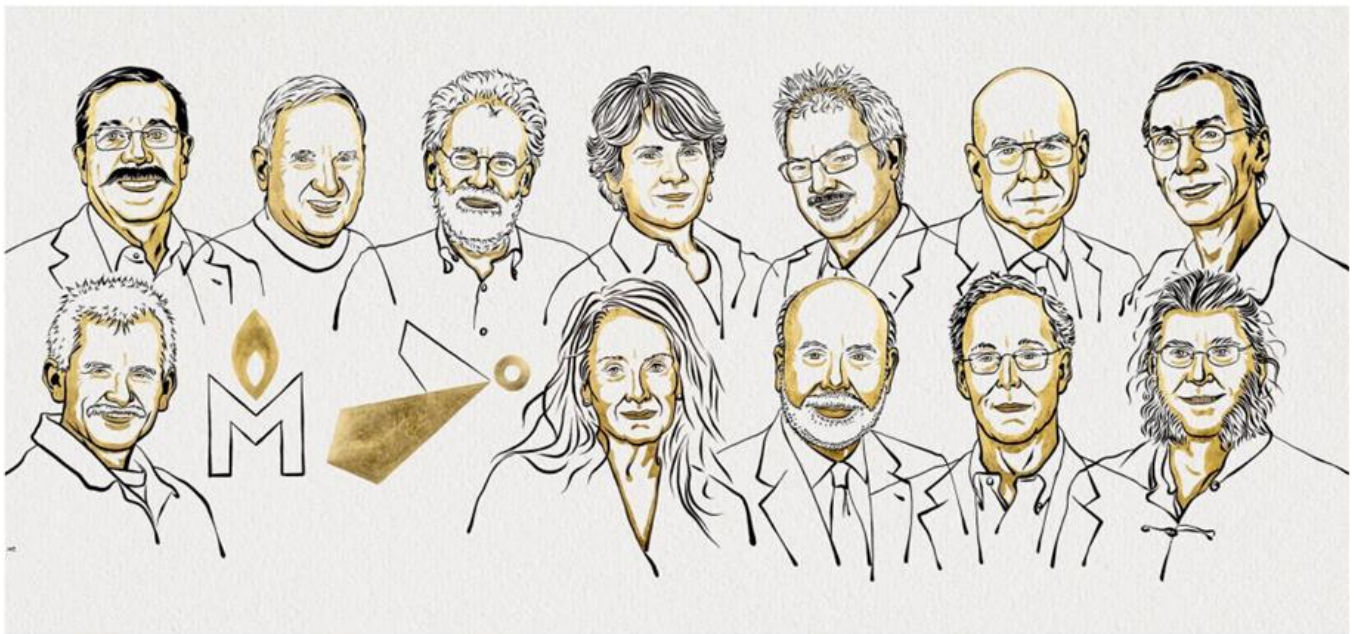


The 2022 Nobel Laureates: International Collaboration & Groundbreaking Knowledge Production

By Fanni Farago, MA



All Nobel Prize laureates 2022. Ill. Niklas Elmehed. © Nobel Prize Outreach

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Key Findings

1. In 2022, there are no immigrant* Nobel Laureates from the United States, a notable exception to the rule for over a decade. Since 2010, the Nobel Foundation has awarded prizes to 28 immigrant Laureates in the United States.
2. Immigrants to the United States, a typically overlooked group of awardees, comprise a considerable share (15%) of all Nobel Laureates awarded since 1901. These 148 immigrant individuals to date, have made lasting contributions across all six Nobel Prize fields, achievements which will continue to benefit humankind for decades to come.
3. In 2022, it is noteworthy that three of the Laureates are foreign-born individuals who have significant experience internationally collaborating with U.S. based scientists through professional activities such as co-authored publications, postdoctoral research positions, or visiting professorships. These Laureates include Alain Aspect (Physics), Svante Pääbo (Physiology or Medicine), and Anton Zeilinger (Physics). Additionally, four native-born U.S. Laureates have closely collaborated with foreign scientists based in other parts of the world. They are: Carolyn R. Bertozzi (Chemistry), John Clauser (Physics), Douglas W. Diamond (Economic Sciences), and K. Barry Sharpless (Chemistry).

* Please note that the terms “immigrant” and “foreign-born” are used interchangeably throughout this report. Foreign-born refers to individuals who are not a U.S. citizen at birth or who were born outside the U.S., Puerto Rico, or other U.S. territories and whose parents are not U.S. citizens. The foreign-born may include naturalized U.S. citizens, Legal Permanent Residents, temporary residents, refugees and asylees, and others. Native born includes those who are U.S. citizens at birth, those born in the United States, Puerto Rico, or other U.S. territories, and those born abroad to a parent who is a U.S. citizen.

Introduction

The Nobel Prize, first awarded in 1901, is among the most prestigious awards around the world. Established by Alfred Nobel, the Prize recognizes the extraordinary accomplishments of outstanding scientists, scholars, literary masterminds, and human rights advocates. Since 1901, there have been 959 individual Nobel Laureates¹ across the fields of Physics, Medicine or Physiology, Chemistry, Peace, Literature, along with Economic Sciences.² This year there are 12 individual Nobel Laureates, half of whom are from the United States, while the rest are foreign scientists living abroad. Another two Nobel Peace Prizes were awarded to two organizations, the Ukrainian Center for Civil Liberties and the Russian human rights organization, Memorial for Peace prizes.

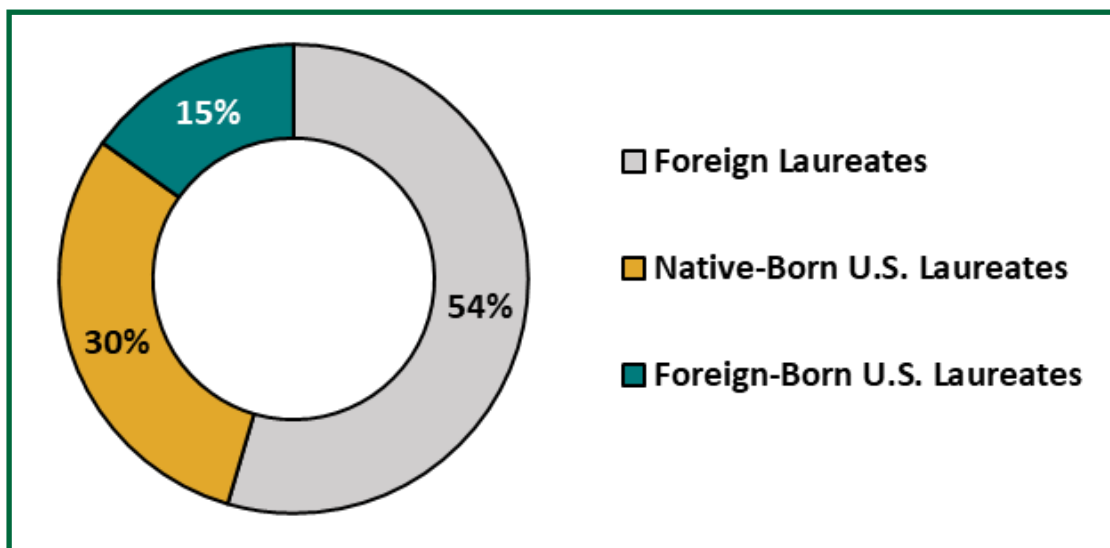
Immigrants³ to the United States, a typically overlooked group of awardees, comprise a considerable share (15%) of all Nobel Laureates awarded since 1901 (see Figure 1). These 148 immigrant individuals to date, including the most recent five Laureates who were featured in our 2021 report⁴, have made lasting contributions across all six Nobel Prize fields, achievements that will continue to benefit humankind for decades to come. In this report, Nobel Laureates are identified by the country of residence and university or research institution with which they were affiliated at the time of the Nobel Prize announcement, not by country of citizenship. Therefore, we categorize a foreign-born individual working at a U.S. university or living in the United States at the time of the award as a U.S. winner. We distinguish between native-born U.S. winners and foreign-born U.S. winners, based on the biographical information provided by the Nobel Prize administrators or official university biographies. The foreign-born may include naturalized U.S. citizens, Legal Permanent Residents, temporary residents, refugees and asylees, and others.

In 2022, there were no immigrant Nobel Laureates from the United States, a notable exception to the rule for over a decade (See Figure 2). Since 2010, the Nobel Foundation has awarded 28 immigrant Laureates in the United States (See Figure 2).⁵ This year, it is noteworthy that three of the Laureates are foreign-born individuals who have significant experience internationally collaborating with U.S. based scientists through professional activities such as co-authored publications, postdoctoral research positions, or visiting professorships (see Table 1). These Laureates include Alain Aspect (Physics), Svante Pääbo (Physiology or Medicine), and Anton Zeilinger (Physics). Additionally, four native-born U.S. Laureates have similarly collaborated with foreign scientists based in other parts of the world. They are: Carolyn R. Bertozzi (Chemistry), John Clauser (Physics), Douglas W. Diamond (Economic Sciences), and K. Barry Sharpless (Chemistry).

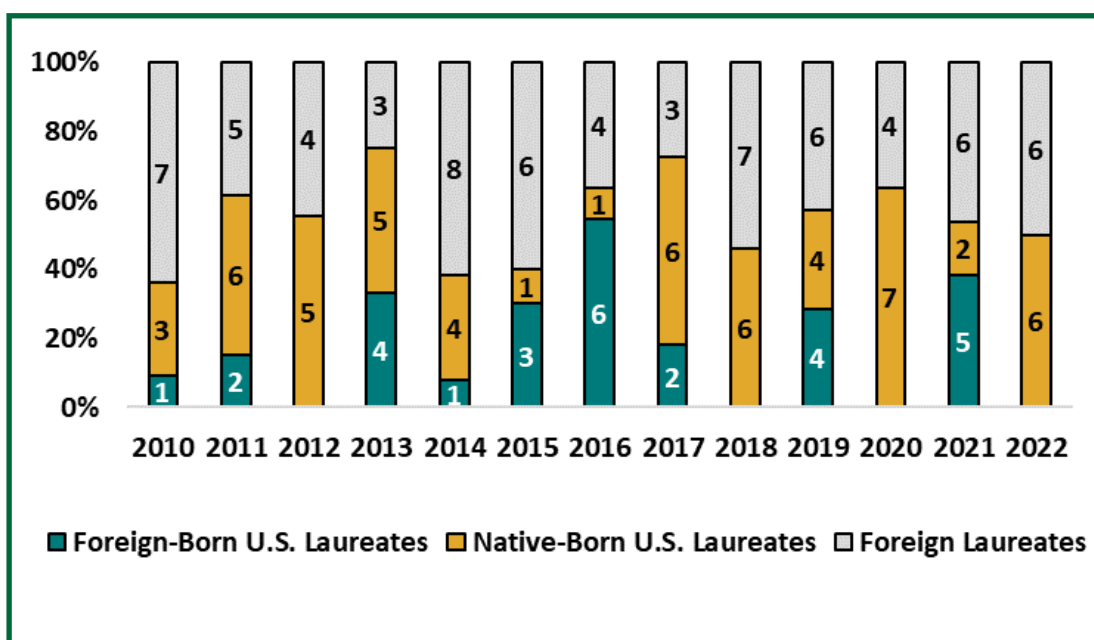
Indeed, the corpus of Nobel Prize research⁶ from the Institute of Immigration Research (IIR) demonstrates that scientific collaboration across international borders is a key element in the process of becoming a Nobel Laureate. Scientific collaboration across national borders is also a vital part of the scientific discovery process in today's increasingly global knowledge economy. Whether international collaboration happens in-person, such as at U.S. institutions of higher learning which attract large numbers of foreign scientists, or in more indirect ways through co-authorship, it is a key ingredient to generating groundbreaking, Nobel Prize-worthy knowledge. This remains a recurring theme in contemporary scientific knowledge production. For example, in our 2020 Nobel report⁷, the IIR showcased the central role international collaborations played in inventing revolutionary genetic engineering technology in Chemistry and medical research on the hepatitis C virus in the field of Physiology or Medicine.

Figure 1. Nobel Laureates, 1901-2020

Data Snapshot: Immigrant, or foreign-born, Laureates in the United States comprise 15 percent of 959 individual Laureates since 1901.

**Figure 2. Nobel Laureates, 2010 to 2022**

Data Snapshot: There have been 28 foreign-born U.S. Nobel Laureates since 2010. Overall, 2016 holds the record for the highest number of immigrant Laureates (6) in a single year, followed by 2021, when there were 5 immigrant Laureates.



Source: IIR Analysis of all Nobel Prize Winners. <https://www.nobelprize.org/prizes/lists/all-nobel-prizes/>

Nobel Laureates, U.S. Institutions of Higher Education, & Scientific Collaboration Across Borders

A recurring finding throughout the IIR's Nobel Prize research⁸ is that scientific collaboration across international borders is a crucial component of becoming a Nobel Laureate. Often times, U.S. institutions of higher learning serve as the meeting ground for such scholarly exchange, although scientists also share and produce scientific knowledge while working remotely with peers around the world. In fact, many of the current and past Nobel Laureates have produced their award-winning research through collaborations with an international array of peers.

Among this year's foreign-born Laureates are Swedish and Austrian scientists, Anton Zeilinger and Svante Pääbo respectively, who have been formally affiliated with U.S. higher education institutions (see Table 1). Per previous IIR Nobel Prize research reports from 2020⁹ and 2018¹⁰, it is evident that U.S. universities play a crucial role in the development of foreign-born Nobel Laureates' career trajectories. Overall, IIR analysis of Laureates' biographical data shows that prominent educational institutions, such as Harvard, MIT, Stanford, and Princeton, attract many foreign scientists, who come to the United States to pursue unique academic and scientific research opportunities. A recently published case-study of international collaborations at MIT underscores this finding.¹¹ For instance, the study found that there were more than 2,000 visiting researchers, professors, and lecturers during the 2018-2019 academic year who came to MIT from 90 different countries.¹² Nobel Laureates' biographies also reveal that such U.S. based work experiences can establish the foundation for Nobel Prize winning work and prolific international collaboration with U.S. based colleagues.

The story of Pääbo's three-year stay in the United States further illustrates this point. Shortly after earning his PhD, Pääbo came to the United States to work as a postdoctoral researcher at U.C. Berkeley from 1987 to 1990, an experience that became foundational to his career development.¹³ It was at U.C. Berkeley that Pääbo conducted research with Allan Charles Wilson, a pioneer in molecular ecology and evolution research and winner of a MacArthur Fellowship.¹⁴ Wilson, himself an immigrant to the United States from New Zealand, became one of Pääbo's most influential mentors.¹⁵ Among the 2022 U.S. based Laureates, Douglas W. Diamond, one of three Laureates in Economic Sciences, has the most notable history of formal affiliation with foreign institutions (see Table 1). As an established researcher, Diamond has collaborated with fellow scientists abroad while working as a Visiting Professor in Hong Kong and Germany.¹⁶

At the same time, it is important to note that international collaboration among scientists also happens in more informal and indirect ways, such as through co-authored publications, a commonly used measure of scholarly collaboration patterns.¹⁷ Among the 2022 Chemistry Nobel Laureates are two American scientists, Carolyn R. Bertozzi and K. Barry Sharpless, with a long-history of co-authoring publications with foreign scientists in Europe and Asia.¹⁸ Similarly, the three 2022 Physics Laureates have actively co-authored with one another, along with other American and foreign scientists abroad. For example, Alain Aspect, a French physicist, and John F. Clauser, an American physicist, collaborated with Anton Zeilinger, an Austrian physicist, by authoring a book chapter for Zeilinger's edited volume, *Quantum [un]speakables, from Bell to Quantum information* (2002).¹⁹

Moreover, Aspect, Clauser, and Zeilinger were awarded the prestigious 2010 Wolf Prize in Physics, in honor of their collaborative scholarly accomplishment: “their conceptual and experimental contributions to the foundations of quantum physics, specifically an increasingly sophisticated series of tests of Bell’s inequalities or extensions thereof using entangled quantum states.”²⁰

Table 1. International Scholarly Collaboration Among Select 2022 Nobel Laureates

Name	Nobel Prize Type	Country of Birth	Significant International Scholarly Collaboration Endeavors
Foreign-Born Winners			
Alain Aspect	Physics	France	Co-authored publications with U.S. based researchers
Svante Pääbo	Physiology or Medicine	Sweden	Post-doctoral researcher at the University of California, at Berkeley; Co-authored publications with U.S. based researchers
Anton Zeilinger	Physics	Austria	Fulbright Fellow at the Massachusetts Institute of Technology (MIT); Associate Professor of Physics at MIT; Summer Research Associate at MIT; Adjunct Professor at Hampshire College; Co-authored publications with U.S. based researchers
Native-Born Winners			
Carolyn R. Bertozzi	Chemistry	United States	Co-authored publications with foreign -born scientists outside of the United States
John F. Clauser	Physics	United States	Co-authored publications with foreign -born scientists outside of the United States
Douglas W. Diamond	Economic Sciences	United States	Visiting Professor at Hong Kong University of Science and Technology; Visiting Professor at the University of Bonn; Visiting Scholar at the Bank of Japan
K. Barry Sharpless	Chemistry	United States	Co-authored publications with foreign -born scientists outside of the United States

Source: IIR Analysis of all Nobel Prize Winners. <https://www.nobelprize.org/prizes/lists/all-nobel-prizes/>

Biographies of Select 2022 Nobel Laureates



Photo Courtesy of Stanford University



Chemistry

Carolyn R. Bertozzi, PhD is the eighth woman to be awarded the Chemistry Prize since 1901.²¹ Like her co-recipients, K. Barry Sharpless and Morten Meldal, she was recognized for her significant contributions to the field of “click chemistry.”²² Her research on mapping biomolecules revolutionized scientists’ ability to detect and analyze molecules in living organisms.²³ Bertozzi’s work has many beneficial applications for treating and diagnosing illnesses. Bertozzi was born on October 10, 1966 in Boston, MA and began studying Chemistry as an undergraduate student at Harvard University. She graduated from Harvard in 1988 and then pursued her doctorate in Chemistry at U.C. Berkeley.

Shortly after obtaining her PhD in 1993, Bertozzi became a faculty member at Berkeley’s College of Chemistry in 1996. Since 2015, she has been working as the Anne T. and Robert M. Bass Professor of Chemistry and Professor of Chemical & Systems Biology and Radiology (by courtesy) at Stanford University, the *Baker Family Director at Sarafan ChEM-H*, and an Investigator of the Howard Hughes Medical Institute. The most recent examples of Bertozzi’s internationally collaborative research outputs include two peer-reviewed journal articles with British scientists affiliated with the University of Oxford and The Francis Crick Institute.²⁴

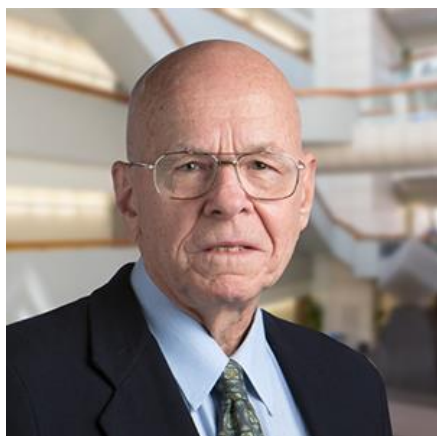


Photo Courtesy of Scripps Research



Chemistry

K. Barry Sharpless, PhD is the fifth two-time Chemistry Nobel Laureate and one of three 2022 Chemistry Laureates. He was born on April 28, 1941 in Philadelphia, PA and earned his PhD from Stanford University in 1968.²⁵ Sharpless currently works as the W.M. Keck Professor of Chemistry at Scripps Research where he directs the Sharpless Lab. He shares the 2022 Chemistry Prize with two other scientists, Carolyn R. Bertozzi of Stanford University, and Morten Meldal of the University of Copenhagen. Sharpless was recognized for his groundbreaking work in the field of click chemistry, which he established in 2000.²⁶ Through his discovery of click chemistry, Sharpless revolutionized the

molecule building process by making it more efficient and cost-effective to link molecules together than ever before.²⁷ Sharpless’ work became the foundation on which Meldal and Bertozzi built their research, independently discovering a chemical reaction (i.e., the copper catalyzed azide-alkyne cycloaddition), deemed as the “crown jewel” of click chemistry.²⁸ Together, these three scientists produced innovative scientific knowledge that is now widely used in pharmaceutical production and mapping DNA. Sharpless is a prolific author and collaborative researcher who regularly publishes together with his international colleagues to discover new frontiers in click chemistry.²⁹

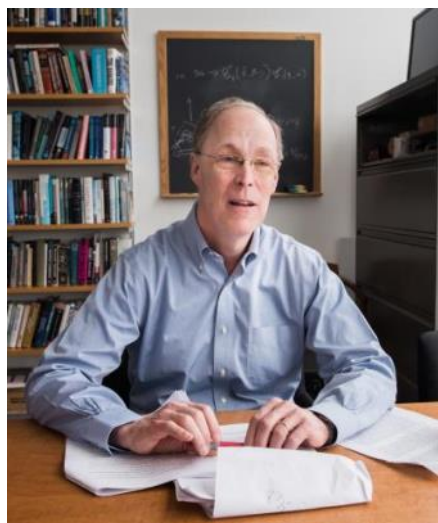


Photo Courtesy of National Bureau of Economic Research



Economic Sciences

Douglas W. Diamond, PhD is one of three recipients of the 2022 Nobel Memorial Prize in Economic Sciences, along with two American economists, Drs. Ben S. Bernanke and Philip H. Dybvig.³⁰ All three 2022 Laureates were awarded for their research on banks and financial crises. Diamond is a native-born U.S. winner who was born in 1953. He has four higher education degrees in economics that he earned between 1975 and 1980; one undergraduate degree from Brown University, as well as two master's degrees (i.e., M.A. and M. Phil.) and a PhD from Yale. He currently works as the Merton H. Miller Distinguished Service Professor of Finance at the University of Chicago. Diamond is regarded as the father of modern banking theory and has spent the past four decades investigating banking behaviors and their consequences. Diamond and

Dybvig together developed a foundational model in banking theory in the 1980s (i.e., the Diamond-Dybvig model), which was published in 1983 in their well-known paper, "Bank Runs, Deposit Insurance, and Liquidity."³¹ Bernanke expanded upon this research by examining banking failures and its societal consequences. Eager to share and expand his knowledge through collaboration with international colleagues, Diamond has worked abroad numerous times as a Visiting Professor at the Hong Kong University of Science and Technology, the University of Bonn, and the Bank of Japan.³²



Photo Courtesy of Hong Kong Institute for Advanced Study



Physics

Alain Aspect, PhD is a renowned French quantum physicist and one of three recipients of the 2022 Physics Prize.³³ Aspect shared the prize with two American and foreign-born physicists, Drs. John Clauser and Anton Zeilinger, respectively. They were honored for their novel experiments with entangled photons and for advancing the field of quantum information science.³⁴ Born on June 15, 1947 in Agen, France, Aspect grew up in France and studied physics from college through graduate school. He earned his master's and PhD from Université d'Orsay. The experiments he conducted as a doctoral student culminated in his dissertation and became the basis of his Nobel Prize-winning work. After finishing his graduate education in 1983, Aspect worked as a scientist and a faculty member at various research institutions, including Collège de France and CNRS. Currently, he works as a Professor at the University of Paris-Saclay.³⁵

Biographies of Select 2022 Nobel Laureates

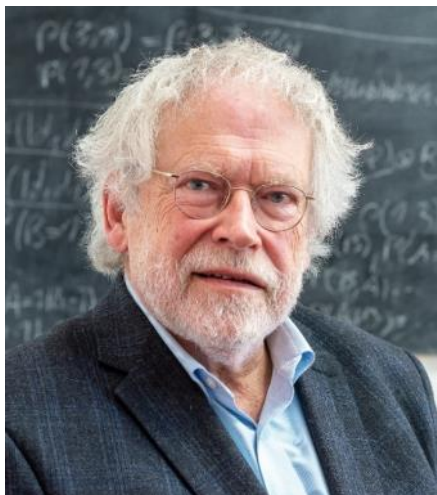


Photo Courtesy of Wikipedia



Physics

Anton Zeilinger, PhD is an Austrian physicist and another recipient of the 2022 Physics Prize.³⁶ Zeilinger was born on May 20, 1945 in the Austrian town of Ried im Innkreis. He moved to the capital city of Vienna to pursue his college and graduate degrees at the University of Vienna from 1963 to 1971. Zeilinger currently works as a physicist at the Austrian Academy of Sciences at its Institute for Quantum Optics and Quantum Information. Zeilinger's biography reveals that international collaboration is deeply embedded in his career development as a Nobel Laureate. For example, some of his most influential professional experiences happened at educational institutions in the United States, including MIT and Hampshire College.³⁷ Notably, Zeilinger has a very robust publication record, with

over 550 publications, many of which are co-authored pieces with U.S. based and other colleagues living across international borders.³⁸



Photo Courtesy of the American Institute of Physics



Physics

John F. Clauser, PhD is an American experimental and theoretical physicist who is among the three co-recipients of the 2022 Physics Prize.³⁹ Like his co-recipients, Drs. Alain Aspect and Anton Zeilinger, he is most known for his contributions to quantum mechanics research. For instance, Clauser's novel experimental studies have formulated a new theory (i.e., Local Realism) and proof for how quantum entanglement works (e.g., 1969 CHSH inequality prediction and the 1972 Freedman-Clauser proof).⁴⁰ Clauser was born on December 1942 in Pasadena, California. It was only after obtaining his B.S. in physics from the California Institute of Technology in 1964 that he left his home state and relocated to New York to pursue his graduate education. Clauser established the foundation for his Nobel-winning research in quantum mechanics as a doctoral student at Columbia University. By 1969, he earned

his PhD in physics from Columbia and then relocated back to California to pursue his scientific career at U.C. Berkeley's reputable Lawrence Berkeley National Laboratory. By 2010, Clauser and the two other 2022 Physics Laureates, were highly accomplished physicists who were internationally recognized for their collaborative work when they were awarded the 2010 Wolf Prize in physics.⁴¹ Today, Clauser continues his innovative research activities through his own company, J.F. Clauser & Associates.



Photo Courtesy Max Planck Institute



Physiology or Medicine

Svante Pääbo, PhD is a Swedish evolutionary biologist and the sole recipient of the 2022 Prize in Physiology or Medicine.⁴² He was born on April 20, 1955 in Stockholm, Sweden and earned his PhD in 1986 at Uppsala University. While conducting his postdoctoral research at U.C. Berkeley from 1987 to 1990, Pääbo began developing his now seminal research on sequencing the DNA of the Neanderthal, an ancient relative of homo sapiens.⁴³ This work eventually motivated the development of a new

scientific discipline called paleogenomics.⁴⁴ In essence, paleogenomics is scientific inquiry about the genetics of extinct human species. As eloquently stated by the Nobel Foundation, Pääbo's "discoveries provide the basis for exploring what makes us uniquely human"⁴⁵ and help answer questions about our origin and unique traits as the human species. Pääbo actively publishes with U.S. based colleagues, while his current, formal professional affiliations further illustrate the wide scope of his international network. He is presently affiliated with the Max Planck Institute for Evolutionary Anthropology, in Leipzig, Germany, as well as with the Okinawa Institute of Science and Technology, in Okinawa, Japan.

CONCLUSION

International scholarly collaboration drives scientific innovations across disciplines and international boundaries. As demonstrated in this report, seven of the 2022 Nobel Laureates' career trajectories have been significantly shaped by such global scholarly exchange. Among current and past foreign-born Laureates, it is further evident that U.S. institutions of higher education are a chief destination of choice for furthering one's graduate education and participating in prestigious international research collaborations. As foreign-born scientists come to work in the United States, they bring with them their scientific talents and contribute in many ways that help U.S. institutions remain competitive and innovative in the global scientific community.



About the Author

Fanni Farago is a PhD student in the Department of Sociology at George Mason University and is a Graduate Research Assistant at the Institute for Immigration Research.

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About the Institute for Immigration Research

The Institute for Immigration Research (IIR) is a multidisciplinary research institute at George Mason University. The IIR's mission is to produce valid, reliable, and objective multidisciplinary research on immigrants and immigration to the United States and to disseminate this information through peer-reviewed academic journals, as well as in print and digital formats that make this research easily accessible to policy-makers, the media, the business community, and the general public. Our faculty affiliates, graduate students, and partners are at the forefront of research examining the economic contributions of all immigrant in the United States. The IIR produces high quality, timely research and analysis intended to promote informed action.

The IIR was founded in 2012 through the generous donation of Ms. Diane Portnoy and is a joint venture with The Immigrant Learning Center, Inc. (ILC) of Malden, Massachusetts.

The IIR is located on the campus of George Mason University in Fairfax, Virginia, outside the nation's capital, Washington, DC. Its strategic location allows the IIR to draw on unparalleled academic, government, and private resources to advance its mission in research, education, and professional opportunities for current and future scholars of immigration studies. Through conferences, workshops, lectures, and other events, the IIR is able to engage in community outreach with one of the most diverse populations in the United States.

Endnotes

¹ This number includes all individuals who have been named a Nobel Laureate for each year that the Prize has been awarded since 1901 to 2022. The number excludes 30 additional Nobel Laureates that have been organizations.

² The Sveriges Riksbank prize in Economic Sciences was established in 1968.

³ Defined as foreign-born individuals who were at a U.S. higher education institution at the time of receiving the Prize. The foreign-born winners may be naturalized U.S. citizens, legal permanent residents, or temporary residents.

⁴ IIR. "Five of the 2021 Nobel Laureates from the United States are Foreign Born." 2021. (https://d101vc9winf8ln.cloudfront.net/documents/41281/original/Nobel_Prize_Summary_2021.pdf?1634227855).

⁵ Since 2010, there were immigrant Nobel Laureates each year but 2012, 2018, and 2020, and 2022.

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⁷ IIR. 2020. "Leading Through Creativity and Innovation: The 2020 Nobel Laureates, MacArthur and Schmidt Science Fellows, and Immigrant Scientists in Search of a COVID-19 Vaccine." (https://d101vc9winf8ln.cloudfront.net/documents/37892/original/Nobel_Prize_Paper_2020_FINAL_12.8.20.pdf?1607459171).

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¹² Ibid.

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