

# **U.S. Nobel Laureates**

# The Impact of Immigrant Faculty Members on U.S. Universities and Research Institutes

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### Introduction

In 2016, U.S. Nobel laureates dominated the headlines not only for winning seven of the eleven prizes given worldwide, but because six of the winners are immigrants to the United States working at U.S. educational institutions. Oliver Hart and Bengt Holmstrom are economists and shared the Nobel Prize in Economic Sciences. Hart was born in the United Kingdom and Holmstrom was born in Finland. Furthermore, the four other winners were born in the United Kingdom: J. Fraser Stoddart in chemistry; David J. Thouless, F. Duncan M. Haldane, and J. Michael Kosterlitz in physics. In addition to working at U.S. education institutions, many of the laureates also received advanced degrees in the United States. Hart received his PhD from Princeton University, has worked for U.S. universities since 1984, and is currently at Harvard University. Holmstrom received his PhD from Stanford University, has worked at U.S. universities since 1983, and is at Massachusetts Institute of Technology (MIT). Kosterlitz has been at Brown University. Thouless received his PhD from Cornell University and was at the University of Washington – Seattle from 1980 until he retired in 2003. This trend of current Nobel laureates learning, teaching, and conducting research at U.S. educational institutions demonstrates the incredible influence the U.S. educational system has in producing environments that encourage potential Nobel laureates.



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Since the Nobel Prize was established in the early 1900s, about 40 percent of the more than 900 prizes have gone to individuals conducting research at U.S. institutions. Additionally, about 35 percent of these U.S. Nobel laureates were immigrants to the United States, eighty percent of whom worked at universities at the time of winning the Nobel Prize. Immigrant scholars have been winning Nobel Prizes alongside their U.S. born counterparts since the creation of the Nobel Prize. See Figure 1 for a comparison of U.S. born and U.S. immigrant Nobel laureates over time.

Additionally, an analysis of the last 10 years indicates that there has been a decrease in Nobel laureates operating outside the United States and an increase in the mix of U.S. born and U.S. immigrant Nobel laureates, except in 2012 when all the winners were U.S. born. Seven of the 10 years displayed in Figure 2 show that at least 40 percent of the Nobel laureates won based on their work in the United States.



*Source for Figures 1 & 2: The data on Nobel Prize laureates was collected by the IIR from publicly available data. See <u>www.nobelprize.org</u>.* 

### Nobel Laureates, Basic Research, and Innovation

Innovation has been a core component of the U.S. educational system; experts contend this is what attracts immigrants to the United States' educational institutions. Of the 911 Nobel laureates between 1901 and 2016, 382 have been U.S. citizens or individuals affiliated with a U.S. research institution.

Scholars outside the United States come to the country because of the importance placed on conducting innovative research. In an interview with Adam Smith, the chief scientific officer of Nobel Media, 2016 Nobel Laureate Duncan Haldane said that researchers from the United Kingdom, himself included, made their way to the United States due to lack of government funding in the UK for research. Research is a process in which researchers build up on previous research and discoveries, which is not a linear process, Haldane explained. An end result is not always evident or possible within a specific time period. He explained further:

I think it is a very bad thing when government agencies start to say...things like 'What's it used for?' Because all the big discoveries of really useful things don't really come about because someone sits down and thinks 'I want to discover something useful'. They occur because someone discovers something interesting and it turns out to be tremendously useful.

The discoveries made by quantum mechanics are not immediate or instantly realized. Haldane explained that he and fellow Nobel laureates David Thouless and John Michael Kosterlitz would not have been able to conduct their research without the space and funding to experiment. "Just knowing the correct laws of quantum mechanics does not mean that one understands all the strange phenomena that it allows. What has been learned is that it can do *'really cool things'* that had never been guessed at before, and might some day actually be practically useful," Haldane said in his speech at the Nobel Prize Banquet in December 2016. The work conducted by these three physicists is not only foundational to the study of quantum mechanics, but it will also inspire the research of future physicists.

Australian-American Elizabeth H. Blackburn, who won the 2009 Nobel Prize in Physiology or Medicine in 2009, along with American Carol W. Greider and Canadian-American Jack W. Szostak, also spoke of the foundational nature and unpredictable results of research during her speech at the Nobel Prize Banquet in December 2009, "We believe that basic science research is the key to continued advances in, and applications to medicine. Yet biology sometimes reveals its fundamental principles through what may seem at first to be arcane and bizarre." Szostak agreed that scientific research is basic work that requires time for developments to occur. "I think even though the work I'm doing now is totally basic, we always keep our eyes open for possible applications. Because a lot of it is uncovering basic physical phenomena or developing new technologies and you can't really predict when applications will come up," he explained during a phone interview with the Nobel Prize website.

Echoing the unknown scientific phenomena and the importance of scientific research is German-American Thomas C. Südhof, the winner of the 2013 Nobel Prize in Physiology or Medicine. Südhof said in an interview on the Nobel Prize website in December 2013 that his research discovered the ways in which cells speak to each other within the brain, particularly how cells gather and send information to other cells. This research began in the 1990s and built upon research conducted by the other winners of the 2013 Nobel Prize in Physiology or Medicine Americans James E. Rothman and Randy W. Schekman.

Japanese-American Nobel Laureate Shuji Nakamura won the 2014 Nobel Prize in Physics, along with Isamu Akasaki and Hiroshi Amano - both Japanese - for

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-2016 Nobel Laureate Duncan Haldane their work on LED lighting, or light emitting diodes that produce light in an efficient and long-lasting manner. At the Nobel Banquet on December 10, 2014, Nakamura explained:

We are deeply honored that the dream of LED lighting has now become a reality, and is greatly benefiting mankind. Nowadays we can buy energy efficient LED light bulbs at the supermarket and help reduce energy use. LED lighting is ten times more efficient than conventional incandescent lamp so we can drastically reduce energy consumption. I believe that LED Lighting can also reduce global warming too. In addition, by combining LED with solar cell we can give sustainable lighting to the 1.5 billion people without electricity that's cost effective, clean, and safe - truly lighting the world.

Nakamura said his research with Akasaki and Amano on LED lighting begin in the 1980s and they were being told that the work that they were attempting to do was impossible. But the perseverance and dedication of Nakamura in the United States and Akasaki and Amano in Japan helped bring about breakthroughs that have encouraged further research on LED options.



The 2016 U.S. Immigrant Nobel Laureates (from left to right): Duncan Haldane, Oliver Hart, Bengt Holmstrom, Michael Kosterlitz, Fraser Stoddart, David Thouless

### **Immigrant PhD Recipients in the United States**

Immigrants notably perform award winning research at U.S. institutions, in addition to earning PhDs at these institutions. To further understand the impact of immigrants on institutions of higher education, the IIR conducted an analysis of the publicly available Survey of Doctorate Recipients, which is a longitudinal biennial survey conducted by the National Science Foundation to provide demographic and career information about individuals with a research doctoral degree in a science, engineering, or health field (STEM) from a U.S. academic institution. As Figure 3 depicts, in 1993 about 19 percent of these doctorates were awarded to immigrants, this number went up to about 24 percent in 2001 and in 2013, the number jumped to 29 percent. Doctorates in science awarded to immigrants went from about 17 percent in 1993 to about 20 percent in 2001 and 28 percent in 2013. Doctorates in computer science and mathematics awarded to immigrants underwent the largest increase, going from almost 28 percent in 1993 to about 33 percent in 2001 and more than 48 percent in 2013.

Figure 4 exhibits the distribution of immigrants who received PhDs in a science, engineering, or health field in the United States according to the regions of their origin. Asia is represented most prominently and consistently from 1993 to 2013. In 1993, doctorate recipients from Asia represented nearly 12 percent of all immigrant doctorate recipients. This number went up to almost 16 percent in 2001 and then to 21 percent in 2013.





*Source for figures 3 & 4: The data on PhD recipients was collected by the IIR from publicly available data. See www.nsf.gov/statistics/srvydoctoratework/* 

Figure 5 indicates the distribution of immigrant PhD Recipients in the sciences according to regions of origin. Once again, immigrants from Asia are highly represented. In 1993, almost 9 percent of immigrant doctorate recipients came from Asia. This number went up to nearly 12 percent in 2001 and was close to 19 percent in 2013.



Source: The data on The data on PhD recipients was collected by the IIR from publicly available data. See www.nsf.gov/statistics/srvydoctoratework/

Figures 6 and 7 examine the distribution of immigrants in the fields of computer science and mathematics (Figure 6) and engineering (Figure 7) according to regions of origin. Immigrants from Asia are overwhelmingly represented in both fields. Figure 6 indicates that immigrants from Asia represented almost 17 percent of those in the fields of computer science and mathematics in 1993. This number went up to close to 23 percent in 2001 and more than 37 percent in 2013. In the field of engineering, as shown in Figure 7, immigrants from Asia have consistently represented more than 30 percent of those in the field since 1993. In 2013, immigrants from Asia were more than 41 percent of all those in the field.

Nobel laureates who immigrated to the United States highlight the importance of the research-oriented focus of U.S. higher education on their ability to establish their Nobel Prize-winning research. The increase in the number of immigrants earning PhDs from U.S. institutions is projected to grow, therefore it is likely that the overall proportion of immigrants earning Nobel Prizes for the work conducted at a U.S. institution will increase. Thus, U.S. institutions may increasingly become spaces for Nobel Prize worthy research.





Source for Figure 6 & 7: The data on PhD recipients was collected by the IIR from publicly available data. See www.nsf.gov/statistics/srvydoctoratework/

# Immigrants' Contribution to Higher Education and Innovation in the United States

Immigrants to the United States play a significant role in the educational landscape of the country. According to a study by education researchers Zeng Lin, Richard Pearce, and Weirong Wang (2009) that compared data on immigrant faculty members, in 2000 15.4 percent of faculty members were born outside the U.S.; by 2004 that number had increased to 22.1 percent, in 2004, the immigrant population in the United States was only 11.7 percent. The authors argue that this trend shows a shift from a need for immigrant physical labor to immigrant intellectual labor. The study shows that the proportions of U.S. born and immigrant faculty members are nearly equal to each other in terms of teaching and research in the liberal arts, but immigrant researchers are more likely to work within the applied sciences and U.S. born researchers in education and applied arts. Thirty-five percent of immigrant faculty members research in the applied sciences, compared to 25 percent for U.S. born faculty researchers. About nine percent of U.S. born researchers are in education, compared to four percent of immigrant researchers. Nearly 20 percent of U.S. born researchers are in the applied arts, while immigrant faculty members occupy nearly 14 percent in the same field.

According to the same study, U.S. born faculty members hold more tenured positions than immigrant faculty members – about 50 percent to about 44 percent, respectively. However, immigrant faculty members on average publish more journal articles than U.S. born members. Differences in publication patterns between immigrant faculty members and U.S. born faculty suggest higher productivity among immigrant faculty in the United States. This pattern requires more nuanced analysis, but suggests generational differences in expectations for higher rates of publication among younger faculty members. Karen Webber, a professor at the Institute of Higher Education at the University of Georgia, examined differences in research productivity between U.S. born and immigrant faculty members (2012) and concluded that the production of research depends on workload and tenure status. Those occupying junior positions, or non-tenured positions, produce more scholarship, to possibly obtain a tenured position because the production of knowledge is connected to promotion within the academic world.

Individuals from all over the world have come to the United States to study at its educational institutions, which speaks to the global influence the country's academic atmosphere has on knowledge production, education, and innovation. As noted earlier, physicist F. Duncan M. Haldane credits his migration to the United States to the openness to innovation within the U.S. educational system. According to the Economics of Industrial Research & Innovation (IRI), a scientific institute of the European Commission's Joint According to a study by Lin, Pearce, and Wang in 2004, 22 percent of faculty members at four-year universities in the United States were immigrants.

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-Atkinson and Blanpied Research Centre, which studies the contribution of research and development to the growth and employment of the European economy in particular, Europe spends less on research and development compared to the United States and Japan. The 2015 and 2016 IRI reports indicate higher spending levels in the United States, but also show incremental attempts by Europe, Japan, and China to increase their own spending on research and development. These new spending efforts indicate a changing global research and development landscape.

In an article regarding research universities and their importance to the U.S. science and technology system, Richard Atkinson, a former president of the University of California system, and William Blanpied, a senior research scholar at George Mason University, detail three ways in which U.S. research universities are essential centers that advance knowledge in all science and engineering disciplines, contributing to the U.S. economy on national, local, and regional levels. Firstly, U.S. research universities are successful in commercializing the results of their research and expanding their global impact. Secondly, education and research are linked within the U.S. graduate school system and this allows students to build a comprehensive base of knowledge as well as conduct research under the guidance of topnotch mentors. This educational system is not readily available across the globe, although countries like India, Pakistan, and China are moving to implement such a system in their respective educational institutions. Thirdly, adding to the success of U.S. educational institutions is a competitive environment that demands constant innovation. Universities and faculty members compete for funds to support their research from the government and private organizations. The fact that research grants are awarded to individual faculty members is crucial to maintaining competitiveness among U.S. research universities because it fosters a high quality of research. "That the U.S. university system today is undoubtedly the best in the world can be gauged by several indicators, including the number of Nobel Prizes awarded to faculty members, and the fact that U.S. graduate schools are favored destinations for aspiring scientists and engineers from abroad. Several countries have tried to replicate the success of the U.S. university system, but with limited results" (2008: 31).

According to Victor C. Johnson, a senior advisor for public policy at NAFSA: Association of International Educators, international students, researchers, and scientists are necessary for the enhancement of U.S. economic and scientific competitiveness, as well as fostering mutual understanding between the United States and the rest of the world (2009). However, there is concern that immigration policies have limited a significant number of individuals wanting to study and work in the United States due to a time-consuming and expensive visa application process. Since the 1990s, which was when new immigration policies went into effect, the United States has adhered to certain limits on various categories of immigrants. Johnson argues that this system has prevented talented individuals from entering the country to study or work. Furthermore, Johnson writes:

Other countries have seized this weakness to lure people to their knowledge-based economies. While the United States provides a patchwork of limited, shortterm work options with long and uncertain paths to permanent residency, other countries promise quick membership in their societies for talented people and their families (4).

Canada runs ads in U.S. newspapers in an attempt to attract workers caught in immigration red tape in the United States. Countries like China and India are attempting to attract their citizens back from the United States with the promise of good jobs and advanced facilities. Johnson argues that the recent trend is creating a new phenomenon in the United States: talented workers returning to their home countries or going to more welcoming countries. This change in the talent pool will likely have ramifications for the research productivity in United States research institutions, as well as the future commercial impact of these institutions.

#### Conclusion

The recent change in the U.S. administration has ignited waves of antiimmigration rhetoric and triggered dramatic changes to U.S. immigration policies. The changes began in February when newly-elected U.S. President Donald Trump signed an executive order that halted admission of all refugees and temporarily barred immigrants from seven Muslimmajority countries - Syria, Yemen, Libya, Iraq, Iran, Somalia, and the Sudan. Since then Trump amended his executive order by removing Iraq. However, the Trump Administration has been fielding judicial challenge after judicial challenge calling into question the constitutionality of the executive order. At the time this brief was published, the U.S. Justice Department requested that the U.S. Supreme Court review a decision made by U.S. Court of Appeals in Virginia blocking the implementation of the executive order.

The 2016 U.S. Nobel laureates have not shied away from the growing controversy and have spoken out against anti-immigration sentiment in the United States. During his speech at the Nobel Banquet in December 2016, Sir J. Fraser Stoddart said that the research he and others conducted relied on the cooperation of scientists from more than 30 countries: "Our chemistry has been conducted without prejudice and has recognized no borders. Science is global and there's no going back, even in the face of the uncertain future that pervades some of the Western world's major democracies today." During the same Nobel Banquet in December, Nobel Laureate Oliver Hart also commented on immigration "Science is global and there's no going back."

-2016 Nobel Laureate Sir J. Fraser Stoddart by saying, "At a troubled time in the world, this is a reminder of how important it can be for a country to open its doors to those suffering from persecution." Sixty-two Nobel laureates signed the petition titled "Academics Against Immigration Executive Order" in January 2017.

Adding to the for immigrants in academia, Atkinson and Blanpied argue that immigrants have made exceptional research contributions while studying at U.S. universities, which highlights the significance of the U.S. research university system in providing paths to citizenship for students educated within the system. Immigrant students have gone on to become faculty members at U.S. educational institutions or have contributed to innovations in U.S. industry, such as in Silicon Valley. The United States has been able to incorporate immigrant students into its science and technology system, while other countries are still working toward that objective. According to Atkinson and Blanpied, East Asian and South Asian universities have been increasingly attempting to improve the quality of university research and teaching in their countries during the past few years. China, in particular, has been working to mold its universities in such a way that they would become as competitive as U.S. universities.

Echoing these sentiments in an opinion-editorial in the *Washington Post*, George Mason University President Àngel Cabrera argues for immigration policies that would allow for the unrestricted flow of education and business because it is necessary for the economic growth of the United States. Cabrera states:

American innovation has been the envy of the world for the last century. Our ability to discover scientific breakthroughs, invent disruptive technologies and build successful companies that make those advances broadly available has been unparalleled. This creativity is the product of a culture that is uniquely open to new ideas, that encourages and rewards risk taking, that values people for what they achieve, not where they come from. It is also the result of a constant supply of talented people from outside the United States, many of whom came to this country seeking world-class education and an open society where they could thrive.

These voices and others underscore the consensus on necessity of immigrants to the success of U.S. educational institutions and the economy.

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## About Us

The mission of the IIR is to refocus the immigration conversation among academics, policy-makers and the public, including the business community and media, by producing and disseminating unbiased and objective, interdisciplinary academic research related to immigrants and immigration to the United States. The Institute for Immigration Research is a joint venture between George Mason University and The Immigrant Learning Center, Inc. (ILC) of Massachusetts.

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