

## Caught in the Crossfire: Fears of Chinese-American Scientists

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### **Caught in the Crossfire: Fears of Chinese-American Scientists**

A 2007 report, *Rising above the Gathering Storm* (1), shocked the scientific community with an alarming message that American science may be in decline and soon lose its long-held leadership in the world. Evidence cited in support of this claim included inadequate US investments in science education at all levels and in scientific research, in an era when competing countries, China in particular, had been increasing science-related investments and narrowing gaps with the US. This report received a great deal of attention from policymakers, spawning over two dozen bills in Congress within a year of its release.

Addressing this science policy question, sociologists Xie and Killewald published a book in 2011, *Is American Science in Decline?* (2). After examining a variety of indicators on science, Xie and Killewald dismissed the alarmist view of the 2007 report and concluded that American science had fared reasonably well. One of the main reasons for their relatively optimistic conclusion was America's benefit from immigration: even if the US does not train an adequate number of scientists and engineers that it needs for its modern economy, it is able to attract the best and the brightest scientists and engineers from around the world. For example, China has been the most important foreign supplier of US-based scientists for several decades.

### **Chinese Scientists in the US**

Out of about 34,000 Ph.D. recipients in science/engineering (S/E) fields awarded by US institutions in 2020, 46% (approx. 15,000) held temporary visas, a lower-bound estimation of "foreign students." Among these 15,000 recipients with temporary visas, the largest portion came from China, at 37%. In other words, 17% of all 2020 US doctoral degrees in S/E went to foreign students from China (see Supplementary Materials 1, Table S1). Most foreign-born

noncitizen recipients of US S/E doctorates remain in the US for subsequent employment. For those from China, about 87% have stayed in the US, constituting a significant part of the American S/E labor force (Supplementary Materials 1). Along with native-born Chinese Americans, Chinese immigrants have become a large and visible demographic group in American science and technology (3). Today, it is hard to open an issue of any major scientific journal and not to find a Chinese name among its contributing authors. However, both the future supply and retention of current scientists and engineers from China have been impacted by the chilling effect of the “China Initiative” launched by the US federal government in 2018.

### **The China Initiative**

In 2018, the Department of Justice under the Trump administration launched the China Initiative with the objective of stopping “Chinese economic espionage” (4). In reality, the Initiative mostly targeted US-based academic scientists of Chinese origin for “research integrity” issues, the most prominent being failure to disclose relationships with Chinese institutions on federal grant applications, particularly those to the National Institutes of Health (5). The Initiative was heavily criticized for its ethnic profiling tactics by both the scientific community and civil rights advocates, leading to an ending of its official name in early 2022, but not its substantive operations (6). So far, the China Initiative has openly investigated about 150 academic scientists and prosecuted two dozen of them with criminal charges (5, 6).

One high-profile case was against Gang Chen, a former head of the Department of Mechanical Engineering at MIT and a member of the US National Academy of Engineering. After his arrest on January 14, 2021, his lab was closed, and his research group dispersed. A year later, all charges were dropped (7). The chilling effect of the Gang Chen case was significant and

consequential; it resulted in greater community awareness among Chinese-American scientists and heralded nationwide discussions in the community as to how to protect oneself. For example, a new non-profit organization, the Asian American Scholar Forum (AASF), was established in response to Gang Chen's case to promote academic belonging, openness, freedom, and equality for all. Since 2021, three surveys of Chinese-American scientists have been conducted to understand their concerns and feelings in this new climate (Supplementary Materials 4, 8).

### **The Reverse Brain Drain of Chinese Scientists in the US**

The China Initiative caused panic and an exodus of senior academic researchers of Chinese descent in the US. When Song-Chun Zhu, an accomplished computer scientist and the director of the Center for Vision, Cognition, Learning and Autonomy at UCLA, announced his intention to return to China in 2019, an article was widely circulated on Chinese social media, publicly thanking Donald Trump and his China Initiative for sending top Chinese-American scientists like Zhu back to China (8). Zhu currently serves as the dean of the Institute for Artificial Intelligence at Peking University.

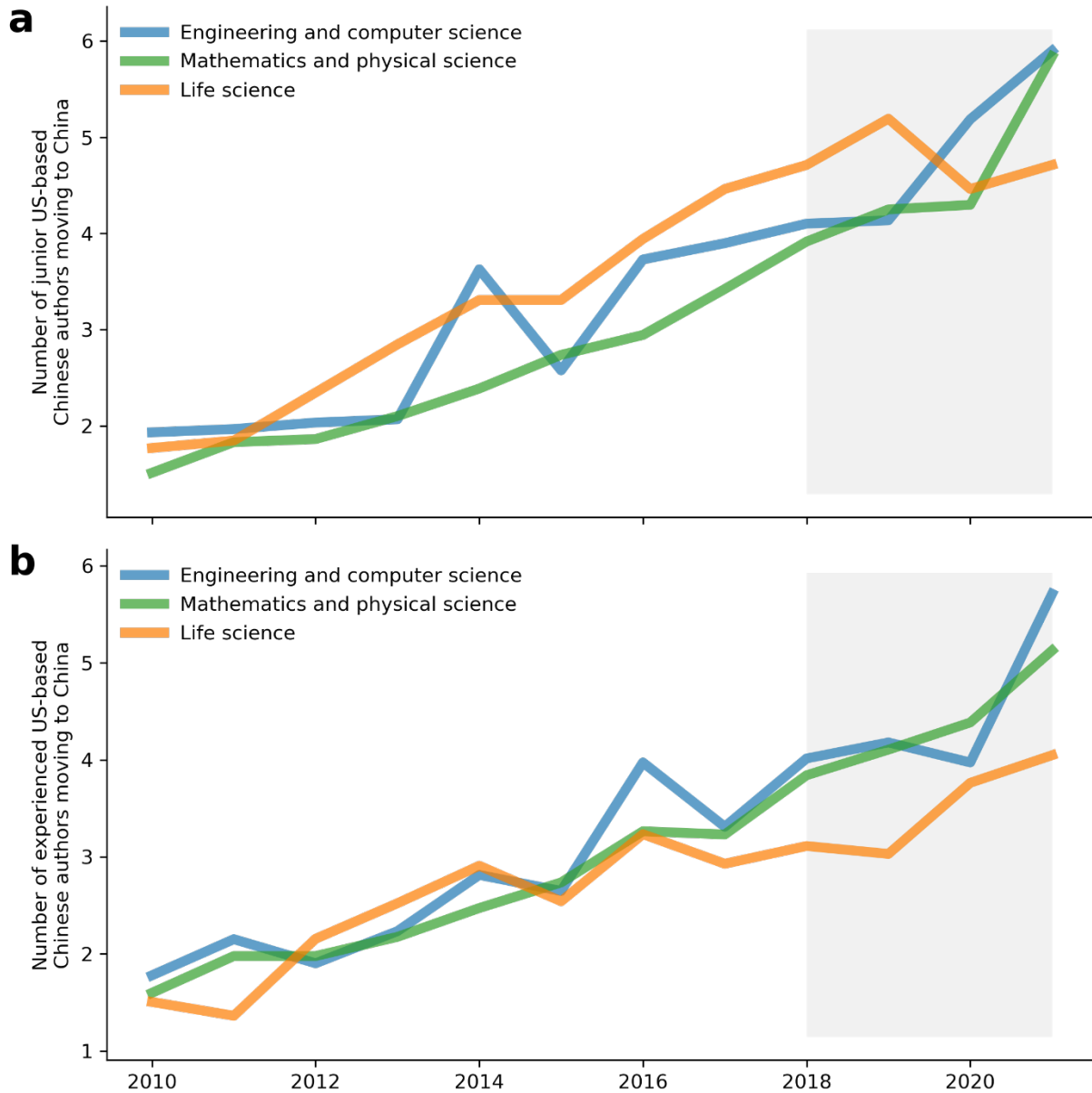
While mainland China's contribution to the world's science and technology was minor only three decades ago, it is now a major contributor of science and technology (9). In terms of the total number of science and technology publications in scientific journals, China has now surpassed the US as the world leader (9). In terms of patent applications by residents, China outperforms the US by a factor of five (Supplementary Materials 2). Four explanations accounting for China's recent success in science and technology development are (1) a large population and human capital base, (2) a labor market rewarding academic meritocracy, (3) a

centralized government willing to invest in science, and (4) the return migration of foreign-trained scientists and engineers of Chinese origin to China (10). Chinese-origin scientists living and working overseas have been lured to return to China by a combination of factors: large and fast-growing investments in science, high social prestige and attractive financial rewards tied to positions in Chinese institutions, and capable research collaborators and assistants. In this study we ask whether and to what extent—net of these “pull” factors—the China Initiative contributed to pushing Chinese-origin scientists to return to China.

We conducted an analysis to estimate trends in return migration of Chinese-origin scientists to China using bibliometric data. The methodology is described in Supplementary Materials 3. The trends, respectively, for life science, mathematics and physical science, and engineering and computer science, are presented in Figure 1, separately for junior scholars (Figure 1a) and experienced scholars (Figure 1b). We define experienced scholars as those with 25 or more publications (see Supplementary Materials 3). The Y-axis represents the ratio of the number of returning scientists each year relative to the baseline in 2005–2010 by corresponding fields. It is apparent that the number of returning scientists had been increasing steadily before the China Initiative, and that this was true for both junior scholars and experienced scholars.

By 2018, the factor ranged between 4 and 5 for junior scholars and 3 and 4 for experienced scholars, across each of the fields. After 2018, when the China Initiative was first implemented, the trend picked up speed, reaching the 5–6 range in 2021, except for life scientists. While the return rate slowed for junior life scientists, it increased for experienced life

scientists after 2019. This finding is consistent with the reported sharp fall in dual affiliations and collaborations between the US and China by 2021 (11).



**Figure 1: Normalized number of (a) junior and (b) experienced Chinese scientists leaving the US each year for China from 2010 to 2021.** Note: Chinese scientists are counted as “leaving” if they published their first paper with an affiliation in the US and later published with a China affiliation but without an affiliation in the US. Yearly numbers are normalized by the average

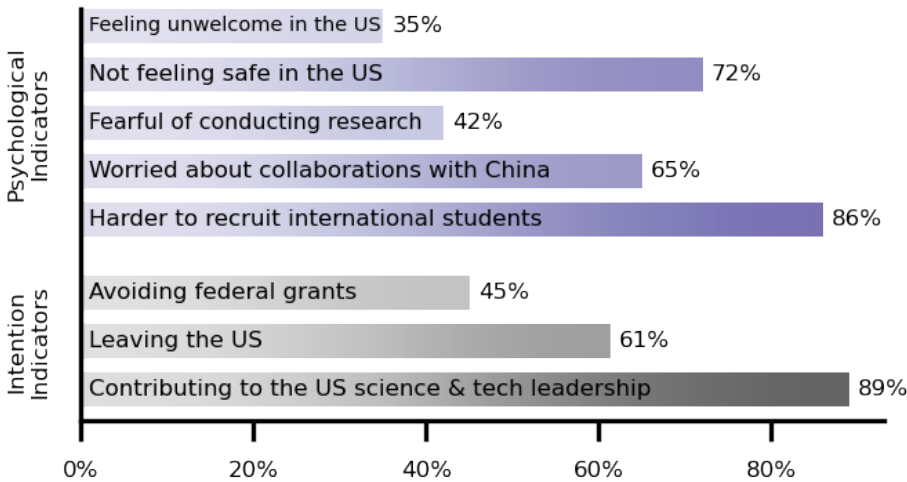
number of leaving Chinese scientists in 2005–2010 to ensure the reported numbers are comparable across disciplines. The shaded portion highlights the notable increase after 2018.

### **Fears of Chinese-American Scientists**

Relative to the size of the total Chinese-American scientist/engineer population, the number who have returned to China is very small. The vast majority prefer to stay and continue their work in the US. However, they now fear that their work and lives in the US may be jeopardized by the China Initiative.

Between December 2021 and March 2022, we conducted an online survey of US-based scientists of Chinese origin on behalf of the AASF. We obtained responses from 1,304 Chinese-American researchers currently employed by US universities. They are well represented in terms of geography, institution type (private versus public), gender, field of study, and seniority (Supplementary Materials 4). By survey standards, the AASF survey is a “convenience” sample. It is not a probability-based sample because there is no national sampling frame from which we could draw such a sample. In Supplementary Materials 9, we compare the representativeness of the sample with data from the American Community Survey (ACS).

A methodological caveat is in order. There are two sources of potential bias with our survey data (discussed in more detail in Supplementary Materials 4): “sample selection bias” and “social desirability bias,” both in the direction of exaggeration of the negative impact of the China Initiative. Therefore, caution is needed when we interpret the results. However, the high degree of consistency of our survey results with those from two other similar surveys (Supplementary Materials 8) lends credence to the results we report below.



**Figure 2: Chinese-origin scholars' perceptions and intentions.** Note: Only past and current grant awardees were asked the question of whether they were considering “avoiding applying for federal grants.”

In Figure 2, we present our main findings with eight indicators: five “psychological indicators” and three “intention indicators.” Our results are largely consistent with the findings from two earlier similar surveys (12). In Supplementary Materials 8, we compare both the design and the findings across the three surveys. All five psychological indicators reveal a strong sense of uneasiness and fear: 35% of respondents feel unwelcome in the US, and 72% do not feel safe as an academic researcher; 42% are fearful of conducting research; 65% are worried about collaborations with China; and a remarkable 86% perceive that it is harder to recruit top international students now compared to five years ago. The intention indicators address the potential impact of these psychological concerns on behavioral intent: 45% of respondents who have obtained federal grants say that they now wish to avoid applying for federal grants; and a shocking 61% have thought about leaving the US (for either Asian or non-Asian countries).



Among those who intend to continue applying for federal grants, 95% indicate they rely on grants to conduct research, especially life scientists. Despite an overall fearful sentiment, an overwhelming majority (89%) of our respondents indicated their desire to contribute to the US leadership in science and technology.

Regression analyses predicting the first two behavioral intentions with demographic and professional characteristics, presented in Supplementary Materials 5 (Models 1A and 1B), reveal that faculty members in engineering and computer science, those of senior ranks, and those from public institutions are much more likely to consider avoiding federal grant applications. Our results also show that junior faculty and those who have been funded by federal grants are much more likely to consider relocating abroad. This is particularly worrisome because junior researchers and federal grant awardees are important to the global competitiveness of the US in cutting-edge science and technology.

As reported in Supplementary Materials 5 (Models 2A and 2B), we also find that indicators of fear (shown in Figure 2) strongly predict the first two intention measures—avoiding federal grant applications and considering relocating abroad, after adjusting for demographic, professional, and geographical covariates. Variables capturing perceptions of professional belonging and university leadership are not significantly predictive of those two intentions. After accounting for psychological indicators, engineering and computer science faculty are not statistically different from other respondents in avoiding federal grant applications, suggesting that fear of conducting research explains the observed difference. After accounting for these fear effects, junior faculty and federal grant awardees remain much more likely to consider leaving the US.

These survey data on Chinese-American scientists should be interpreted in the broader US context. Not only were Chinese-Americans subject to racial discrimination in America's past, anti-Asian and anti-Chinese sentiments in the US have increasingly prevailed since the COVID-19 pandemic began (13, 14). The high percentage of those considering leaving the US is partly attributable to a Chinese-hostile societal environment in the US nowadays. Our data show that 83% of the respondents had experienced insults in a non-professional setting in the past year, and experiencing insults of this kind significantly heightened individuals' intention of leaving the US. However, this large societal effect of insult experiences does not explain away the net effects of "fear" and "feeling unwelcome" resulting from the China Initiative on the intention of leaving the US.

We further explore the reasons behind our respondents' fears. Supplementary Materials 6 displays the detailed results. Our analysis suggests that engineering and computing science faculty, life science faculty, federal grant awardees, senior faculty, and males are relatively more likely to feel fearful of conducting research in the US. Of the five possible reasons for "not feeling safe as an academic researcher in the US," most survey respondents pointed to fears of "US government investigations into Chinese-origin researchers" (67%) and "Anti-Asian hate and violence in the US" (65%). Meanwhile, relatively smaller percentages of respondents expressed other fears, such as that "US government officials often attack the Chinese government or Chinese policies" (38%), "My family, friends, or collaborators might be targeted by the US or Chinese government in retaliation for something I say or do" (37%), and "Others might report what I say or do to the US or Chinese government" (31%).

Our survey uncovers many Chinese-American scientists' intention to avoid applying for federal grants out of fear of federal government prosecution under the China Initiative. In our data, of the 445 respondents who intended to avoid applying for federal grants, 84% indicated that this was "Because I am afraid that I would have legal liability if I made mistakes in forms and disclosures," while 66% reported that this was "Because I worry that my collaborations with Chinese researchers or institutions would place me under suspicion."

### **Conclusion**

Immigrant scientists and engineers from China have been an integral part of the US research enterprise for decades. In the past, there have been complaints that while they contributed a large share of the hard work, on the whole they failed to achieve leadership positions or commensurate recognition, reaching a "bamboo ceiling" (15, 16). Under the China Initiative, a majority of Chinese-origin American scientists now feel the chilling effect of potential federal investigations and prosecution and have a new reason to be pessimistic about their careers in the US. Indeed, although an overwhelming majority would like to contribute to the US leadership in science and technology, many feel unwelcome and fearful of conducting research in the US. For some Chinese-American scientists, this fear leads to their consideration of avoiding federal grant applications, especially among engineering and computer science faculty, and of leaving the US, especially among junior faculty and federal grant awardees. There are indications that applications for National Science Foundation grants declined significantly between 2011 and 2020 (17). While the decline was 17% overall, it was much higher, at 28%, for Asian American scientists.

Modern science has been making tremendous progress since its inception in the seventeenth century because it has been open, benefitting the entirety of humanity. The world center of science has shifted several times in the past, from Renaissance Italy to England in the seventeenth century, to France in the eighteenth century, and to Germany in the nineteenth century, before crossing the Atlantic in the early twentieth to the US (2). Still, scientists everywhere have belonged to a single worldwide community, as they share new knowledge with one another through publications in the public domain. What attracts scientists the most is not material comfort but academic freedom and opportunities to pursue one's ideas; for a long time, the US has been providing a working environment that is more conducive to these values than that of any other country (2). This is and should remain a distinctive advantage of the US.

In this article, we have shown unintended consequences of the China Initiative that are harmful to American science: (1) discouraging new Ph.D. recipients of Chinese origin from working in the US, (2) encouraging world-class Chinese-American scientists to leave the US, especially junior researchers and federal grant awardees; and (3) discouraging experienced Chinese-American scientists from securing federal sponsorship, especially among engineering and computer science faculty. Addressing the fears of scientists of Chinese origin and making the academic environment welcoming and attractive for all will help retain and attract scientific talent and strengthen the US leadership in science and technology in the long run.

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