

AMERICA CHALLENGES CHINA'S NATIONAL TALENT PROGRAMS

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EDITOR'S NOTE

There rightly is great concern in the United States about Chinese efforts to obtain American technology through any means necessary. The Chinese Communist Party's "Thousand Talents Program" (TTP) is viewed as a central pathway of theft, and there is a growing chorus in the United States to shut down any connections between the TTP and the United States and to more generally circumscribe U.S.-Chinese cooperative research. But any such steps need to be based on a full understanding of the TTP. In this paper, veteran China hand David Zweig, one of the leading authorities on Chinese overseas study and research, and Siqin Kang examine the creation and evolution of the TTP. Their analysis suggests that the problematic and controversial elements of TTP, and U.S.-China scholarly collaboration in general, are real but manageable. To address these concerns, China should be far more transparent about the program and eliminate incentives for illegal or unethical behavior. For its part, the U.S. government likewise should be more transparent about its investigations and any evidence of possible wrongdoing, and research funding agencies should limit Chinese participation until the TTP is more transparent. Finally, the two sides should carry out extensive dialogue to eliminate abuses and find a sustainable path forward for Sino-U.S. collaborative research and educational exchange.

EXECUTIVE SUMMARY

The Thousand Talents Program (TTP) was created by the Chinese Communist Party (CCP) in 2008 to overcome the brain drain of Chinese talent that has seen many of the best Chinese scholars and researchers take up residency in Canada, the United Kingdom, and particularly the United States.

The goal of Li Yuanhao, a reformist former CCP Politburo member who created the TTP, was to create an "innovative society," not to steal U.S. technology. The first shift in a problematic direction occurred in 2010, when the TTP created a "part time" (PT) program to allow Chinese to have simultaneous appointments abroad and in China. Such PT participants engage in collaborative research in China, which involves some technology transfer, triggering concerns among U.S. government officials. Although there are some cases involving theft or illegal transfer of technology from the United States to China, the major problem with the TTP is "double dipping"—where Chinese researchers surreptitiously draw full-time salaries in the United States and in China or hold grants simultaneously from both American and Chinese funders. But in such instances there has been minimal theft of technology or intellectual property (IP). The National Institutes of Health (NIH) has banned mainland scholars found to have violated their policies. Another major problem is the Foreign Thousand Talents Plan, through which China hires senior American researchers, sometimes in secret, who transfer the product of their own research to China. However, while such action is not necessarily illegal, it does transfer IP created with U.S. taxpayer funds to China for which American researchers receive handsome rewards. Going forward, China should make the TTP more transparent, the U.S. should be more transparent about its investigations, and the two sides should carry out extensive dialogue. Such steps will protect collaborative research and publishing. Neither country will benefit from going it alone.

INTRODUCTION

The U.S. federal government has raised serious concerns about China's national talent programs, in particular the Thousand Talents Program (TTP), through which China has been enticing its current and former nationals to transfer technology created in the United States back to China. The U.S. government feels strongly that economic security is a key component of national security and therefore sees the illicit transfer of knowledge to a strategic competitor as a threat to U.S. national power. But the United States appears to be overstating the threat, accusing hundreds of Chinese permanent residents, and American citizens of Chinese descent, of engaging in a massive theft of U.S. technology at the behest of the Chinese Communist Party (CCP).

This paper argues that the evidence supporting that assertion remains weak, as it is based on a unverified assumption that China, unlike most other countries, utilizes its current and former citizens to spy.¹ Therefore, the U.S. government needs to make its case in a more transparent manner. There is no doubt that the Chinese TTP is opaque, a situation that China must resolve. However, the U.S. government effort is creating widespread suspicion of those engaged in collaborative research with China and alienating large numbers of ethnic Chinese scientists who were trained at the best schools in the United States and who prefer to remain in the United States. The result will be to intensify the decoupling of U.S. and Chinese scientific research, a situation that is harmful not only to China but to the United States and the world.

The first section of this paper will present the history of the TTP. The second focuses on the emergence of the “part-time” (PT) option, under which 75 percent of Chinese TTP participants remain abroad, creating the conditions for China to engage in illicit technology transfer. The third part of the paper draws on two data sets to show that the majority of TTP participants worldwide are in the United States and that these are among the best Chinese researchers in the world. The discussion then turns to considering the American concerns against the TTP, which is followed by the Chinese response to this attack. The paper concludes by laying out some policy suggestions for the United States and China in order to maintain the most important scientific relationship in the world.

THE ORIGINS AND EVOLUTION OF CHINA'S NATIONAL TALENT PROGRAMS

Despite Deng Xiaoping's assertion in 1978 that China would be willing to send scientists and scholars overseas, even if 5 percent did not return, reality has been much more punishing to China's effort to create a world-class pool of talent. After the People's Liberation Army (PLA) assault on Tiananmen Square, a new diaspora of Chinese scientists emerged instantly.

Since then, the return rates of Chinese who have received overseas doctorates (PhDs), who may be seen as the *crème de la crème* of global talent, have remained persistently low. For example, according to Michael G. Finn, as of 2013, the 5-year stay rates of those receiving PhDs in the United States in science or engineering was 84 percent for Chinese and 85 percent for Indians (see Table 1).

¹ The idea that Chinese intelligence is unique in that it relies heavily on individual Chinese who, willingly or unwillingly, spy for the state was put forward by a former CIA analyst, Paul Moore, in 1996 and is known as the “thousand grains of sand” theory. Moore has since rejected this view, but it reinforces the view in the current administration that the TTP is a widespread threat. This analysis draws on Mara Hvistendahl, *The Scientist and the Spy* (New York: Riverhead Books, 2020), 100-110.

Table 1: Five-year Stay Rates in the United States for Foreign Students on Temporary Visas Receiving Science & Engineering Doctorates, for Selected Countries, 2001-2011 (%)

	2001	2003	2005	2007	2009	2010	2011
China	98	93	95	94	89	87	85
India	89	90	89	83	79	83	82
Europe	53	63	67	67	60	N/A	N/A
Turkey	N/A	N/A	N/A	66	63	56	56
Canada	66	63	60	56	53	N/A	42
South Korea	22	36	44	42	42	45	42
Israel	N/A	N/A	N/A	53	38	38	41
Japan	24	39	41	33	40	43	38
Taiwan	41	48	52	43	37	41	38
All Countries	58	64	67	63	62		66

Source: Michael G. Finn, “Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2011,” *Science Education Programs*, Oak Ridge Institute for Science and Education, January 2014, <https://orise.orau.gov/stem/reports/stay-rates-foreign-doctorate-recipients-2011.pdf>.

According to the Center for Security and Emerging Technology (CSET), as of 2018, return rates of Chinese with a PhD in a discipline related to artificial intelligence (AI) was still under 10 percent. This is about the same level as in 2014.²

Given these numbers, it is not surprising that China’s leaders, since the 1980s, have made enormous efforts to encourage Chinese scientists, entrepreneurs, and academics to return home and, since 1996, have introduced a series of programs with positive incentives.³ In 2003, the CCP recognized the limited success achieved by the Ministries of Education and of Personnel in encouraging reverse migration of talent, so it established a Leadership Group on Talent (LGT) to take control over this issue. Still, in March 2007, Chen Zhili, the state counsellor responsible for education, proposed a series of policies to bring back the best Chinese talent from overseas. In her proposals, Chen announced that China needed “new ways of thinking” and “new methods” for bringing back top-quality overseas talent that had stayed abroad. Later that year, Politburo member Li Yuanchao, who had experimented with recruitment strategies while party secretary of Jiangsu Province, took over the CCP’s Organization Department and the LGT, pledging to do what no previous leader had accomplished—“bring back the best.”⁴ In December 2007, following the 17th Party Congress and Li’s ascension to chair of LGT, several ministries, led by the Organization Department, drafted three documents about returnees, focusing on improving their working conditions, introducing short-term methods for increasing the flow, and awarding special privileges to returnees in terms of work benefits.⁵ The documents emphasized that “human talent is the most important resource” and that attracting China’s overseas talent was “absolutely necessary” if China were “to raise its global competitiveness” and become “an innovative society.” This plan also called for the return of people who could make breakthroughs in key technologies and serve as scientific and technological leaders who could bring forward newly emerging fields.⁶

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2 Remco Zwetsloot, “Is the U.S. losing top tech talent — and global competitiveness?” *Washington Post*, February 4, 2020, <https://www.washingtonpost.com/politics/2020/02/04/is-us-losing-top-tech-talent-global-competitiveness/>.

3 David Zweig, “Learning to Compete: China’s Efforts to Encourage a Reverse Brain Drain,” *International Labour Review* 145, nos. 1-2 (2006): 65-90, https://www.researchgate.net/publication/229519904_Competing_for_talent_China’s_strategies_to_reverse_the_brain_drain.

4 This section draws on David Zweig and Huiyao Wang, “Can China Bring Back the Best? The Communist Party Organizes China’s Search for Talent,” *China Quarterly* 215 (September 2013): 590-615, <https://www.cambridge.org/core/journals/china-quarterly/article/can-china-bring-back-the-best-the-communist-party-organizes-chinas-search-for-talent/5AFA4235E24738BBAE36CB8F0BEE4088>.

5 Miao Danguo, *Chuguo liuxue liushi nian* (Sixty years of overseas study), (Beijing: Zhongyang wenxian chubanshe, 2010), 957.

6 “Zhongyang jue ding zuzhi shi she haiwai gao cengci rencai yinjin jihua” (Central Committee decides to organize and bring into effect a plan to bring in high quality overseas talent), *Xinhua News Agency*, January 8, 2009.

In 2008, a “Group on Coordinating Talent,” directed by the Ministry of Personnel (later renamed the Ministry of Human Resources and Social Services, or MHRSS), under the State Council, was replaced by the Central Coordinating Group on Talent (CCGT), under the CCP’s Organization Department and its Office of Human Talent, with the latter running the policy on a daily basis. All key line ministries responsible for the reverse brain drain were members of the CCGT, but leadership rested with the CCP’s Organization Department.

Though Li Yuanchao was himself quite liberal relative to other CCP leaders in terms of his policies, he still fell back on classic CCP mobilization strategies. In fall 2009, localities nationwide were directed to determine the type of talents they needed. Cities then made commitments as to the number of highly talented returnees in those fields that they would recruit. Beijing, which is home to the Zhongguancun Science Park, announced a target of 500 people, Guangzhou 300, and Jinan (in Shandong) 150, with all work to be completed within three to five years.⁷ Thereafter, city and provincial government and party officials set out across the globe on recruitment drives. In December 2009, Shanghai sent out a team to recruit 115 people in the financial sector alone, a task made easier by the global financial crisis; the plan was to visit New York, Toronto, and Singapore. Officials from Jinan visited Toronto, New York, and Silicon Valley, seeking to fill the 150 positions in 5 years, under its “5-150 jobs campaign.”⁸

In December 2010, at the Guangzhou Convention of Overseas Chinese Scholars in Science and Technology, Li Yuan-chao introduced a new Young Thousand Talent Program aimed at attracting 2,000 talented people under age 40 before 2015. The CCP also launched a new “Foreign 1,000 Talents” program aimed at “high-end foreign scientists, engineers and managers from developed countries.”⁹ Assessment was to be rigorous. Local and foreign experts from related fields made an anonymous assessment, followed by comprehensive appraisals by a committee of international experts in the relevant field. All awardees had to be approved by a Working Group for the Introduction of Overseas High-level Talent under the CCP’s Organization Department.

At the same time, local authority over the programs changed significantly. The program was administered by a local Coordinating Group on Talent, directly under the municipal CCP committee, so urban bureaucrats faced more pressure to meet their commitments, though the quotas to which they committed were reportedly “soft.” But as one local official commented, “the policy is now under the CCP’s leadership, so of course the pressure is greater.”¹⁰ Interviews with officials from a well-respected university in a large city in northern China attested to the new pressures.¹¹ First, the city established its own Thousand Talents Plan and encouraged the university to bring in talent to help the city meet its quota. Deans in the colleges were busy searching for highly talented scholars resident abroad, and senior faculty were asked to contact friends and former students to consider coming back. As one human resources (HR) staffer at the university said, “the government is eager to see the achievements of this project quickly.”

As for the incentives, if a college in this university brought in a candidate who was approved as a “national”-level Thousand Talents—regardless of whether they returned full time (FT) or part time—the school received RMB 12 million (roughly \$1.7 million). And while the returnee got the bulk of the monies for their research, the dean redistributed some of the funds to other faculty, making the awarding of a TTP fellowship a positive benefit for the whole college. Reportedly, colleges with locally approved Thousand Talents fellows received RMB 8 million, some of which they could keep; however, PT returnees under the municipal project only obtained an air ticket, enhancing the incentives to return FT.

As with many CCP directed projects, localities adjusted the numbers to meet their quotas by giving awards to people who had already returned to China, as there had not been enough time to persuade talented people who were settled overseas to come home. Guangzhou, which should have been attractive, gave only six TTP awards in 2009 and 20 in

7 “Chinese Job fair in US tried to woo talent,” China Economic Net, April 26, 2010, http://en.ce.cn/Business/Macro-economic/201004/26/t20100426_21326070.shtml.

8 Ibid.

9 Denis Fred Simon and Cong Cao, “National Talent Safari,” *China Economic Quarterly* 15, no. 2 (June 2011): 18.

10 Interview, David Zweig, south China, June 2011.

11 Interview, David Zweig, north China, November 2011.

2010, all of whom had returned before the program began.¹² Some provinces, such as Guangdong and Zhejiang, also responded by establishing their own locally based programs.

Data on the number of TTP participants is difficult to obtain, but based on our research, through 2012, the program had attracted 3,319 well educated and highly skilled Chinese talents to return to the country from overseas. This figure rose to just over 4,000 in 2013 (see Table 2).¹³ As of 2018, it is estimated that the program had over 7,000 participants.¹⁴

Table 2: Annual and Accumulated Number of Thousand Talent Participants, 2008-15

Year	Number of Recipients	Innovation Scheme ***	Entrepreneurs Scheme	Young Talent	Foreign Talent	Total as of that year
2015	N/A	N/A*	121	1226	48	N/A
2014	861	301	97	396	67	4180
2013	526	132	154	151	89	3319
2012	1283	562	87	594	40	2793
2011	367	281	86			1510
2010	537	454	82			1143
2009	263	204	59			607
2008	222	222	122			342
Total**		2156*	687	2397	244	

Source: Data compiled by the authors from numerous sources.

Note: * There is not complete data for 2015 for the Innovation Scheme.

** Total is the total for that category circa 2014 or 2015.

*** Innovation Scheme awardees are academics and scientists in universities and the Chinese Academy of Sciences. The number of Innovation Scheme awardees in 2012, 2013, and 2014 was calculated by the authors.

THE PART-TIME OPTION

Although Li Yuanchao hoped to create a program comprised only of FT returnees, a low take-up rate as of 2010 forced him to introduce a “PT” (part-time) component. As of 2011, among 501 cases our team identified from online sources (Table 3), only 26.5 percent of scientists and professors who joined the program returned FT, meaning that three-quarters only returned PT (see Table 3).

The introduction of a PT program is a major source of current tensions between China and other countries because those people have remained abroad and have become a major conduit for the transfer of technology back to China. This policy also facilitated the type of “double dipping” that became widely known in 2018, as some of these people have kept FT jobs in both countries.

¹² Interview, David Zweig, Guangzhou, May 2011.

¹³ Huiyao Wang and Yue Bao, *Reverse Migration in Contemporary China: Returnees, Entrepreneurship and the Chinese Economy* (London: Palgrave Macmillan, 2015).

¹⁴ The Zhongguancun Science Park reportedly employed 1,343 returnees through the “Thousand Talents Program,” accounting for 19 percent of the national total. Based on that statement, we can calculate the total number of participants as of the middle of 2018. See Ren Xiaoyuan, “The number of foreign citizens engaged in industry in Zhongguancun is already approaching 10,000,” *Beijing qingnian bao* (Beijing Youth Daily), July 14, 2018, <http://finance.people.com.cn/n1/2018/0714/c1004-30146998.html>.

Table 3: Part-time vs. Full-time Participants in TTP, 2011

Type of Returnee	Full-time	Part-time	Total
A: Universities & Scientific Institutes	99 (26.5%)	275 (73.5%)	374 (74.7%)
B: State-owned Enterprises	36 (80.0%)	9 (20.0%)	45 (9.0%)
C: Private Entrepreneurs	73 (89.0%)	9 (11.0%)	82 (16.4%)
Total	208 (41.5%)	293 (58.5%)	501 (100%)

Sources: 350 names were released initially online by the Organization Department of the CCP and our research found another 150 online.

When the policy was expanded to include a PT option, it also became less transparent. According to the director of the talent office at a university in northwest China, the faculty who had chosen the PT option asked that the university not list their names on the school’s website.¹⁵ This was because they did not want to cause colleagues and administrators back in the United States to doubt their commitment to those institutions. But some awardees used this secrecy to hold two jobs simultaneously. One famous case was of a FT Ohio State University professor who became dean of a new school of pharmacy at Nankai University in Tianjin. According to Cong Cao, “so many of the recruits hold concurrent positions at Western institutions, the disclosure could embarrass them and even cause them to lose their permanent positions overseas, which are more secure.”¹⁶ The last public list of senior awardees on the website of the Organization Department was in 2011. However, according to Henry Wang, the list was posted recently for a month each year, after the awardees were selected.¹⁷

INCENTIVES TO CHEAT

The incentives created by the state and the market in China, rather than a nationally driven conspiracy, can go a long way to explain the theft of IP that has been carried out by participants in this program, though of course it cannot justify it. Chinese companies, research laboratories, and universities have similar incentives. These incentives may be described as “rent seeking,” that is, the opportunities within the Chinese market created by the “shortage” of various

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technologies whose transfer back to China can earn large “rents” or “extra-normal profits.”

As demonstrated elsewhere, much of the technology transferred by Chinese scientists, researchers, and entrepreneurs circa 2005 was mid-range technology that could earn the transferrer large rents or extra-normal profits in China because it filled shortages existing in China’s technological landscape.¹⁸ In those days, due to the widespread technology shortages in China, returnees did not need to bring cutting-edge technology from the West which may have infringed on the IP rights of its inventors or patent

holders. In fact, among 100 reverse migrants we interviewed in 2004, 55 percent said that a major reason for them to return was to set up a company using technology they had acquired in the West, and in most cases, it was not globally leading technology but only “new for China.” Wang and Bao agreed, arguing that opportunities within the domestic market were a major reason that people returned to China.¹⁹ As a result, the transfer caused very little concern within the U.S. scientific or national security establishment.

15 Interview, David Zweig, northwest China, October 2012.

16 Personal communication between David Zweig and Cong Cao, 2009.

17 Personal conversation with David Zweig, March 2020.

18 David Zweig, Chung Siu Fung, and Wilfried Vanhonor, “Rewards of Technology: Explaining China’s Reverse Migration,” *Journal of International Migration and Integration* 7, no. 4 (November 2006): 449-471, <https://link.springer.com/article/10.1007/BF02934904>.

19 Wang and Bao, *Reverse Migration in Contemporary China*.

After these initial gaps were filled, however, the quality of the technology in short supply in China changed; there simply were no longer large “rents” that could be earned from bringing back easily appropriated, mid-range technology from the United States. Chinese firms, research institutes, and universities wanted more cutting-edge technology that could help enhance its status or enlarge its market share by beating out foreign competitors; national leaders hoped such technology could help China jump up into the top ranks of technological development. In either case, the transfer often abused the creators’ (e.g., foreign universities, companies, or research labs) IP or involved “dual use” or strategic technology with some potential national security implications. In the case of proprietary technology, much of it would allow the Chinese firm or institution to become a major player in China’s domestic market and thereby squeeze Western inventors out of the Chinese market. This process seems to be highly prevalent in biotech and cancer research, where there is growing Chinese consumer demand for advanced health care and curative technologies.²⁰ American firms also worried that Chinese firms would use this technology to compete internationally for market share.

THE TTP AND THE UNITED STATES

Since 1979, the United States has played a very significant role in training a generation of Mainland Chinese.²¹ And, as the data on the limited role of reverse migration introduced at the outset of this report demonstrate, the United States has benefitted enormously from this investment in China’s human capital: over 85 percent of Mainland Chinese with PhDs in science and engineering were still working in the United States five years after receiving their degree. In fact, the United States has hosted more recipients of national talent programs than any other nation, and these researchers are among the best ethnic Chinese scholars in the world.

Among the 501 participants our team found online in 2011, 55.9 percent had a PhD from the United States, while 68.7 percent had worked in the United States (see Table 4). And within this latter group, 60 people holding PhDs from elsewhere wound up working in the United States before joining the program. In our 2013 sample, the share of TTP participants with U.S. PhDs still comprised 53.9 percent of our sample, but the number with a PhD from China had increased, as the CCP sought to decrease hostility within China toward Chinese with foreign PhDs who were rewarded with special privileges unavailable to local PhDs.

Table 4: Region/Country of PhD and last residence of participants in the TTP, 2011 and 2013

Year	PhD 2013		PhD 2011		Workplace 2011	
	No.	Percent	No.	Percent	No.	Percent
U.S.	383	53.9	274	55.9	334	68.7
China	96	13.5	59	11.8	N/A	N/A
Europe	67	9.4	52	10.6	36	7.4
U.K.	60	8.4	42	8.6	37	7.6
Japan	37	5.2	23	4.7	16	3.3
Canada	36	5.1	19	3.9	19	3.9
Hong Kong	XX	XX	2	0.4	16	3.3
Singapore	XX	XX	0	0	11	2.3
Others	32*	4.5	18	5.9	17	3.1
Total	711	100	490	100	486	100

Includes PhDs from Hong Kong and Singapore in “Others” for 2013. Half of the “others” come from Australia.

20 A 55-year-old researcher in Texas, who was part of the TTP, was accused of sharing advanced cancer research with a university hospital in Shanghai. “Xie Keping - Chinese scientist facing child porn charge in America said to be under investigation for spying,” *South China Morning Post*, October 10, 2018, <https://www.scmp.com/news/china/society/article/2167884/chinese-scientist-facing-child-porn-charge-america-said-be-under>.

21 David M. Lampton with Joyce A. Madancy and Kristen M. Williams, *A Relationship Restored: Trends in U.S.-China Educational Exchanges, 1978-1984* (Washington, DC: National Academy Press, 1986).

COLLECTING AND ANALYZING OUR DATA

Data we have collected clearly showed that as of 2013, the best Chinese talent had not left the United States and, in fact, was making significant contributions to America's leading role in scientific development. To test this argument, we collected all the CVs we could find online from participants in the TTP. According to our calculations, 1,723 scientists and academics had been awarded FT or PT awards by 2013. The majority worked in universities, but 12 percent worked in the Chinese Academy of Sciences; and because universities in the early years of the program publicized the names of the TTP awardees on their institutional websites, we found 733, or 42.5 percent, of participants. To assess the quality of their scientific contributions, we calculated the following three measurements from their CVs.

- **The h-index:** This metric measures the productivity and citation impact of a researcher's publications based on the set of the scientist's most cited papers and the number of citations they received.²²
- **Average Annual Impact Factor of Publications (AAIF):** We recorded all the journal articles written by our list of scholars, and based on the impact factor in 2013 of the journals in which they published, we calculated their AAIF.²³
- **The number of publications:** This is the total number of articles published in Social Sciences Citation Index (SSCI) journals.

Table 5 compares FT and PT participants in the TTP who received an American PhD, where the former had returned to China FT and the latter have kept a position in the United States and participate in the TTP for no more than 2-3 months a year. As we see, the part-timers (Table 5, row 1) are significantly better on all three of our measures than those who have returned FT.

Table 5: Quality of FT and PT Participants in the TTP with American PhDs, 2013

Variables	h-index	Impact Factor	Average Number of Papers Per Year
Part Time	0.414*** (0.116)	0.781*** (0.176)	2.851*** (0.547)
Years Joined Plan	0.027 (0.036)	0.030 (0.060)	0.024 (0.323)
Female	0.119 (0.150)	0.057 (0.264)	-1.646* (0.957)
Age	-0.022 (0.053)	-0.147* (0.082)	0.063 (0.245)
Age²	0.000 (0.000)	0.001* (0.001)	-0.001 (0.002)
Field of Study Constant	-0.116 -50.352 (71.406)	-0.547*** -55.044 (119.711)	-0.933 -48.078 (647.329)
Observations	337	337	337
R-squared	0.085	0.194	0.049

Note: Robust standard errors in parentheses.

Level of statistical significance: *** p<0.01, ** p<0.05, * p<0.1

*We use the log of the h-index and Impact Factor.

22 J. E. Hirsch, "An index to quantify an individual's scientific research output," *Proceedings of the National Academy of Sciences of the United States of America* 102, no. 46 (2005): 16569–72, <https://www.pnas.org/content/102/46/16569>.

23 First, the authors summed all impact factors one researcher accumulated and then divided it by the length of their career (if their publication list is not up to date, the denominator will be equal to the difference between the year they receive their doctorate and the year of latest publication).

Still, our findings show that just getting an American PhD did not significantly enhance their research (Table 6, row 1). Rather, receiving an American PhD and working in the United States, as compared to working in another country, had a very significant impact (Table 6, row 2) on the extent to which their work was cited (h-index), as well as on the impact factor of the journals in which they published ($p < 0.05$). It did not affect the number of papers they published each year.

Table 6: Quality of TTP Participants Who Studied or Worked in the United States vs. Other Countries

Variables	h-index	Impact Factor	Average Number of Papers Per Year
US_PhD	0.030	0.056	0.260
	(0.023)	(0.045)	(0.177)
US_work	0.214***	0.355***	0.752
	(0.075)	(0.136)	(0.524)
Years Joined	-0.024	-0.044	-0.095
	(0.030)	(0.053)	(0.260)
Female	0.125	0.075	-0.896
	(0.121)	(0.237)	(1.020)
Age	-0.030	-0.130**	0.065
	(0.043)	(0.057)	(0.237)
Age ²	0.000	0.001**	-0.001
	(0.000)	(0.001)	(0.002)
Field of Study	Controlled	Controlled	Controlled
Constant	53.086	93.396	194.118
	(59.122)	(106.894)	(521.839)
Observation	470	470	470
R-squared	0.046	0.138	0.018

Notes: Robust standard errors are in parentheses.

* We used the log of the h-index scores and the Impact Factor.

Level of statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The comparative or baseline group are those with PhDs or work experience from countries other than the United States.

Third, our data also show that if we compare FT and PT participants who had all worked in the United States before joining the program, those who stayed abroad (PT) produced higher quality scholarship on all three measures than those who returned to China on a FT basis (Appendix Table A1, Row 1). So, the Chinese researchers who remained in the United States were better than the ones who returned to China.

Our data also show that while the PT participants in the United States are better than those who returned FT, the same is also true for PT participants in the TTP in Canada and the United Kingdom but not for Japan, European countries, or others. Thus, the research of those TTP participants who remained in the United Kingdom and work with China is as well cited as those who have stayed in the United States ($p < 0.05$).²⁴ Those who remained in Canada are both as highly cited and as well published as the ethnic Chinese scholars originally from China who joined the TTP in the United States (Appendix Table A2).

THE FOREIGN TTP PROGRAM

Perhaps the biggest source of conflict for the United States and for Sino-American scientific exchanges is the “Foreign TTP” program. China has proven quite willing to pay large salaries and bonuses to major international researchers who accept the remuneration for what is essentially transferring their knowledge to China. This transfer is usually perfectly legal so long as they report this income. The issue seems less problematic when American researchers move to China

²⁴ However, their impact factor score is probably because they publish more in British journals, which generally have a lower impact factor than American journals.

and work in a university or a research institute since their Chinese employer is paying their salaries and their affiliations are transparent.²⁵ In addition, a part of the related new technology will have been developed within China with Chinese funding. Thus, while there is technology transfer underway, as American scientists bring their knowledge and experience to what the United States sees as its “strategic competitor,” there is typically nothing illegal about this kind of activity.

This problem received wide attention when the American recipients, such as Professor Charles Lieber of Harvard or a team of researchers at the Moffit Cancer Center in Orlando, did not acknowledge receiving large salaries and research support that were paid into undisclosed Chinese bank accounts.²⁶ Interestingly, though, Lieber would have been allowed to spend three months a year at the Wuhan University of Technology if he had been above board about the relationship. As long as it was his own human capital and the results of his own laboratory that he was swapping for a salary and research funding, there was nothing illegal about it.²⁷ Still, much of his research had originally been funded with U.S. monies, which raised ethical concerns and the issue of “double-dipping.”

THE CHANGING CONTEXT OF U.S.-CHINA RELATIONS UNDER PRESIDENT TRUMP

Did the program change in any significant way after 2013, when Li Yuanchao left the post of director of the Organization Department? There is very little public information provided by the Chinese government or the CCP’s Organization Department, but we think not. First, his replacement, Zhao Leji, seemed quite divorced from the program, leaving it largely on autopilot, or under the control of the office of the LGT. In fact, what seems to have really changed in China was the advent of a more assertive foreign policy following the global financial crisis of 2007-08 (and particularly after the Xi ascension), which convinced many Chinese foreign policy observers that the time had come for China to challenge the United States.²⁸ Also, beginning in 2013, new policies emerged targeting technological upgrading (which eventually morphed into Made in China 2025), insufficient constraints were imposed on IP theft, and the TTP’s expansion continued, particularly the expansion of the Foreign TTP, all of which intensified China’s search for new world-leading technologies.²⁹

For most of the Obama presidency, research collaboration with China was welcomed. During a visit to China, the head of the NIH reportedly heralded exchanges with China as “cancer research across borders.”³⁰ Still, in September 2015, just as the Obama administration threatened to place sanctions on China for industrial cyber espionage, the FBI also for the first time raised concerns about China’s national talent programs, especially the TTP, and it advised U.S. researchers to protect their IP.³¹ The report also emphasized the dilemma for the FBI because “associating with these talent programs is legal and breaks no laws; however, individuals who agree to the Chinese terms must understand what is and is not legal under US law when sharing information.”³² During that period, the FBI arrested one physicist at Temple University, Xi Xiaoxing, and charged him with sharing technology with China. But four months later, the case was dropped.³³

25 Early participants included Robert Glenn Parker, a UC Berkeley PhD and former University of Michigan professor who joined Shanghai’s Jiao Tong University; Ross Macallister, who became chief information officer of Sinopec and previously was a partner at Atos Consulting in the United Kingdom; and Mikhail Eremets, a German expert in high-voltage superconductors, who became a professor of physics at the South China University of Technology in Guangzhou. Still, if the technology under question is subject to U.S. export controls, it could be against the law for an American to work on such projects for a Chinese organization. They would first need an export-control license.

26 Elizabeth Redden, “Florida Lawmakers Probe ‘Foreign Meddling’ in Research,” *Inside Higher Education*, January 13, 2020, <https://www.insidehighered.com/news/2020/01/13/florida-lawmakers-launch-investigation-foreign-meddling-state-research-universities>.

27 Geoff Brumfiel, “Harvard Professor’s Arrest Raises Questions About Scientific Openness,” National Public Radio, February 14, 2020, <https://www.npr.org/2020/02/14/806128410/harvard-professors-arrest-raises-questions-about-scientific-openness>.

28 Daniel C. Lynch, *China’s Futures: PRC Elites Debate Economics, Politics, and Foreign Policy* (Stanford, CA: Stanford University Press, 2015)

29 David Zweig, “China counts the costs of its lurch from market reform to ‘Made in China 2025,’” *South China Morning Post*, April 22, 2019, <https://www.scmp.com/comment/insight-opinion/article/3006942/china-counts-costs-its-lurch-market-reform-made-china-2025>.

30 This point is emphasized by Chinese consular officials in New York City. Interview, David Zweig, February 2020.

31 Strategic Partnership Unit, “Chinese Talent Programs,” September 2015, <https://info.publicintelligence.net/FBI-ChineseTalentPrograms.pdf>.

32 Ibid.

33 Matt Apuzzo, “Former Espionage Suspect Sues, Accusing F.B.I. of Falsifying Evidence,” *New York Times*, May 10, 2017, <https://www.nytimes.com/2017/05/10/us/politics/fbi-xi-xiaoxing.html>.

Once Donald Trump took the reins of the U.S. presidency, ties with China deteriorated rapidly. While the trade deficit emerged as the initial point of contention, technological and strategic challenges moved to the forefront.³⁴ Steve Bannon, Trump's key adviser for more than a year, saw the battle between the United States and China as one for the future of humankind. In January 2018, the Pentagon published a very tough National Defense Strategy asserting that "China is a strategic competitor using predatory economics to intimidate its neighbors while militarizing features in the South China Sea."³⁵ U.S. Trade Representative Robert Lighthizer elevated China's IP theft and programs such as Made in China 2025 to the top issue in the trade dispute.³⁶ Also, in November 2018, then Attorney General Jeff Sessions, began the "China Initiative." As reflected in a February 2020 conference at CSIS, it is clear the initiative was highly concerned about the linkages between national talent programs, IP theft, and China's technology strategy.³⁷

Thus, the current crisis is also the result of the intensification of belief that U.S. economic security is a key component of U.S. national security in the eyes of key members of the administration. They mobilized the FBI, which felt that U.S. universities were not taking Chinese IP theft, and the resulting

technological threat, seriously enough; the FBI searched for as many cases as possible to convince the academic and research community and their administrators that there was a serious problem to which they needed to respond. Still, while there is definitely room for concern, their assertiveness in this search for internal enemies has bordered on zealotry.

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THE ACCUSATIONS

As mentioned above, the current attack on the TTP is led largely by the FBI and the Justice Department.³⁸ But it also includes the U.S. Senate, the House of Representatives' China Security and Economic Commission, the U.S. National Intelligence Council, and even the Asia Society in coordination with the Hoover Institution.³⁹ The American institutions seen as vulnerable include the NIH, a major funder of biomedical research; the Department of Energy (DOE), which is responsible for nuclear research and U.S. nuclear weapons; and the NSF, whose \$150 billion in funding accounts for 27 percent of all federally funded basic research at U.S. universities and research institutes.⁴⁰ Even the Florida state legislature is investigating whether state-funded institutions, particularly universities and research hospitals, have been transferring technology to foreign governments (that is, China) in return for payments.⁴¹

34 David Zweig, "Tussle for tech supremacy powers US-China animosity," *Financial Times*, December 6, 2018, <https://www.ft.com/content/ddbe9522-f878-11e8-a154-2b65ddf314e9>.

35 See James Mattis, *Summary of the 2018 National Defense Strategy of The United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: Department of Defense, 2018), <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

36 See "Evolving Made in China 2025, China's industrial policy in the quest for global tech leadership," MERICS, February 7, 2019, <https://www.merics.org/en/papers-on-china/evolving-made-in-china-2025>. Also see David Zweig, "China's Political Economy," in William A. Joseph, ed., *Politics in China: An Introduction, Third Edition* (New York: Oxford University Press, 2019).

37 "China Initiative Conference," (public event, Center for Strategic and International Studies, Washington, DC, February 6, 2020), <https://www.csis.org/events/china-initiative-conference>.

38 In July 2019, Christopher Wray, the director of the FBI, told a congressional hearing that "there is no country that poses a more severe counter-intelligence threat to this country right now than China," accusing it of trying "to steal their way up the economic ladder at our expense." Bryan Gruley, "Track Record," *Post Magazine* (Hong Kong), October 27, 2019, 16.

39 See inter alia, U.S. Permanent Subcommittee on Investigations, "Threats to the U.S. Research Enterprise: China's Talent Recruitment Plans," Committee on Homeland Security and Governmental Affairs, United States Senate, November 18, 2019, <https://www.hsgac.senate.gov/imo/media/doc/2019-11-18%20PSI%20Staff%20Report%20-%20China's%20Talent%20Recruitment%20Plans.pdf>; Anthony Carpaccio, "U.S. Faces 'Unprecedented Threat' From China on Tech Takeover," Bloomberg, <https://www.bloomberg.com/news/articles/2018-06-22/china-s-thousand-talents-called-key-in-seizing-u-s-expertise>; and Larry Diamond and Orville Schell, eds., *China's Influence & American Interests: Promoting Constructive Vigilance* (Washington, DC: Hoover Institution, November 2018), <https://www.hoover.org/research/chinas-influence-american-interests-promoting-constructive-vigilance>. At an April 2018 hearing, titled "Scholars or Spies," organized by the House of Representatives, the commissioner of the U.S.-China Economic and Security Review Commission, Michael Wessel, advised Congress to cut federal grants, loans, or other assistance to participants of the TTP. At the same meeting, U.S. Congressman Lamar Smith accused China of planting "sleeper agents" in U.S. universities to steal scientific breakthroughs. See United States Senate, "Threats to the U.S. Research Enterprise."

40 Since the campaign against the TTP began, the DOE has forbidden its employees from participating in it.

41 Redden, "Florida Lawmakers Probe."

U.S. agencies have targeted the TTP over other recruitment programs because it is run by the CCP's Organization Department, arguing that "the Party is able to exert exceptional levels of control" over this plan and that "to ensure control, Thousand Talents Plan members sign legally binding contracts."⁴² Also, the Chinese government had never discussed this project with the U.S. government despite 300 U.S. government researchers and more than 600 U.S. corporate personnel accepting TTP money.⁴³

Numerous accusations have been targeted at participants in the TTP; these include running "shadow laboratories" in China which engage in the same research that Chinese scientists are carrying out in the United States with U.S. government funding; "double dipping," in terms of drawing two FT salaries—one in the United States and one in China; direct transfer of patented IP; stealing proprietary defense information related to U.S. military jet engines; sharing research proposals with colleagues back in China that Chinese scholars in the United States are given for carrying out peer review; and exporting "dual use" technology that has both commercial and military applications.

A major U.S. concern is the biomedical field, which directly effects the NIH. The NIH, as of October 2019, has reportedly referred at least 24 cases "in which there may be evidence" of nefarious activity to the inspector general of the Department of Health and Human Services, which then may turn over the cases to the Justice Department for prosecution.⁴⁴ According to one article, many universities have ongoing investigations, but rather than involve military security, "Some researchers under investigation have obtained patents in China on work funded by the United States government and owned by American institutions," while "others are suspected of setting up labs in China that secretly duplicated American research."⁴⁵ As of October 2019, approximately a dozen scientists had resigned or been fired.⁴⁶ In the case of MD Anderson, a major cancer center in Texas, three faculty members were found to have engaged in unauthorized data transfer or to be planning such activities when they were caught and were therefore forced to resign, of whom one received \$75,000 for a one-year affiliation with the TTP.⁴⁷

However, in several instances, the U.S. investigators have been forced to drop cases, much as they did with Wen Ho Lee in 2007, who was accused of spying for China. But often by the time the case is dropped, the reputation of the Chinese researcher has been smeared, causing them to leave the United States. According to one report, since 2014, the U.S. Justice Department has dropped theft charges against four Chinese-American scientists: two former Eli Lilly scientists in Indiana, a National Weather Service hydrologist in Ohio, and a professor at Temple University.⁴⁸ The lead target in the MD Anderson affair, a female scientist with American citizenship who has resided in the United States for over 30 years, was also never prosecuted, but she has already returned to China. In other cases, where there is no proof of espionage or IP theft, the Chinese scientist is being charged with fraud.

Finally, a U.S. Senate report published in November 2019, *Threats to the U.S. Research Enterprise: China's Talent Recruitment Plans*, presents several cases of misbehavior by TTP participants and to a certain extent fairly criticizes the TTP, as it "incentivizes individuals engaged in research and development in the United States to transmit the knowledge and research they gain here to China in exchange for salaries, research funding, lab space, and other incentives."⁴⁹

Still, certain parts of the report are problematic.⁵⁰ Among three TTP participants working on DOE programs, one was criticized for "disproportionate collaboration with Chinese institutions" and for attempting "to initiate official sharing agreements between the laboratory and a Chinese organization."⁵¹ Also, much of the misbehavior by individual scholars in the report's case studies related to "double dipping," not IP theft.

42 U.S. Permanent Subcommittee on Investigations "Threats to the U.S. Research Enterprise," 2.

43 Diamond and Schell, eds., *China's Influence & American Interests*.

44 Gina Kolata, "Scientists with Links to China May be Stealing Biomedical Research, U.S. Says," *New York Times*, October 30 2019, <https://www.nytimes.com/2019/11/04/health/china-nih-scientists.html>.

45 Kolata, "Scientists with Links to China May be Stealing Biomedical Research."

46 *Ibid.*

47 *Ibid.*

48 *Ibid.*

49 U.S. Permanent Subcommittee on Investigations, "Threats to the U.S. Research Enterprise."

50 During my presentation at the Center for Naval Assessment (CNA) a government official who is critical of China admitted that this was a very poor report.

51 What is "disproportionate collaboration?" If two scholars, one in the United States and one in China, work closely together, they will publish most of their papers together. Also, the second criticism is for initiating "official sharing agreements"—not secretive transfers. This kind of transparent exchange should be allowed if there is to be collaboration.

Also, when the report criticizes the U.S. Commerce Department for giving export licenses to Chinese working in the United States who also participated in a “talent recruitment plan,” the link with the TTP falls flat. In 2013-18, China was by far the most important country of origin for the 7,777 deemed export licenses given in that period, totalling 2,706 or 34.8 percent of all approvals (Iran was second with 18.3 percent and India third with 7.6 percent).⁵² However, despite China’s numerous requests, only 20 licenses, or 0.7 percent of all Chinese applications, were deemed problematic. And the report fails to identify the licenses as going to TTP participants.

Still, any misbehaviour should not be acceptable, and the level of non-compliance, in terms of not reporting either affiliations with foreign institutions or foreign funding, is significant. Of 130 individuals who had received NIH funding and were suspected of misbehaviour, 51 (39 percent) had undisclosed foreign affiliations, and among them, 45 (34.6 percent) were no longer eligible to receive NIH grants “due to their participation in foreign talent recruitment plans.” Still, investigations by the American institutes described in the report generally found no overlap between the National Science Foundation of China (NSFC) and NIH-funded projects, despite investigations by the NIH. Finally, multiple affiliations in both China and the United States could strengthen a scholar’s research due to their ability to use facilities and funding in both China and the United States, although drawing two FT salaries from the United States and China is highly unethical, if not illegal.

RETHINKING THE “DIASPORA OPTION”

The problems raised by the U.S. government and Western media challenge an idea propagated since 1999 by analysts of science and migration that the “diaspora option”—whereby scholars from developing states living abroad help their former homeland—and “brain circulation” are positive strategies by which developing states can overcome the punitive impact of the “brain drain.”⁵³ But the current crisis in Sino-American scientific collaboration suggests that, from America’s perspective, this “diaspora option” has morphed into IP theft and illicit technology transfer that threatens the norms of scientific research and U.S. national security.

Part of the problem lies with individuals who have a limited moral compass. Investigations have documented several cases where Chinese researchers, particularly in cutting-edge fields such as biomedical products or procedures, cannot resist the opportunity to make a quick buck based on the “rents” that can be earned in China; therefore, they pilfer others’ IP in order to sell the product, or set up their own companies, back in China.

Second, the CCP’s reliance on mobilization to bring its policy priorities to fruition has created troubles for the TTP. As we have shown, universities, research institutes, high-tech development zones, and local CCP committees have all been pressured to meet the CCP’s demands. With the CCP in a rush, institutions and local officials have cut corners or even rewarded illegal behaviour.

Third, the strategic context within which the TTP developed made this policy problematic. While the “diaspora option” and state promotion of brain circulation and reverse migration are lauded worldwide, America’s fear of China’s rise, and the strategies China has used to speed up its scientific development, has turned the technology flows under such initiatives into apparent threats to U.S. national security.

Even the issue of co-ethnic publications, which lies at the heart of the TTP and which has been lauded in most academic and scientific circles as a positive phenomenon, takes on sharply negative connotations in the current context.⁵⁴ According to the NIH, the “frequent publishing with colleagues outside the United States” by U.S.-based scientists is an important indicator of the possibility of illegal behaviour and technology transfer.⁵⁵ Unfortunately, we simply do not have the data to evaluate the extent to which co-ethnic publications facilitate illicit technology transfer; but then again, neither does the NIH when making such an assertion.

52 U.S. Permanent Subcommittee on Investigations, “Threats to the U.S. Research Enterprise.”

53 Jean-Baptiste Meyer et al., “Turning Brain Drain Into Brain Gain: The Colombian Experience of the Diaspora Option,” *Science, Technology and Society* 2, no. 2 (1997): 285-315; and AnnaLee Saxenian, with Yasuyuki Motoyama and Xiaohong Quan, *Local and Global Networks of Immigrant Professionals in Silicon Valley* (San Francisco, CA: Public Policy Institute of California, 2002). See also David Zweig, Chung Siu-Fung, and Han Donglin, “Redefining the ‘Brain Drain’: China’s Diaspora Option,” *Science, Technology and Society* 13, no. 1 (2008): 1-33.

54 Jenny J. Lee & John P. Haupt, “Winners and losers in US-China scientific research collaborations,” *Higher Education*, November 7, 2019, <https://doi.org/10.1007/s10734-019-00464-7>.

55 Quoted in U.S. Permanent Subcommittee on Investigations, “Threats to the U.S. Research Enterprise.”

THE CHINESE RESPONSE

The CCP's response to these concerns has been mixed. On the one hand, they have increased the program's opacity. As with the Made in China 2025 program, the CCP ended all public discussion of the TTP program, sending it "underground."⁵⁶ They insisted that research institutes and universities end all references to the program to "insure that they remain free from suspicion."⁵⁷ They renamed the TTP the National High-end Foreign Experts Recruitment Plan.⁵⁸ In fact, the deputy director of one think tank in China received a phone call from the Cyberspace Administration of China, also known as the CCP's Internet Information Office, insisting that all reference to the plan on their website be removed.

On the other hand, the Chinese government has criticized American policy with what it calls the "three unfair."⁵⁹ The first "unfair" is the switch from the Obama administration lauding collaborative research with China to the Trump administration's attacks. The second "unfair" is the criminalization of "double-dipping," which the Chinese government argues is a relatively minor offense and partly the result of mainland Chinese scholars who have misunderstood NIH grant rules. Many Chinese in the United States also denounce what they see as racial profiling, which they claim harms scientific progress.⁶⁰

POLICY RECOMMENDATIONS FOR CHINA

There are several steps the Chinese government and CCP should take to provide much greater reassurance to the United States and the international community about the TTP.

1. China should stop blaming all the challenges to the TTP on the U.S. government and its changing perspectives. As mentioned above, the intensity of the current attack on research collaboration reflects the changing view of China in Washington under the Trump administration. But as with the trade issue or technology policy, there is a consensus in the United States that China has overplayed its hand and created many of the problems through its own assertiveness or by flaunting global norms.
2. China needs to win back the trust of the U.S. government. According to the Senate Committee's report, perhaps the most damning aspect of the TTP are the contracts that recipients of the award must sign, which "Under Chinese law, Chinese companies and researchers must — I repeat, must — under penalty of law, share technology with the Chinese military."⁶¹ Such contracts should be ended, as they create the deep mistrust toward the Chinese scholars who join such programs. Chinese scientists interviewed by *The Intellectual* agreed, saying that China had caused this problem itself because individual Chinese scientists failed to follow the rules of scientific research.⁶² One scholar argued that participants in the TTP must strictly adhere to academic norms so that they can avoid any adverse impact. A second scholar added that China should regulate the management of "part-time professors" according to international standards for academic cooperation and set up a reasonable system to which all parties agree. He added that "We have to use this dispute as an opportunity to clean up our own act."
3. Beijing should follow through on plans it has introduced to improve its scientific environment and cut back on academic and scientific fraud.⁶³ Under the new policy, the Ministry of Science and Technology (MOST) became responsible for managing investigations and ruling on cases of scientific misconduct, a role previously

56 Smriti Mallapaty, "China Hides Identities of Top Scientific Recruits Amidst Growing US Scrutiny," *Nature*, October 22, 2018, <https://www.natureindex.com/news-blog/china-hides-identities-of-top-scientific-recruits-amidst-growing-us-scrutiny>.

57 Yuan Yang and Nian Liu, "China hushes up scheme to recruit overseas scientists," *Financial Times*, January 10, 2019, <https://www.ft.com/content/a06f414c-0e6e-11e9-a3aa-118c761d2745>.

58 "National High-end Foreign Experts Recruitment Plan (2019 annual call)," China Innovation Funding, European Union, <http://chinainnovationfunding.eu/project/2019-high-end-foreign-experts-recruitment-plan>.

59 Interview, David Zweig, Chinese consulate in New York City, February 2020.

60 Lu S. et al., "Racial Profiling Harms Science," *Science* 363, no. 6433 (2019): 1290-92, <https://science.sciencemag.org/content/363/6433/1290>.

61 "Why the U.S. is Concerned about Chinese Research Theft," Share America, January 30, 2020, <https://share.america.gov/why-u-s-is-concerned-about-chinese-research-theft/>.

62 Zhishi Fenzi, "Huaran: Meiguo zhengfu xinshengming dui huaren xuezhe he zhongguo you shenme yingxiang" (What was the impact on Chinese scholars and on China of the American government's new statement?), Zhishi fenzi (The Intellectual), August 2018, <http://zhishifenzi.blog.caixin.com/archives/186877>.

63 David Cyranoski, "China introduces sweeping reforms to crack down on academic misconduct," *Nature*, June 8, 2018, <https://www.nature.com/articles/d41586-018-05359-8>.

performed by individual institutions. For the first time, misconduct cases are to be logged in a national database being designed by MOST. As part of the reforms, MOST will work with agencies, such as the Chinese Academy of Sciences, to create standards for determining misconduct; protocols for monitoring and investigating allegations; and rules for deciding on the severity of penalties according to the type of misconduct. The policy states that funding and jobs can be revoked. Yet such a policy, if targeted only at domestic fraud, and not international IP theft, will have only limited impact on Sino-American scientific cooperation.

4. Even more useful for improving bilateral scientific ties would be much greater transparency. The Chinese government and CCP should once again publish the names, affiliations, and projects of all TTP participants, including FT, PT, and particularly the Foreign Talent Program participants. Secret payments to foreign nationals who remain in the United States must be suspended. The NSFC should also list all of its grants and the principal investigators (PIs) by name. They must also encourage TTP participants to report fully on their affiliations in China and report any Chinese funding they may be receiving when filling out grant applications in the United States. Moving the program underground did not ameliorate, but in fact exacerbated, mistrust, especially as there are reports that recruitment to the program is continuing in a form that is even more secretive.
5. It would be wise for the Chinese government to send a clear signal to the Chinese media, encouraging them to report on these cases.

POLICY RECOMMENDATIONS FOR THE UNITED STATES

The United States should take a variety of steps to improve how it responds to the TTP and to U.S.-China collaborative research in general.

1. A major dilemma for the United States is that much of the proprietary technology being developed within American universities and which is being transferred to China, occurs in formats that do not break U.S. law, even if they may be counter to U.S. national interest. As the FBI noted, “associating with these talent programs is legal and breaks no laws.” The United States should make its policies and legal standards mutually compatible.
2. U.S. law enforcement should narrow its attack. It makes sense for the Department of Energy to forbid its staff with high-level clearances from joining a talent program run by the CCP or from taking monies from the Chinese government. But it must turn this effort into a “surgical strike,” not declare “the China threat as not just a whole of government threat, but a whole of society threat on their end. . . . [which] I think it’s going to take a whole of society response by us.”⁶⁴ Such a blanket strategy will decimate highly valuable Sino-U.S. collaboration.
3. Funding agencies such as the NIH or NSF should restrict Chinese participation until the TTP is managed in a more transparent way and removes incentives for misbehavior. They could consider not asking participants in Chinese talent programs to serve as peer reviewers, given the possibility that they will share that information. They may also consider a moratorium on grant applications by non-American citizens until China becomes more transparent on the participants in the TTP. In fact, the organizations may even decide not to fund Chinese who are participating in the TTP on a PT basis.
4. The U.S. government and its funding agencies, such as the NIH, must be particularly aggressive in monitoring the behaviour of institutions and specialists in the biotechnology field.
5. As in the case of the Hong Kong University of Science and Technology, American universities should work with the universities in China which have given these awards to the American professors in order to monitor the terms of collaboration.⁶⁵

64 Elsa B. Kania, quoted in Ellen Barry and Gina Kolata, “China’s Lavish Funds Lured U.S. Scientists. What Did It Get in Return?” *New York Times*, February 7, 2020, <https://www.nytimes.com/2020/02/06/us/chinas-lavish-funds-lured-us-scientists-what-did-it-get-in-return.html>.

65 The vice president of Baylor College of Medicine believes that efforts to monitor all faculty are impossible, so was leaning toward cancelling all international collaboration. Jeffrey Mervis, “U.S. Universities Reassess Collaborations with Foreign Scientists in Wake of NIH Letters,” *Science*, April 26, 2019, <https://www.sciencemag.org/news/2019/04/us-universities-reassess-collaborations-foreign-scientists-wake-nih-letters>.

6. To compete successfully with China, the United States must spend more money on R&D, as scientists are always looking for research funds. Given the cutbacks by the current administration even as Chinese investment increases dramatically, it is not surprising that funds from China are so attractive to American scientists, particularly in the biotech sector.
7. American law enforcement agencies, particularly the FBI, must present their data in a more transparent form, publishing the number of cases they are investigating, with a clear sectorial breakdown. Only in this way can their arguments and cautions be more compelling. They also need to differentiate between IP theft and “double dipping” and not go after double-dippers through other mechanisms, such a wire fraud. The goal is not to create high levels of concerns among Chinese scientists in the United States or scare Chinese students away but to keep America’s status as an open scientific environment, even while protecting U.S. national security.
8. For example, the recent policies of the Trump administration have created a deceleration in the number of students coming to America in 2019. Thus, even though the number of Chinese students going abroad to study increased in 2017-2019 by 12.9 percent, much of that increase went elsewhere, as the number coming to the United States in that period rose by only 5.4 percent (see Appendix Table A3).⁶⁶ Moreover, America’s share of the total number of Chinese students going abroad dropped from 43.3 percent in 2017 to 40.5 percent in 2019.

In addition to the unilateral steps both countries should take, the two sides must re-establish regular communication channels on “talent.” American participants should at a minimum include the Justice Department, State Department,

Funding agencies such as the NIH or NSF should restrict Chinese participation until the TTP is managed in a more transparent way and removes incentives for misbehavior.

the NSF, and the NIH. Chinese participants should include the Ministry of Science and Technology, the CCP’s Organization Department, and the NSFC. While eliminating abuses, a key goal should be to find mechanisms through which collaborative research can be maintained without scaring ethnic Chinese working in the United States and without making the U.S. government feel that its national security is at risk due to these exchanges. Otherwise, the loss to both sides will be considerable.

CONCLUSION

For two decades, governments worldwide have adopted programs similar to the TTP in their efforts to bring back current and former citizens who have settled abroad in research and academic posts. Canada Research Chairs, funded by Canada’s foreign ministry, give higher salaries and larger research stipends to Canadian academics who return to Canada full time.⁶⁷ Taiwan and South Korea have developed their own programs and organizations to generate reverse migration, as have a few state governments in India.

As the United States is the key repository of such talent, it has become the major target of these programs. But although transfers to the regions listed above could harm America’s competitiveness, the United States has not complained because it is not a strategic rival with these regions. In the Chinese case, however, a state policy that moves knowledge from the United States to China has led the U.S. government to accuse China of a strategically motivated, organized conspiracy to steal U.S. technology.

Would this policy and the dilemma created by the TTP have evolved differently had the Chinese government worked out some deal in advance with U.S. government and academic/research institutions? Perhaps the current crisis might have been mitigated had Chinese scholars in the United States been more transparent about their academic affiliations back in China and about the grants they received from China, allowing for some degree of coordination between universities

⁶⁶ “Infographics and Data,” Project Atlas, Institute for International Education, <https://www.iie.org/Research-and-Insights/Project-Atlas/Explore-Data>.

⁶⁷ Zha Qiang, “What factors influence the direction of global brain circulation: the case of Chinese Canada Research Chairholders,” *Compare: A Journal of Comparative and International Education* 46, no. 2 (May 2014): 214-234, doi:10.1080/03057925.2014.916967. Still, Canada uses this policy only to attract full-time returnees; unlike China, it does not supply research funds to Canadians who are working abroad.

in the two countries. Still, China did not really hide the goal of these programs; technology transfer and catching up with the West through technology transfer has always been a goal of the Chinese state since the “open policy” began in 1978.

But even if China is substantially benefiting from this program, the evidence from recent research suggests that closing down research collaboration between the United States and China will hurt U.S. scientific scholarship more than China. China plays a leading role in U.S.-China research collaboration, based on first authorship and governmental funding patterns. Findings also showed that over the past five years, U.S. research article publications would have declined without co-authorship with China, whereas China’s publication rate would have risen without the United States.⁶⁸ The evidence also shows that the top Chinese and U.S. agencies are jointly funding research, making the relationship more of a mutually beneficial partnership than a one-sided affair. This willingness to support joint funding and China’s ability to contribute financially to these projects means that China is significantly promoting the development of scientific knowledge by partnering with the United States.

No doubt, it may be wise for the United States to limit access by TTP participants to sensitive areas, including military contracts or military funded research as a way to control the mistrust that is emerging. And funding agencies may withhold support for TTP participants until the program is more transparent. Such a strategy, if carefully contained to certain types of scientific research, may help sustain the overall scientific relationship. Moreover, the criticisms of the TTP has triggered a backlash from Chinese scientists against their own colleagues, blaming their immoral behaviour as a key source of the current state of affairs. Should more Chinese in the United States adopt greater caution in their use of patented IP or research outputs and work more transparently when they move technology from the United States to China, we may yet see continued cooperation between these two great scientific academies.

APPENDIX

Table A1: Quality of Full-time and Part-time Participants Who Worked in the United States

Variables	h-index	Impact Factor	Average Number of Papers Per Year
Part time	0.332***	0.556***	2.831***
	(0.100)	(0.191)	(0.637)
Years Joined Plan	0.050	0.014	-0.020
	(0.032)	(0.061)	(0.328)
Female	0.121	-0.071	-2.114**
	(0.138)	(0.244)	(1.038)
Age	-0.027	-0.165***	-0.011
	(0.050)	(0.056)	(0.265)
Age ²	0.000	0.001**	-0.001
	(0.000)	(0.001)	(0.003)
Field of Study Constant	-0.186*	-0.678***	-1.813***
	-96.241	-21.209	44.947
	(63.958)	(122.917)	(658.994)
Observations	322	322	322
R-squared	0.067	0.152	0.049

Note: Robust standard errors in parentheses.

Level of statistical significance: *** p<0.01, ** p<0.05, * p<0.1

Comparative group for the regression is full-time returnees who had not worked in the United States.

⁶⁸ Lee and Haupt, “Winners and losers in US-China scientific research collaborations.”

Table A2: Quality of TTP Part-time Participants, by Country

Variables	h-index	Impact Factor	Average Number of Papers Per Year
U.S.	0.279**	0.412**	1.092
	(0.122)	(0.201)	(0.675)
U.K.	0.341**	0.335	1.012
	(0.150)	(0.264)	(0.839)
Japan	0.136	0.063	0.497
	(0.199)	(0.376)	(1.126)
Europe	0.111	0.160	0.152
	(0.157)	(0.283)	(0.807)
Canada	0.310*	0.734***	1.507
	(0.173)	(0.281)	(1.032)
Others	0.289	0.378	3.228*
	(0.207)	(0.419)	(1.780)
Years Joined Plan	-0.020	-0.037	-0.085
	(0.029)	(0.054)	(0.262)
Age	-0.027	-0.125***	0.091
	(0.045)	(0.058)	(0.248)
Age ²	0.000	0.001*	-0.001
	(0.000)	(0.001)	(0.002)
Field of Study Constant	Controlled	Controlled	Controlled
	43.224	79.539	173.826
	(57.911)	(107.376)	(525.340)
Observations	470	470	470
R-squared	0.048	0.139	0.024

Note: Robust standard errors in parentheses.

Level of statistical significance: *** p<0.01, ** p<0.05, * p<0.1

Comparison for the country where they earned their degree is the group with Chinese PhDs.

*We use the log of the h-index and Impact Factor.

Table A3: Chinese Students Studying Abroad, 2017-2019

	2017	2018	2019	% Change, 2017 to 2019	% of Total, 2017	% of Total, 2019
U.S.	350,734	363,341	369,546	5.4%	43.3	40.5
Australia	114,006	135,072	153,822	34.2%	14.1	16.8
U.K.	97,850	102,770	109,180	11.2%	12.1	11.9
Canada	90,700	91,155	96,195	5.5%	11.2	10.5
Japan	75,262	79,502	86,439	14.5%	9.3	9.5
Germany	32,268	34,997	36,915	14.7%	4.0	4.1
France	25,388	30,071	30,072	18.1%	3.2	3.3
Russia	22,529	27,127	29,950	33.3%	2.8	3.3
Total*	808,737	864,035	912,119	12.9%		

Source: "Infographics and Data," Project Atlas, Institute for International Education, <https://www.iese.org/Research-and-Insights/Project-Atlas/Explore-Data>.

* The Total is only for countries included in this table. It does not include the number of Chinese students in other countries, including South Korea, which had 65,000 Chinese students in 2018.

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