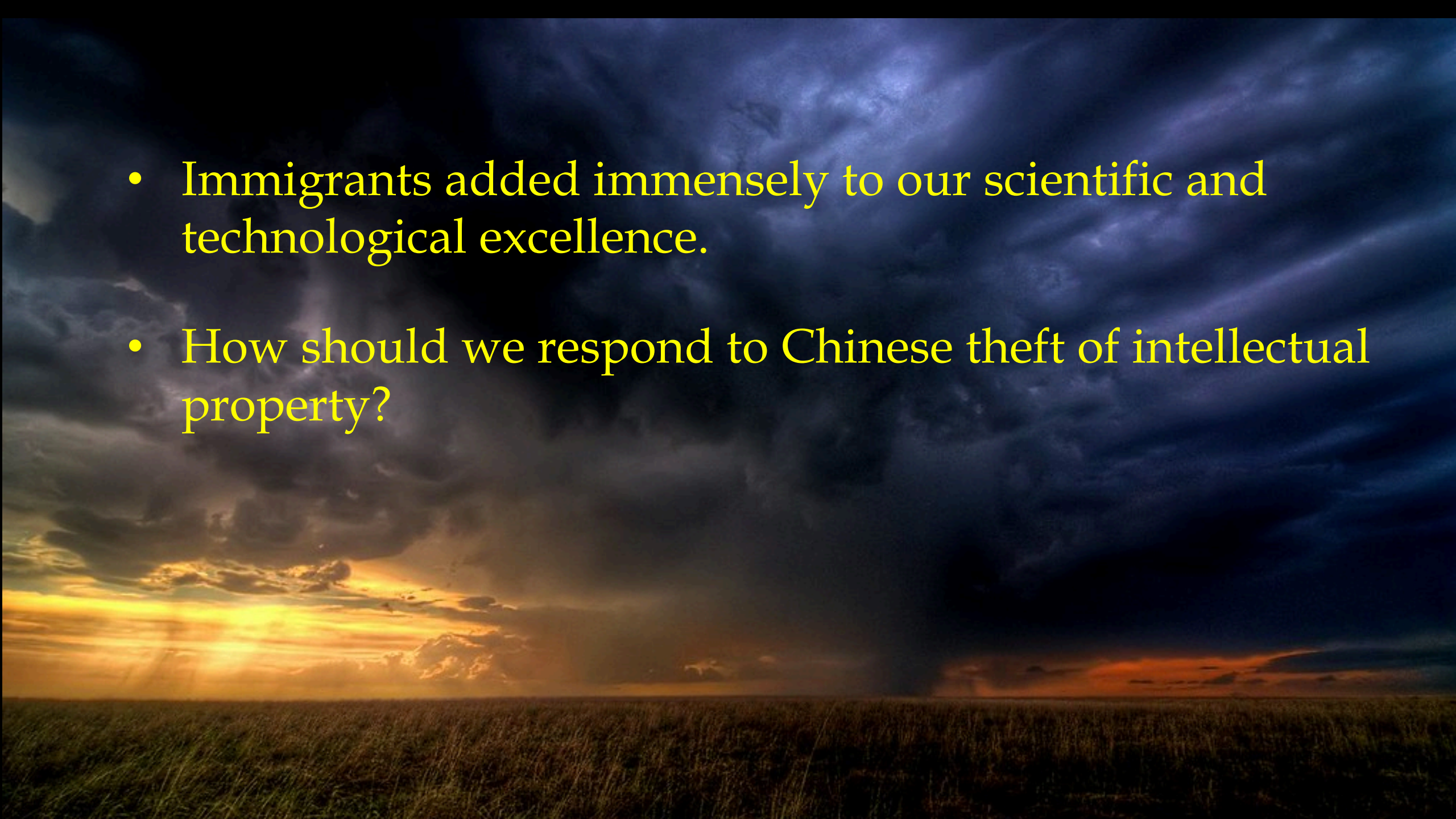


Immigration and US Science

APS Webinar
17 September 2021

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- Immigrants added immensely to our scientific and technological excellence.
 - How should we respond to Chinese theft of intellectual property?

- Immigrants added immensely to our scientific and technological excellence.



The U.S. is a country comprised largely of immigrants

- The brain-gain of the U.S. was stimulated by political events that were **gifts** to American Science
 - Germany and Italy in the 1930s -1940s
 - China in 1949, the Cultural Revolution, Tiananmen Square
 - Soviet Union and Jewish emigration (1989 -2000)
- Graduate students and postdocs in foreign countries came to study in America and stayed because we are a free, open and accepting society.
- Most of these students became U.S. citizens and raised their families in the U.S.

Immigrants added immensely to our scientific and technological excellence.

- 143 immigrants to the United States have won Nobel Prizes (34% of all U.S. Laureates). If we count 2nd generation immigrants (e.g. me), immigrants and the children of immigrants are likely be the majority of U.S. Nobel Laureates.
- All 7 Physics Nobel Laureates born in China earned their PhDs in the U.S. and became American citizens.

* Source: Inst. For Immigration Research, George Mason University

Immigrants played an essential role in our national defense

Immigrants who worked on the Manhattan Project included

Hans Bethe, Felix Bloch, Enrico Fermi, James Franck, Rudolf Peierls, Isidor Rabi, Emilio Segrè, Leo Szilard, Edward Teller, John von Neumann, Victor Weisskopf, Eugene Wigner



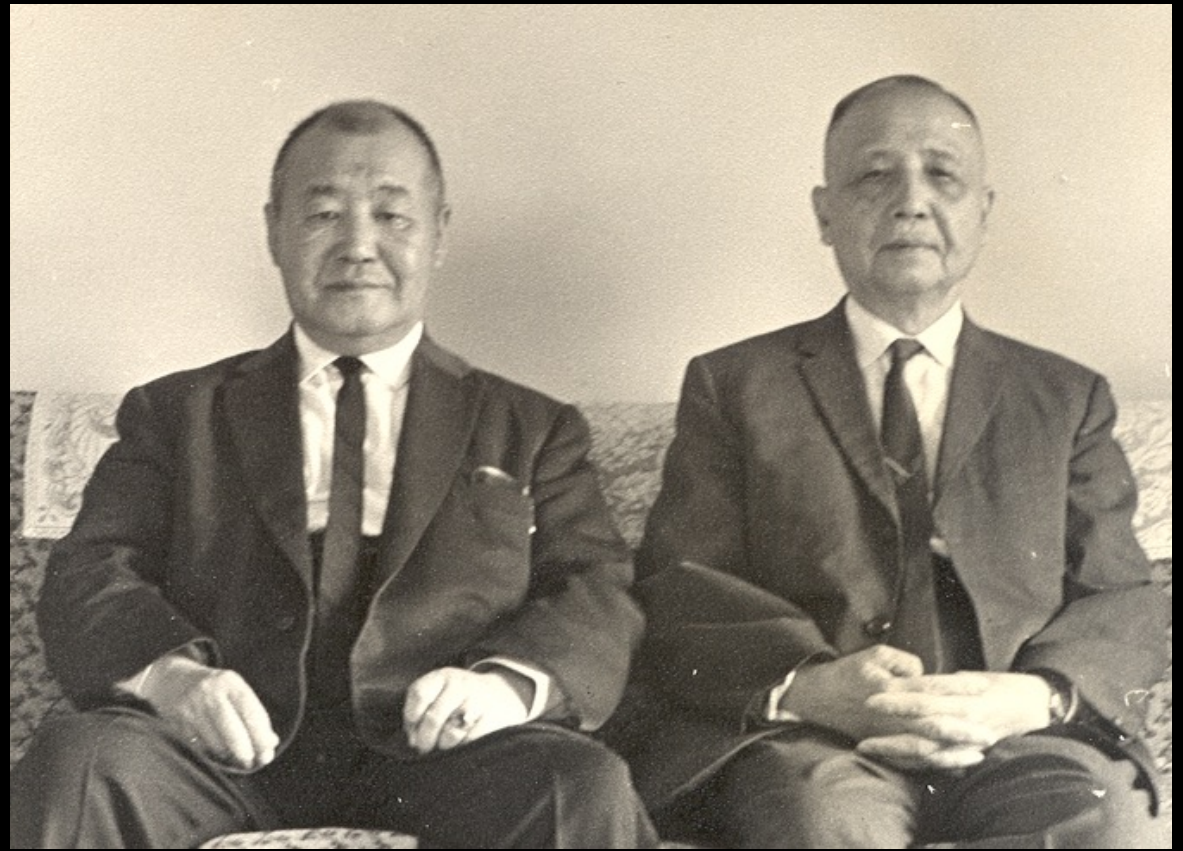
Reunion at the University of Chicago of atomic scientists on the 4th Anniversary (1946) of the first controlled nuclear fission chain reaction on December 2, 1942



Edith Ju-hwa Chu
Prof. of Chemistry
Tsinghua Univ.

Ju-Chin Chu
Prof. Chem. Eng.
Brooklyn Poly.

Ching Chen Li



Shu-tian Li
President of Peiyang
Univ. from 1932 -1949

Shu-hua Li
Prof. of Physics Peking U.
Academia Sinica

Became a practicing
civil engineer; received
the highest award from
the American Concrete
Inst. in 1985

Worked with Perrin;
named "Officier de la
Legion d' Honneur" the
same year Perrin received
his Nobel Prize.

Regarded as the most significant
woman chemist in pre-war China,
but could only get a job in a small
college that trained women to be
high school teachers

The Nobel Prize in Physics 1957



My mother was in the same class as C.N. Yang when Tsinghua was unified with Peking and Nankai University in Kunming during WWII

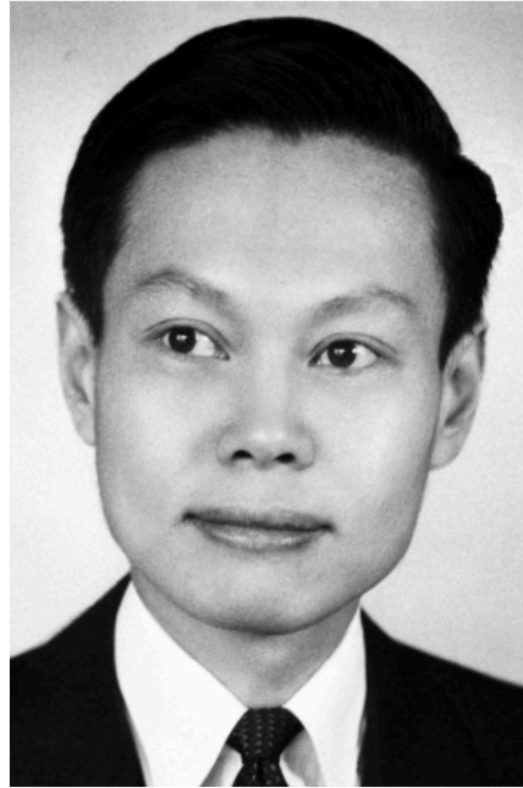


Photo from the Nobel Foundation archive.

Chen Ning Yang

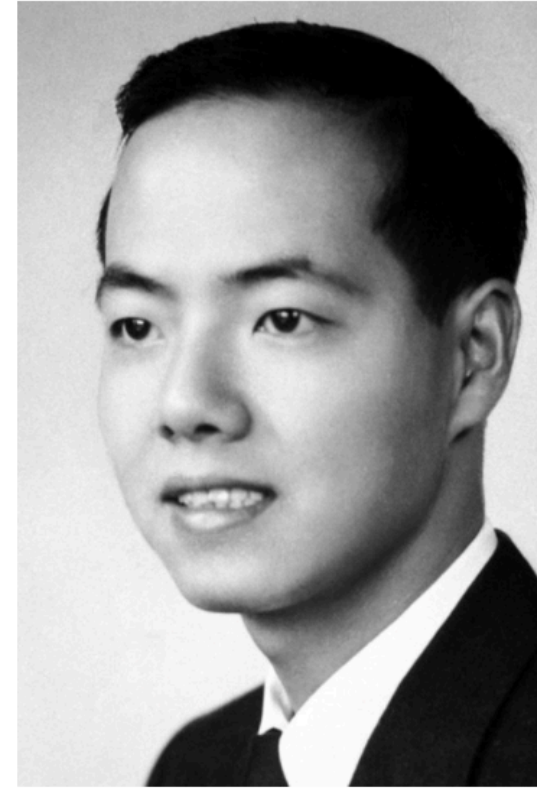


Photo from the Nobel Foundation archive.

Tsung-Dao (T.D.) Lee


Awarded jointly "for their penetrating investigation of the so-called parity laws which has led to important discoveries regarding the elementary particles."

1st or 2nd generation Americans were instrumental in founding **44 of the top 100 Fortune 500** companies listed in 2018.

45% of Fortune 500 companies were founded by immigrants or their children, including **Intel** (**Andy Grove**, 1st generation Hungarian), **Google** (**Sergey Brin**, 1st generation Russian), **Amazon** (**Jeff Bezos** is a 2nd generation Cuban), **Tesla** (**Elon Musk** is a 1st Generation South African), **Yahoo** (**Jerry Yang**, Taiwan), **Nvidia** (**Jensen Huang**, Taiwan) ... and many more.

The CEOs of two companies that developed the COVID vaccine (Pfizer, **Albert Bourla**) and (Moderna, **Stéphane Bancel**) are immigrants.

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- Immigrants added immensely to our scientific and technological excellence.
 - How should we respond to Chinese theft of intellectual property?



How have we been responding to foreign intellectual property theft?

“The China Initiative was launched in November 2018 by then-Attorney General Jeff Sessions to highlight DOJ’s efforts to thwart Chinese theft of trade secrets, intellectual property, technologies and other sensitive information developed using U.S. resources. DOJ has focused on researchers at U.S. academic institutions with undisclosed ties to China, including universities, companies, talent programs, the government, or the PLA (People’s Liberation Army)”

Source: <https://www.jdsupra.com/legalnews/doj-s-china-initiative-falters-7187959/>

FBI Director Christopher Wray (July 7, 2020 speech):

“We’ve now reached the point where the FBI is opening a new China-related counter-intelligence case about every 10 hours. Of the nearly 5,000 active FBI counterintelligence cases currently underway across the country, almost half are related to China.”

<https://www.fbi.gov/news/speeches/the-threat-posed-by-the-chinese-government-and-the-chinese-communist-party-to-the-economic-and-national-security-of-the-united-states>

Out of the thousands of FBI cases on Chinese espionage, ~ 100 people were formally charged. There are 4 convictions or guilty pleas since April 2018.

- DOJ case against Prof. Anming Hu, University of Tennessee, Knoxville (UTK), ended in a mistrial on June 15, 2021. The DOJ announced that it would retry the case, but on September 9, 2021, Thomas Varlan, US District Court judge, acquitted Hu of all charges of **wire fraud** and **making false statements**.

“When evaluating motions for judgment of acquittal, courts view the evidence in the light most favorable to the prosecution and consider whether any rational trier of fact could have found the essential elements of the crime beyond a reasonable doubt.”

“Wire fraud” requires **deceit and injury or loss**. The court found there was no injury.

Hu was also acquitted of concealing that he worked with “China or a Chinese-owned company.” The court found that neither Hu, UTK, NASA clearly stated that collaborating with Chinese faculty and students falls under the NASA funding restrictions.

At the bottom of the Chinese Assurance letter written by UTK, **in bold**, was the following language:

“This letter of assurance is predicated on the understanding that the NASA Class Deviation ... does not apply to the participation of students, faculty and staff from non-Chinese entities engaged in fundamental research with a meaning consistent with National Security Decision Directive 189. Such fundamental research does not raise national security or economic security concerns.”

National Security Decision Directive (NSDD) 189 defines fundamental research

“Fundamental research means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons.”

“It is the policy of [the Regan] Administration that, to the maximum extent possible, the products of fundamental research remain unrestricted.The mechanism for control of information generated during federally-funded fundamental research in science, technology and engineering at colleges, universities and laboratories is classification. ... No restrictions may be placed upon the conduct or reporting of federally-funded fundamental research that has not received national security classification”

- **On January 14, 2021, Gang Chen of MIT was arrested for Grant Fraud**
Andrew E. Lelling, the federal prosecutor in Boston said, “The allegations of the complaint imply that this was not just about greed, but about loyalty to China.” Prof. Chen has been a U.S. naturalized citizen since June 2000.
- On January 20, 2021, Joe Biden became the 46th President of the United States
- On June 22, 2021 Attorney General Merrick Garland announced:
“We want to be careful to separate out a country that is a serious competitor with us -- aggressive competitor -- with Americans and also with residents who come from that country ... We are going to be careful that we do not forget the distinction between those two.”

Source: <https://www.bloomberg.com/news/articles/2021-06-22/garland-say-u-s-will-counter-china-without-stereotyping-asians?sref=yLCixKPR>

- On July 15, 2021 (1 month after the Hu mistrial) the Justice Department dropped its case against Qing Wang (a naturalized U.S. citizen) who was fired by the Cleveland Clinic the same day he was arrested for failing to disclose to the NIH that he had an affiliation with a university in China and had received Chinese grant funding.
- On July 22, 2021, the DOJ dismissed the criminal cases researchers at UC Davis, Stanford, University of California San Francisco, UCLA, and Indiana University accused of covering up their military service in the Chinese People's Liberation Army ("PLA"). A DOJ spokesman stated "recent developments" had prompted a re-evaluation of the cases and that the dismissals were in the interest of justice.

The DOJ cases appears to be in conflict with NSDD 189 established 1985, and reaffirmed in 2001 and 2010.

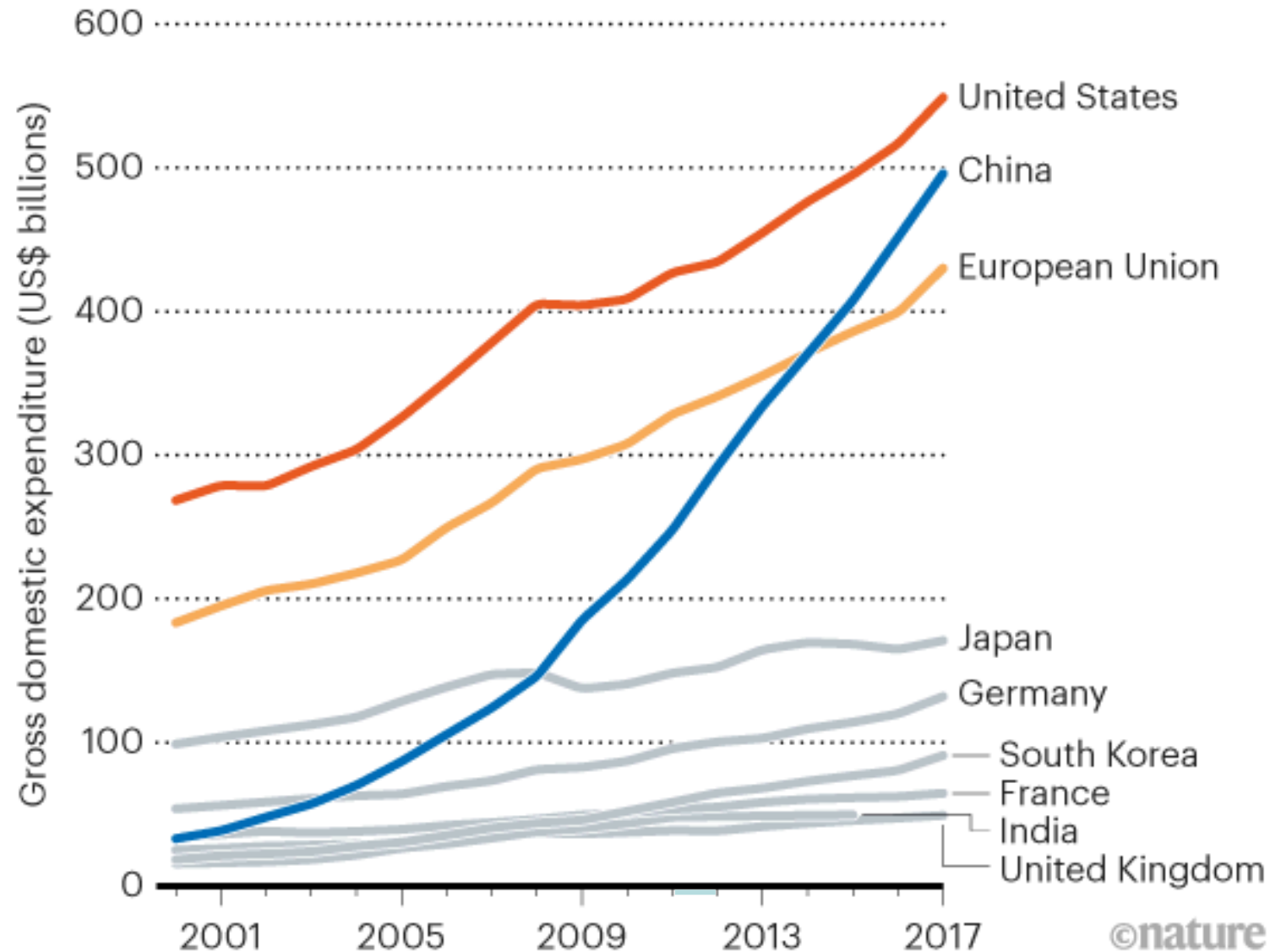
While we must safeguard against attempts by China and other countries to gain early, inappropriate access at what U.S. researchers are doing in fundamental research,

I believe it remains in our best interest to reaffirm the principles of that presidential directive and continue to openly publish the results federally sponsored research

Why is it in our best interests to maintain an open science policy?

1. Creativity in science and technology thrives in an open society with the free flow of information. Scientists stand on the shoulders of the entire international scientific enterprise.
2. The U.S. has led the world in many areas of science, technology and innovation by being a welcome home for international students and scientists. Erecting walls with China will reverse the “Brain-gain” that was responsible for our scientific preeminence since the 1930s. I lost 1 postdoc (accepted my offer, but then went to the National University of Singapore) and another postdoc who left my lab because of the perceived hostile environment against Chinese during the previous Administration.
3. The rest of the world will benefit from world-class Chinese international user facilities such as FAST (the Five-hundred-meter Aperture Spherical Telescope), and the Shanghai Tech x-ray free electron laser that just achieved the *first single-shot femtosecond coherent diffraction image* in a "water window" ($\lambda = 2.4 \text{ nm}$)

Nature (Jan. 15, 2020) “China is closing gap with United States on research spending”



Source: National Science Foundation

U.S. Science and Technological Leadership at Risk

Source: *Rising Above the Gathering Storm, Revisited*, 2010

- In 2009, 51% of U.S. patents were awarded to non-U.S. companies. China has gone from 15th place to 5th in international patents.*
- The World Economic Forum ranks the U.S. 48th in quality of mathematics and science education.
- China's Tsinghua and Peking Universities are the two largest suppliers of students who receive PhD's *in the United States*.

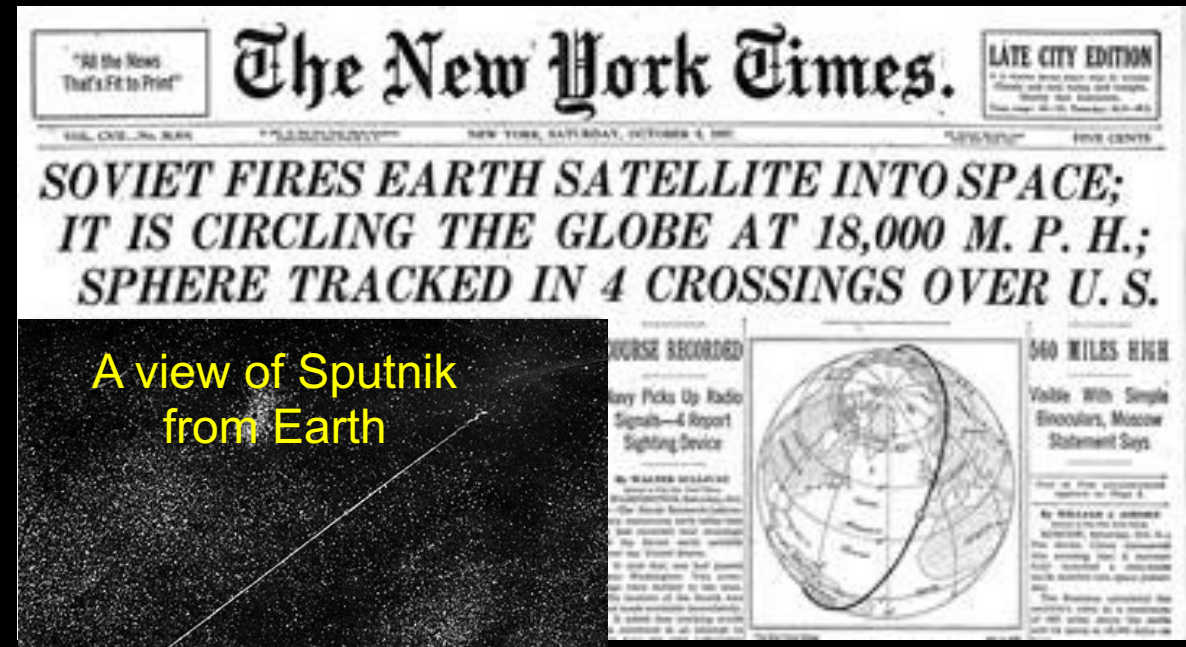
By 2019, China passed the U.S. in world-wide patents *granted*, and had **1,400,661** patent applications vs. **621,453** applications from the U.S.

Source: https://en.wikipedia.org/wiki/World_Intellectual_Property_Indicators

What is the best way to respond to the technology theft of increasingly competitive and adversarial country?

On October 4, 1957, the Soviet Union placed a 184-pound satellite into orbit.

On November 13, 1957, Pres. Eisenhower responded in a major speech. He did *not* call for more military spending:



“According to my scientific friends one of our greatest and most glaring deficiencies is the failure of us in this country to give high enough priority to scientific education and to the place of science in our national life ... Education requires time, incentive and skilled teachers. They believe that a second critical need is that of giving higher priority, both public and private, to basic research.”

More of President Eisenhower's Sputnik speech

<https://www.eisenhowerlibrary.gov/sites/default/files/research/online-documents/sputnik/11-7-57.pd>

“Although for tonight's purposes I stress the influence of science on defense ...The peaceful contributions of science to healing, to enriching life, to freeing the spirit -- these are the most important products of the conquest of Nature's secrets.”

In 1957, I was a 9 year old son of immigrants who benefitted from the resulting investment in science education to train a new corps of U.S. scientists.

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