youth Thousand Talents Plan” (青年千人计划) recipients, found that those accepting the award typically ranked among the top 15% of their peers in productivity—this is not surprising, given that the stipend is only offered to those with high accomplishments. However, it also found that scientists who were offered the award and rejected it were in the top 10% in terms of papers published and held more senior credentials than those who accepted it.¹⁹ While media attention focuses on celebrity returnees, the top strata of diaspora scientists are not, as a whole, those most likely to return.

Among those who do go back, there is reason to believe their public output, on average, declines. An earlier (2022) review of “Youth Thousand Talents Plan” recipients analyzed pre- and post-return production over multiple years, which was found to decline by 30 percent.²⁰ The study noted its:

“. . . results are similar to findings from the previous literature. For instance, Liu et al. (2019) reported a decrease in the number of publications by scholars after they received the YTTP and returned to China. In this paper, the results demonstrate that the number of publications decreased for awardees who returned to China during all five waves.”²¹

Finally, the belief that scientists relocating to China harm U.S. interests fails to consider the benefits that potentially accrue to China when its domestic talent stays abroad. Two vectors account for this, namely (1) comprehensive measures enacted by China to support a “dual bases” (两个基地) mechanism that gives China prompt and continuous access to U.S. scientific research via real-time diaspora contributions, and (2) initiatives taken by diaspora scientists themselves from a natural inclination of all researchers to

act in venues that are familiar to them and willing to fund their laboratories and reward their research activities.

Evidence for the first point exists in the statutes China has enacted to facilitate overseas scholars' China engagement. For example:²²

- 1994 “Ministry of Personnel Notice on Implementing Temporary Measures to Subsidize Overseas Chinese Scholars who Return to China for Short Periods.”²³
- 2001 “Circular on the Release of Opinions of Encouraging Overseas Chinese Scholars to Serve the Country by Multiple Means.”²⁴
- A long-standing “Homeland Serving Action Plan for Overseas Chinese,” which by 2018 had brought “home” some 18,000 technology projects.²⁵

These provisions are supported by China’s now-familiar global “talent” programs and a less familiar network of overseas associations of scientists and engineers formed on topical or geographic lines—many of which are pro-PRC in orientation.²⁶ This conveyor-like mechanism has been described in Chinese sources, as well as in peer-reviewed U.S. studies, and needs no explication here.²⁷ In the present authors’ view, what began as an effort to lessen the effects of a “brain drain” morphed into a net-positive solution the PRC government is in no hurry to erase.

The Example of Physicist Gao Huajian

Complementing these state-guided measures are acts diaspora scientists initiate on their own in their professional lives by virtue of the demand created by their excellence, without explicitly acting in support of China’s or any other government. Gao Huajian, on whom we have chosen to focus, is a poster child of the benefits China accrues from diaspora scientists while they work and research abroad.

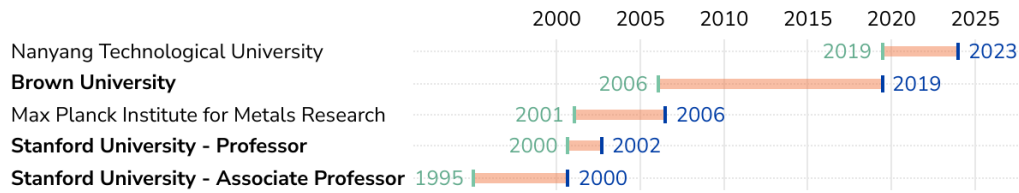
Gao received a BS degree from Xi’an Jiaotong University in 1982 and MS and PhD degrees in engineering from Harvard University in 1984 and 1988, respectively. He became an assistant professor at Stanford University in 1988, was awarded tenure there in 1994, and became full professor in 2000. Immediately afterward Gao initiated a series of working affiliations with Germany’s Max Planck Institute and with a number of PRC institutions, all while maintaining his association with Stanford University. Gao’s links to China’s research community continued to grow after 2005, when he joined Brown University as a professor of engineering. In 2019, he traded his title for emeritus professor at Brown University and added Singapore’s Nanyang Technological University to his working portfolio, as shown in Table 1, below.

Table 1. Timeline of Gao's Appointments from 2000-2024 (U.S. Associations are Noted in **Bold**).²⁸

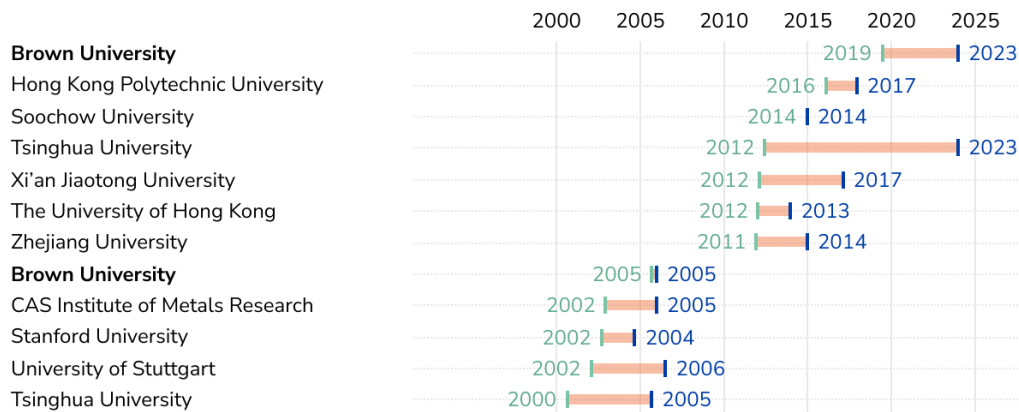
Gao Huajian - Selected Timeline

Two Stanford positions with corresponding labels

Main Employer



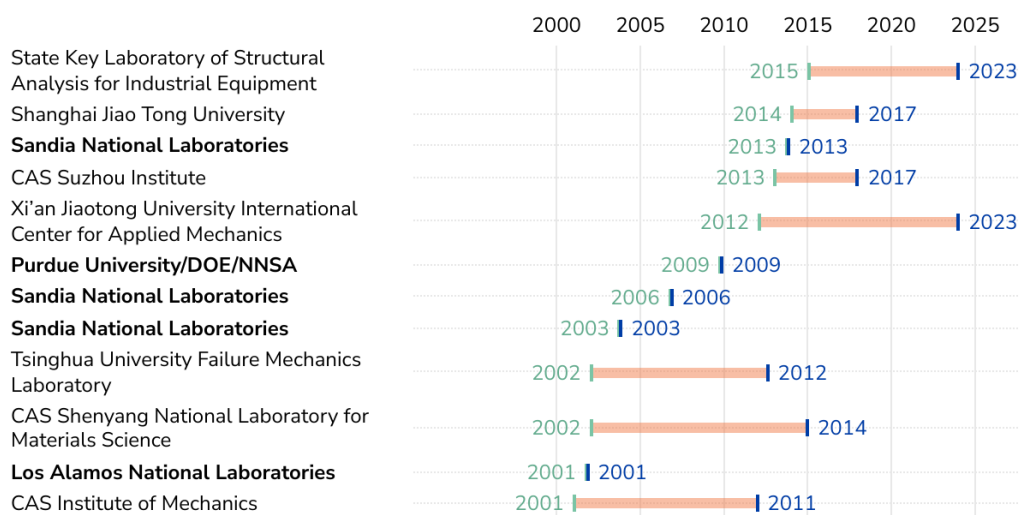
Visiting Position



Honors and Awards



Committees



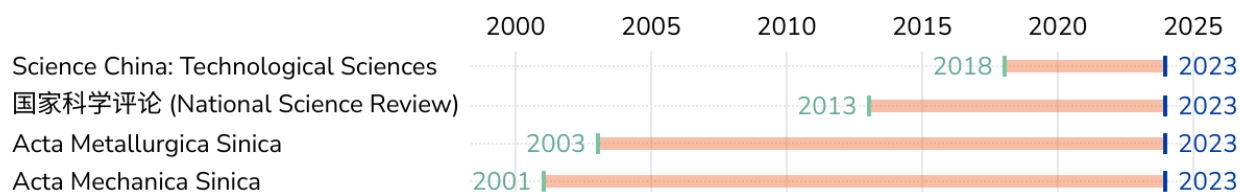
Source: Brown University, "Gao Research Group," <https://sites.brown.edu/gao-group-nanomechanics-engineering-biological-systems/>.

Three facts emerge from the timeline germane to this study: (1) Gao was at top U.S. universities for most of his 40 years abroad; (2) his 2001-2006 hiatus at German institutes was punctuated by engagements with U.S. nuclear weapons design and assembly facilities (Sandia and Los Alamos National Labs), a relationship that continued on and off until 2013, and with Department of Energy nuclear weapons programs at Purdue University,²⁹ according to Gao’s online curriculum vitae; and (3) Gao formed decades-long ties with *multiple* Chinese universities and CAS institutes while at U.S. academic institutions, beginning shortly after his appointment as full Professor at Stanford.

Gao’s contributions to China’s scientific community can also be inferred by his role on the editorial boards of four major Chinese scientific journals, namely:

Table 2. Gao’s Affiliations with Chinese Academic Journals

Gao Huajian - Editorship Timeline



Source: Brown University, “Gao Research Group,” <https://sites.brown.edu/gao-group-nanomechanics-engineering-biological-systems/>.

Relevant information not captured in the tables include the details of Gao’s contributions to China’s research community while at non-China institutes. For example, while at the Max Planck Institute, Gao was “overseas director” (海外主任) of CAS’s Shenyang National Laboratory for Materials Science (沈阳材料科学国家研究中心)—a title that fits squarely within the “dual bases” model described above—while “actively promoting” (积极促进) cooperation between the two.³⁰ Gao also trained “35 doctoral students and mentored 37 postdoctoral fellows,” more than 20 of whom returned to China to become top figures in academia and research.³¹ Examples of people Gao mentored include:

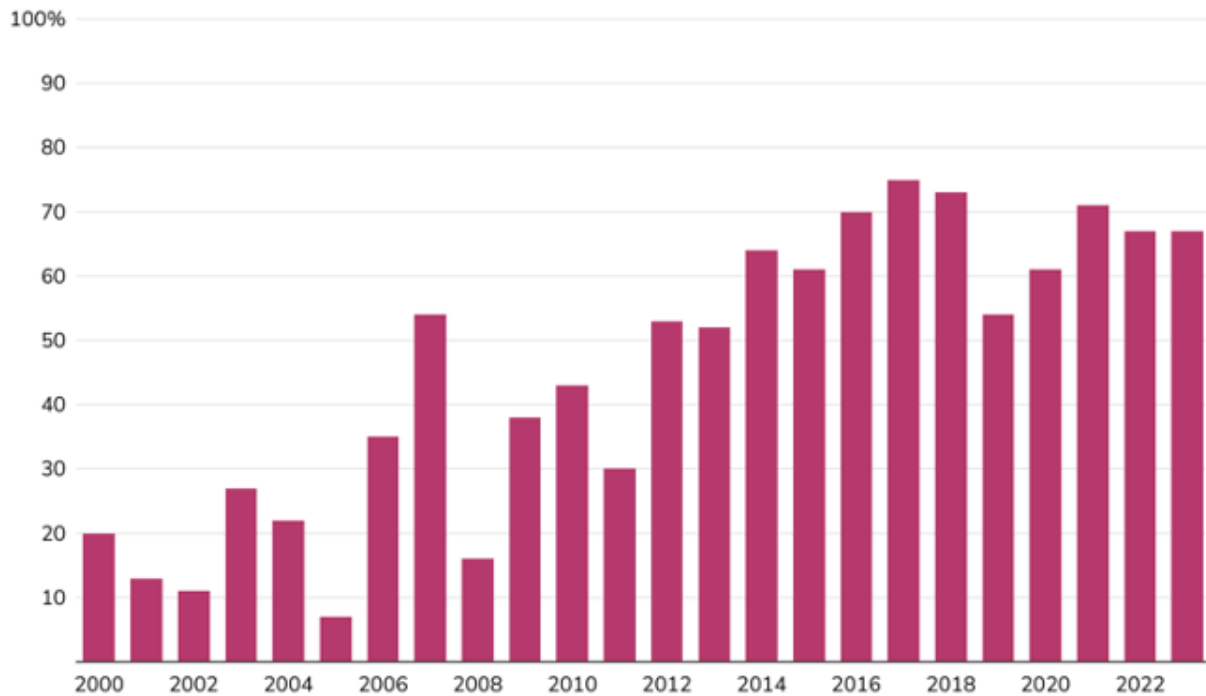
- LI Xiaoyan (李晓雁) finished a PhD at Tsinghua in 2007 and studied under Gao at Brown University from 2007 to 2012. He is now deputy director of Tsinghua’s Institute of Solid Mechanics (固体力学研究所). Li’s work has appeared in a dozen top journals, some funded by various PRC “talent” plans and state key

laboratories with co-authorship funding by the U.S. Department of Defense, U.S. Department of Energy, and Office of Naval Research.³²

- QIAN Jin (钱劲) was a research assistant at Germany's Max Planck Institute until 2006, finished a PhD at Brown University under Gao in 2009, and did postdoctoral work at the Georgia Institute of Technology. In 2011 he was appointed to Zhejiang University's School of Aeronautics and Astronautics, where he is now the school's vice dean. His research is in advanced materials, 3D printing, and biomechanics.³³
- SHI Xinghua (施兴华) earned a PhD under Gao in 2010, took up a post at the CAS's Institute of Mechanics the following year, and in 2016 became vice-director of the CAS National Center for Nanoscience and Technology (国家纳米科学中心). The recipient of numerous PRC "talent" awards, Shi has published on nanoscale drug delivery systems in studies coauthored by Gao.³⁴
- WANG Jizeng (王记增) received a PhD in 2001 from Lanzhou University, the top institution of learning in northwestern China. From there he did postdoctoral work in South Korea and at the Max Planck Institute, until moving on with Gao to Brown University in 2006 as a senior associate researcher. Wang returned to Lanzhou University in 2009, where he continues to publish with Gao.³⁵
- WEI Yujie (魏宇杰) earned a PhD from the Massachusetts Institute of Technology in 2006, did postdoctoral work at Brown University under Gao until 2008 and stints at the University of Colorado and Georgia Tech (2011-2014), while a "100 Talents" scholar at the CAS Institute of Mechanics. He now directs CAS's State Key Laboratory of Nonlinear Mechanics (非线性力学国家重点实验室) and has published with coauthors at Argonne National Lab.³⁶
- ZHOU Haofei (周昊飞) received a PhD in solid mechanics at Zhejiang University in 2013 and did postdoctoral work at Brown University for five years under Gao's mentorship. He returned to Zhejiang University in 2018 under the 100 Talents Program as a researcher and doctoral supervisor, and has published more than 60 papers on high-strength metals, including 14 co-authored with Gao.³⁷

Equally telling of Gao’s China connections while abroad is his output of coauthored papers, shown below in Table 3. Note the uptick in the number of papers coauthored with individuals at Chinese institutions beginning in 2006 with Gao’s appointment at Brown University.³⁸

Table 3. Percentage of Gao’s Papers Showing Coauthorship with Individuals at Chinese Institutions, 2000-2023



Source: CSET merged corpus of scholarly literature.

Gao’s formal return to China is dated January 13, 2024, when he accepted a professorship at Tsinghua University,³⁹ but he has always remained deeply connected with PRC research institutions, and was active as well in mentoring up-and-coming Chinese-born researchers. According to Gao’s CAS biography, “in recent years he has been working in China for more than two months each year, giving more than 100 academic lectures and reports in China.”⁴⁰ Or as Gao himself put it, “I have a long-standing cooperation with Tsinghua” and “have long planned to return to China.”⁴¹

Recommendations

Anxiety over diaspora talent returning to China with the hard-earned secrets of their overseas hosts needs to be tempered by the certainty that information sharing is already happening on a scale that rivals the knowledge inside a returnee's head—information that grows less relevant with time. The challenge, accordingly, is not only to retain talent but to ensure that (1) the majority benefit accrues to the United States, (2) exchanges of information flow in both directions, and (3) sensitive information and intellectual property is not shared inappropriately.

This analysis studies one recent and prominent example, inspired by similarities to other cases documented in earlier CSET reports⁴² and the authors' other published volumes.⁴³ We recommend the topic be researched more broadly to determine the extent to which Gao's case typifies current trends and to learn what other outside venues Beijing may be exploiting to satisfy its own technology needs.

While we have no general solution to U.S.-China technology relations, some measures to address the foreign talent retention issue appear to be within scope:

Practical Measures

- Retain Chinese talent by offering competitive rewards for their services. Higher salaries and well-funded labs will better position U.S. institutions to attract the best and brightest.
- Encourage foreign scientists to settle permanently in the United States by fast-tracking citizenship for top talent and ending prosecution for marginal infractions.
- Provide clear guidelines regarding acceptable data and technology sharing practices to all incoming scientists to preclude misunderstandings about allowable practices.⁴⁴

Borrowed Measures

- Mimic China's strategy by encouraging diaspora scientists who have returned to China to continue their ties with U.S. institutions "through multiple means" (以多种方式).

- Facilitate temporary relocation opportunities for U.S. scientists to Chinese labs while retaining their status at U.S. institutions and links, if any, to the U.S. government.
- Establish a serious open-source document collection and analysis facility within the U.S. government on the China ISTIC⁴⁵ and ITIC⁴⁶ models to track talent movement.

Strategic Measures

- Renegotiate science and technology exchange agreements to ensure equal-or-better value for the United States, measured in concrete terms.
- Refocus intelligence priorities to identify risks posed by malicious actors, opportunities for intervention, and to monitor venues used by China for one-sided “exchanges.”
- Stop treating the problem as a zero-sum game and foster—on multiple levels—the rapid regrowth of domestic U.S. science.

Authors

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Endnotes

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⁴ Huey-Meei Chang and William C. Hannas, “Spotlight on Beijing Institute for General Artificial Intelligence.”

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¹⁵ Deng Hui (邓晖), "Academician of the 7th Academy of Sciences joins Tsinghua full-time!" (七院院士, 全职加盟清华), *Guangming Daily* (光明日报), January 15, 2024, <https://www.tsinghua.edu.cn/info/1182/109379.htm>, also Gao's CV at https://bpb-us-w2.wpmucdn.com/sites.brown.edu/dist/e/211/files/2021/01/Gao-CV-Pubn_Jan2021.pdf.

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²⁰ Ji Young Hwang, "Return or Stay? Impact of Reverse Brain Drain: The Case of the Youth Thousand Talents Plan in China," Thesis submitted to Korean Development Institute, School of Public Policy and Management, 2022, 26.

²¹ Ji Young Hwang, "Return or Stay? Impact of Reverse Brain Drain: The Case of the Youth Thousand Talents Plan in China," 26.

²² See William C. Hannas and Huey-Meei Chang, “Chinese Technology Transfer—an Introduction,” in Hannas and Tatlow, eds., *China’s Quest for Foreign Technology*, 9-11, for a more complete listing. The time elapse between these policy measures itself suggests Beijing’s awareness of the strategic importance of keeping diaspora scientists in place. We are grateful to John Chen of Peraton Labs for making this point.

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³¹ Deng Hui, “Academician of the 7th Academy of Sciences joins Tsinghua full-time!”

³² See Li Xiaoyan’s bio at: <https://www.hy.tsinghua.edu.cn/info/1152/1780.htm>.

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³⁴ Shi Xinghua’s CV is at: <http://www.nanoctr.cas.cn/shixinghua/ktzfzrj/>.

³⁵ Wang Jizeng's biographic information is at: <https://gxy.lzu.edu.cn/shiziduiwu/jiaoshou/2019/0903/107240.html> and <https://www.lzu.edu.cn/static/z/763.html>.

³⁶ "From 2006 to 2008 he worked as a postdoctoral fellow at Brown University in the United States, under Academician Gao Huajian."
http://www.lnm.imech.cas.cn/lnmgk/sysld/202008/t20200810_573889.html.

³⁷ Zhou Haofei's CV is at: https://person.zju.edu.cn/haofei_zhou.

³⁸ We searched the CSET merged corpus of scholarly literature for publications from 2000 to 2023 that list Gao Huajian as an author. [CSET merged corpus of scholarly literature including Web of Science, OpenAlex, Semantic Scholar, The Lens, arXiv, and Papers With Code. Certain data included herein are derived from Clarivate Web of Science.] Our search included several variants beyond the common "Last, First" and "First Last" name ordering and styling of Gao Huajian's name as it appears in different venues. Then we manually reviewed the search results to remove records likely written by different individuals who shared the same pinyin name variants. Removal criteria include a combination of out-of-topic publications (finance, genomics, and medicine but not nanomedicine) and affiliations not listed on Gao's CV. Finally, we tallied publications with contributions by China-based affiliations for each year.

³⁹ Deng Hui, "Academician of the 7th Academy of Sciences joins Tsinghua full-time!"

⁴⁰ "List and introduction of foreign academicians – faculty of the Chinese Academy of Sciences: Gao Huajian"

⁴¹ Deng Hui, "Academician of the 7th Academy of Sciences joins Tsinghua full-time!"

⁴² Chang and Hannas, "Spotlight on Beijing Institute for General Artificial Intelligence."

⁴³ Hannas, Mulvenon, and Puglisi, *Chinese Industrial Espionage*; Hannas and Tatlow, eds., *China's Quest for Foreign Technology*.

⁴⁴ See, for example, "Unwanted Foreign Transfers of U.S. Technology: Proposed Prevention Strategies" for a full-scope presentation of mitigation measures and how they interact with each another to address the "talent loss" versus "technology leakage" conundrum. William C. Hannas and Huey-Meei Chang, (CSET, September 10, 2021), <https://cset.georgetown.edu/article/unwanted-foreign-transfers-of-u-s-technology-proposed-prevention-strategies/>.

⁴⁵ "Institute of Scientific and Technical Information of China" (中国科学技术信息研究所), <https://www.istic.ac.cn/html/1/529/558/index.html>.

⁴⁶ "International Science and Technology Information Center" (国际科技信息中心), <https://itic-sci.com/>.