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From Stockholm to West Lafayette: The Life and Legacy of Herbert C. Brown, Purdue's First Nobel Laureate

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By Angus Pinkerton

Abstract:

The Nobel Prize. Alfred Nobel created the prize in 1901, and it has grown into one of the most coveted and awards in most fields of scholarly research. Many consider it to be the most prestigious form of recognition someone can receive for their work, often making it the pinnacle of someone's career.[1] The Nobel Prize is awarded annually in Stockholm, Sweden to researchers who make outstanding contributions to humanity in the fields of chemistry, economics, physics, literature, medicine, and peace. Starting in 1947, Herbert Charles Brown taught and conducted research at Purdue until his death in 2004. Over the course of his long career, he worked on a wide variety of projects within the department of chemistry, focusing primarily on exploring new possibilities in the field of organic chemistry. Many of his discoveries and achievements became common practice for modern day organic chemical education, earning him a plethora of awards. The pinnacle of his career came in 1979 when he won the Nobel Prize for research on using boron in organic synthesis. This recognition made Brown the first active Purdue professor to win the award. The road to Stockholm came with difficulty. His ability to overcome the struggles of his early life eventually led him to Purdue, where he achieved success in teaching and research, shaping his legacy both on campus and in the world of Chemistry. Due to his personal struggles and modesty, Brown's win benefited both himself and the common man.

Before Purdue: Brown's Early Life (1912-1947)

Throughout his entire life, Brown never considered the idea of achieving anything great, which can be seen largely through the humility he demonstrated between himself and his colleagues. Familial and financial struggles during his early life took this idea to a more extreme level, to the point where he never thought he could achieve more than what he did in the moment. While part of his eventual success resulted from him overcoming these struggles within his early life, he received help; time after time, he relied on the advice and motivation of others who saw his potential to take the next step in his early life.

Herbert Charles Brown, born Herbert Charles Brovarnik, was born on May 22, 1912 in London, England to Charles Brovarnik and Pearl Gorenstein. His Ukranian Jewish parents had moved to the United Kingdom prior to his birth hoping to achieve a higher quality of life. He spent the first two years of his life in England before his family moved to Chicago, Illinois in June 1914, where his parents decided to Anglicize their own name. Brown's father had worked in cabinet making prior to moving to America. Unable to find cabinetry work in America, he opened a hardware and carpentry shop.[2] In 1924, at the age of 12, he enrolled in Englewood High School in south side Chicago. His first struggle came at the age of 14, when his father

[1] Hargittai, István. *The Road to Stockholm Nobel Prizes, Science, and Scientists*. Oxford Paperbacks. Oxford: Oxford University Press, 2002.

[2] "Brown, Herbert C. (Herbert Charles), 1912-2004". *Purdue University Library: Archives and Special Collections*. Accessed March 7, 2019 through https://archives.lib.purdue.edu/agents/people/585.

passed away, leaving behind Brown, his mother, and his three sisters. To support his family, Brown dropped out of high school to work in the family's store, hoping to raise enough money to support his family. He worked in the hardware store until 1929, when his mother picked up more hours at the store so that he could return to his education. He graduated a year later in 1930. Keeping his mother and sisters in mind, he unsuccessfully searched for a job.[3] From Brown's perspective, his father's death inhibited him from ever achieving a higher education due to the fact that he felt it was his duty to provide for his family, thus leading him on this search for a job. Brown proved himself innovative during this time while working at a belt packing company. Brown devised such an efficient method to packing belts that he managed to work himself out of a job.[4]

Brown abandoned the job search in 1933. During this time, Brown enrolled at Crane Junior College in downtown Chicago, originally intending to study electrical engineering. However, during his first semester, he took a chemistry course and fell in love with the content, inspiring him to begin studying chemistry. Unfortunately, due to the Depression and lack of funds, Crane was forced to shut down after Brown's first semester there. Luckily for Brown, a former Crane professor, Dr. Nicholas Cheronis, opened Synthetic Labs in his garage where he allowed former students to participate in independent experimental study at little to no cost. Brown started working on experiments at Synthetic Labs. While working in the lab, Brown met Sarah Baylen, another chemistry student and his future wife. During an interview later in her life, she recalled that, when Brown first arrived, she initially detested him due to him having a competitive skill set. After he arrived, she fell into second place in regards of capability. After realizing she couldn't beat him, she decided to join him. She eventually agreed to go on a date with him and they became a couple. When college became more affordable, both Brown and Baylen enrolled in Wright Junior College in 1934. They both graduated in 1935 with associate degrees in Science.

Brown wanted to continue his education but feared he could not afford to receive one. In order to afford college, Brown applied for a full scholarship to the University of Chicago. Brown recieved the scholarship leading Brown and Baylen to enroll at the university. At the time, the University of Chicago allowed students to take additional credits past a full schedule at no additional cost. Brown took full advantage of this, taking 2 years' worth of classes in just 3 quarters, allowing him to graduate in 1936. Baylen bought The Hydrides of Born and Silicon by Alfred Stock as a graduation present. Brown later stated the book helped inspire his Nobel Prize winning research. From the book, he learned that only two laboratories in the world synthesized boron hydrides: Stock's lab at the University of Karlsruhe and Schlesinger's lab at the University of Chicago.[5]

Once again, after graduating, Brown had no intention of ever receiving higher education or pursuing academia. Brown wanted to find a job in the industrial sector so he could afford to marry Baylen. However, Julius Stieglitz, a famous organic chemist and professor at the University of Chicago, convinced Brown to pursue academia and chemic research.[3] After discussing the matter with Baylen, who agreed with Stieglitz, Brown enrolled in the doctoral

[3] Brown, Herbert C. (Herbert Charles), interviewed by James J. Bohning in Purdue University on November 11, 1994. Philadelphia: Science History Institute, n.d. Oral History Transcript 0117. Accessed March 7, 2019 through https://digital.sciencehistory.org/works/k643b2174.

[4] The Exponent, December 11, 1979, Purdue University Archives and Special Collections, Purdue University Libraries.

[5] Negishi, Ei-Ichi. "A Biographical Memoir of Herbert Charles Brown, 1912-2004." *National Academy of Sciences.* Accessed through http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/brown-herbert-c.pdf

program at the University of Chicago. Baylen had graduated and worked as a medical chemist at Billings Hospital at the University of Chicago to help fund his studies.[6] Brown and Baylen secretly married on February 6, 1937.

In 1938, Brown graduated with a PhD in chemistry from the University of Chicago. His thesis discussed the reaction of diborane and ketones[7]. After graduation, Brown went job hunting. Morris Kharasch at the University of Chicago offered him a job researching different topics, including chlorine based free-radical reactions. A year later, Herman Irving Schlesinger, whom Stock referenced in his book, offered Brown a research assistant position. While working with Schlesinger, Brown started his Nobel prize-winning research, focusing on the synthesis of lithium and sodium borohydrides. He also worked with uranium borohydrides, which the Manhattan Project used in the process of uranium enrichment. In 1943, Kharasch's former mentor, Neil Gordon, offered Brown the position of assistant professor at Wayne University in Detroit. He accepted the position, eventually becoming an associate professor in 1946. During his time at Wayne, Brown and his wife had their first and only child, Charles Alan Brown, who, like his father, eventually pursued a career in chemistry. While at Wayne, Brown's focused largely on empirical research to explain steric effects in organic chemistry[8].

Coming to Purdue: Campus when Brown Arrived

In 1947, Purdue University's Head of the Chemistry Department, Henry B. Hass, offered Brown a position. Brown accepted the offer with some initial hesitation. He didn't want to leave Wayne University, where he helped develop the chemistry department. When he had first arrived, Wayne only had a master's program. The university added a doctoral program in 1945 following an increase in enrollment following World War II. He also helped develop the chemistry research program there, helping others receive funding, aid, or assistance from outside sources. Despite the improvements he helped to implement at Wayne, Brown moved to Purdue, noting "what a lovely little community [West Lafayette] was, without the problems of the large city"[9] and believing he could better raise his family there. Purdue also interested Brown with the Chemistry department's rapid growth and famous researchers. He stayed at Purdue because the school had a strong academic atmosphere he missed from his days at the University of Chicago. Brown also preferred West Lafayette's smaller size, rather than the large cities that housed University of Chicago and Wayne University.[10]

Before Brown came to Purdue, the Chemistry Department had established a strong reputation due to its contributions to the war effort. During the war, the chemistry department conducted research on cures for malaria and uranium processing. During the war, the federal government helped fund research. During the war, major government projects, like the Manhattan Project, used research conducted at Purdue. Much of the academic community held

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[6] "Herbert C. Brown – Biographical." *NobelPrize.org. Nobel Media AB 2019.* Accessed March 7, 2019 through https://www.nobelprize.org/prizes/chemistry/1979/brown/biographical/

[7] Brown H. C. "Herbert Brown (1980) - Organoboranes - The Modern Miracle." *Council for the Lindau Nobel Laureates Meetings.* Accessed March 7, 2019 through https://www.mediatheque.lindau-nobel.org/videos/31494/organoboranes-the-modern-miracle-1980/meeting-1980

[8] Negishi, 2005.

[9] "Herbert C. Brown Interview", MSO2i004_001_brown, MSO 2, Purdue Office of Publications Oral History Program Collection, Purdue University Archives and Special Collections Research.

[10] Sequel- Purdue University, School of Science Newspaper, Issue 4, January 1980, Box 4, Herbert C. Brown Papers 1928-2005, Purdue University Archives and Special Collections, Purdue University Libraries.

poor sentiments towards Purdue, opposing their involvement with commercial research. During the war effort, Purdue prioritized research in chlorination, the addition of chlorine to another molecule.[11]

Some researchers at Purdue at the time worked with organic synthesis, similar to the research Brown had conducted. Henry B. Hass conducted research on the chlorination of hydrocarbons, the nitration of paraffins, and the preparation of fluorocarbons for use in the production of enriched uranium. His research had a wide variety of effects, ranging from the production of commercial products to assist in the development of the atomic bomb. Earl T. McBee, who studied under Hass in the 1930s and succeeded Hass as chair two years after Brown joined in 1949, worked on the development and synthesis of halogenated hydrocarbons, like fluorocarbons, which led to the development of higher quality refrigerants, pesticides, and anesthetics[12].

Brown received his position in 1947, only two years after Purdue had appointed new president, Frederick L. Hovde. Hovde worked in chemical engineering and education prior to his presidency. During Hovde's administration, which lasted until 1971, Purdue oversaw the largest growth in school history, quintupling the number of enrolled students. Hovde also helped Purdue obtain a "modern" reputation, providing funds and resources for extensive research[13]. Hovde also helped influence Brown's decision to come to Purdue through visions of expanding the Chemistry department.

When Brown first arrived in 1947, Purdue had a small but growing chemistry department. This interested Brown, who believed the department's size made it easier for him to conduct research. The small department did not offer specializations, only general chemistry degrees.[14] Upon Brown's retirement in 1978, the department had grown to include just under a dozen chemistry specializations, including general chemistry, organic chemistry, inorganic chemistry, and biochemistry[15]. The first major point of expansion after Brown's arrival occurred in 1950 when the Indiana General Assembly approved the construction and expansion of the chemistry laboratory on Purdue's campus. The laboratory, originally built in 1928, did not have enough space to accommodate the growing department. In 1955, construction on the laboratory finished. The university dedicated the building to Richard Benbridge Wetherill, a former student, a former College of Pharmacy lecturer, and a donor to Purdue[16].

Being a Professor: Brown's Life at Purdue (1947-1979)

During his time at Purdue, Brown became a respected faculty member and researcher. He worked actively at Purdue for a third of his life and spent the rest of his time in West Lafayette.

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[11] "Earl T. McBee Interview", MSO2i025_001_mcbee, MSO 2, Purdue Office of Oral History Program Collection, Purdue University Archives and Special Collections Research Center, Purdue University Libraries, Accessed March 7, 2019 through http://earchives.lib.purdue.edu/cdm/compoundobject/collection/mso2/id/5485/rec/17

[12] "Purdue Chemistry- A Brief History." *Purdue University Department of Chemistry*. Accessed March 7, 2019 through https://www.chem.purdue.edu/about_us/history.php

[13] "Purdue Past Presidents: Frederick L. Hovde." *Purdue University.* Accessed March 7, 2019 through https://www.purdue.edu/purdue/about/presidents.php

[14] Purdue University Course Catalog, 1947-1948, Purdue University Archives and Special Collections, Purdue University Libraries.

[15] Purdue University Course Catalog, 1978-1979, Purdue University Archives and Special Collections, Purdue University Libraries.

[16] "Purdue Chemistry- A Brief History"

He never aimed to win awards, rather conducting research for his love of the subject. Brown experienced struggles with the University, but generally experienced success, earning promotions, awards, and, ultimately, the Nobel Prize.

Brown initially held the position of Professor of Organic Chemistry. He held interests outside of his specialization, including inorganic and physical chemistry. Despite other interests, Brown continued to pursue organic chemistry. His research focused on the role of boronates and other compounds in organic synthesis. His work had roots in his work with Schlesinger in Chicago. Aside from boron-related projects, Brown also researched steric effects, steric strains, non-classical ions, aromatic hydrocarbons, aromatic substitution, and electrophilic substitution constants.[17]

Brown's professorship required him to teach classes in addition to his research. Brown taught multiple undergraduate courses from 1949 to 1951, all of which contained similar subject material. In his early years, Brown taught courses including *CHM 140: Inorganic Lab Tech, CHM 141-142: Advanced Inorganic Chemistry, CHM 245-246: Inorganic Chemistry Preparation*, and *CHM 257: Reaction Mechanics*. Brown's work with undergraduate teaching stopped around the start of the 1960s, following a series of promotions. Although he no longer taught, Brown supervised graduate students and conducted his own research[18].

Brown remained at Purdue until 2004, when he passed away following a heart attack. Brown received numerous promotions over his career. In 1956, while doing research with Bookinkere Channakeshavaiah Subba Rao, a post-doctorate graduate student in Brown's research group, Brown discovered a method of synthesizing organoboranes from unsaturated organic molecules through hydroboration. This publication served a key role when the Nobel committee decided to award Brown the prize[19]. In 1959, Purdue named Brown the Wetherill Distinguished Professor. One year later, in 1960, Brown received the title of Wetherill Research Professor. Around this time, Brown stopped teaching undergraduate courses and focused primarily on research. Perhaps due to the added responsibility, perhaps due to his disinterest, or perhaps due to his own humbleness, Brown never achieved the title of head of the chemistry department. In 1978, Brown retired, taking on the title of Wetherill Research Professor Emeritus, allowing him to continue research at the University. He only worked with post-doctoral student and received no salary for this work.

During the 57 years he conducted research at Purdue, Brown saw numerous department changes. He worked under 10 different department heads and 4 different Purdue presidents.[20] Over the course of his career at Purdue, Brown contributed to 1,266 scientific publications, wrote 7 books, and received with 14 honorary doctorates, one of which came from his alma mater, the University of Chicago. While working full time at Purdue, Brown also received a large number of awards and achievements from various societies and organizations. In 1960, the American Chemical Society presented him the Award for Creative Work in Synthetic Organic Chemistry,

[17] "Rembering HCB" 1987, Box 7, Herbert C. Brown Papers 1928-2005, Purdue University Archives and Special Collections, Purdue University Libraries.
[18] Purdue University Course Catalog, 1959-1960, Purdue University Archives and Special Collections, Purdue University Libraries.
[19] "Purdue Chemistry- A Brief History"
[20] "Department Heads." *Purdue University Department of Chemistry.* Accessed March 7, 2019 through https://www.chem.purdue.edu/about_us/heads.php

which recognizes and encourages creative work in synthetic organic chemistry[21]. In 1969, he became the first Purdue professor to receive the National Medal of Science from the National Science Foundation. Only one other Purdue professor has won the National Medal of Science; Albert W. Overhauser won the prize for physics in 1994.[22]

Despite the positive aspects of his career, Brown experienced some struggles. During an interview with Robert B. Eckles, who worked in the history department and helped maintain the Purdue archives, Brown admitted that, while Purdue did provide him with the necessary resources and students he needed to conduct his research, he rarely received adequate funding. In order to get the funding he needed, Brown and his students often applied for grants from various outside agencies. Brown received grants from numerous agencies, including the National Science Foundation, the National Institutes of Health, and the Army Research Office[23].

During his earlier years, Brown also struggled with Purdue over the rights to his own intellectual property. Before Brown arrived, Purdue had recently set up the Purdue Research Foundation, an industrially-funded sector dedicated to intellectual research. When Brown first came to Purdue, the Purdue Research Foundation claimed the rights to any intellectual discoveries made at the University, including patents. The policy still exists, with a few exceptions. Brown learned of this policy when he came to Purdue, and, while he had issues with it, he did not fight the policy in order to avoid conflict. This policy posed the biggest issue when Brown filed a patent for sodium borohydride. Under the policy of his contract, the patent belonged to the Purdue Research Foundation[24]. In 1960, he received an offer from the University of Wisconsin and their research foundation. Wisconsin promised him the ability to reclaim his patents and the ownership of any future patents. Brown strongly considered the offer, wanting to reclaim his intellectual property. Upon hearing this, President Hovde approached the Board of Trustees and asked them to rewrite Brown's contract so that he could retain the rights to his own intellectual property. The Board unanimously agreed and, during this same meeting, promoted Brown to Wetherill Research Professor.[25]

Organometallic Compounds in Organic Synthesis: Brown's Nobel Prize-Winning Idea

In 1978, Brown retired from his professor role, taking on the title of professor emeritus. Brown still conducted research at the university, staying mostly on the third floor of Wetherill Hall. He also spent time doing consultations with research and development teams in the industrial sector. He consulted for multiple companies, much of which operated the fuel industry, the plastics industry, or the pharmaceutical industry.

On October 15, 1979 at 9:30 AM, during a consultation with the ExxonMobil research and development labs in Linden, New Jersey, Brown received a phone call from AM 560 WIND in Chicago to inform and congratulate him on splitting the 1979 Nobel Prize in Chemistry. The

[21] "ACS Award of Creative Work in Synthetic Organic Chemistry." *American Chemical Society.* Accessed March 7, 2019 through https://www.acs.org/content/acs/en/funding-and-awards/awards/national/bytopic/acs-award-for-creative-work-in-synthetic-organic-chemistry.html

[22] "The President's National Medal of Science." *National Science Foundation.* Accessed March 7, 2019 through https://www.nsf.gov/od/nms/results.jsp

[23] "Herbert C. Brown Interview"

[24] Brown, Herbert C. (Herbert Charles).

[25] "Board of Trustees minutes, 1960 June 04" BOTM19600604, Board of Trustees Minutes, Purdue University Archives and Special Collections Research Center, Purdue University Libraries, Accessed March 7, 2019 through http://earchives.lib.purdue.edu/cdm/compoundobject/collection/bot/id/13754/rec/2

news surprised Brown, who did not believe he had done anything significant to merit winning the Nobel Prize. His wife, Sarah Baylen, had the opposite reaction to hearing the news. She had always believed he would win the prize at some point in his life, inscribing "To a Future Nobel Laureate" in his college yearbook when he graduated in 1936.[6]

Brown split the prize with Georg Wittig, a chemistry professor at the University of Heidelberg in Germany "for their development of the use of boron- and phosphorus-containing compounds, respectively, into important reagents in organic synthesis." Their work introduced a new class of chemical compounds named organoboranes, which "can be used for reductions, rearrangements, and additions & have opened up a range of new possibilities for carbon-linking atoms to each other.[6]" Brown's hydroboration reaction gained significance in the field of chemistry because the reaction violated the Markovnikov Rule, which states that "when an unsymmetrical alkene reacts with a hydrogen halide, the hydrogen adds to the carbon of the alkene that has the greater number of hydrogen substituents, and the halogen to the carbon of the alkene with the fewer number of hydrogen substituents."[26] Brown's hydroboration reaction causes the opposite, since the hydrogen attaches to carbon with the greater number of substituents and the boron attaches to the carbon with less substituents.[27] This development rocked the world of chemistry since almost no other reaction like it had been seen before. Additionally, the fact the development came from a Midwest school drew interest.

The compounds they developed had a wide variety of uses and had profound impacts on the industries that utilize them. The medical field used Brown's hydroboron compounds in birth control, hormone control, pheromones, and other treatments. The compound also found use in the creation of certain autoimmune disease-treating steroids. The field of agriculture used the compound in two distinct ways: to increase mating through the manipulation of hormones and the creation of insecticides. Hydroboration had huge environmental benefits for the paper industry. Before Brown's discovery, paper waste treatment required harmful chemicals that included metals like zinc. These facilities could use Brown's compounds to treat waste, causing less damage to the environment.[28]

Purdue University widely celebrated Brown's nomination. The day after Brown discovered he won, the Exponent ran a special report on Brown, highlighting his time at Purdue and career accomplishments. Interestingly, the columnist wrote that Brown's most well-known work was his work with steric strains, not his work in hydroboration. This came from Brown establishing himself at Wayne State through steric strain research. Prior to this article, Brown rarely appeared in the Exponent. He first appeared in the publication in 1950, when a recurring article called "With the Faculty" interviewed him.[29]

Brown received the Nobel Prize on December 8th, 1979 in Stockholm Sweden. While his speech largely focused on his work, he briefly allowed his personality to shine through during a few moments. In his introduction, he joked that while he had won the academic prize, his wife had won the financial prize for all she had done at home and with their son. While discussing his

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[26] Hunt, Ian. "Markinov's Rule." *University of Calgary Department of Chemistry.* Accessed March 7, 2019 through http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch06/ch6-4-1.html

[27]Torres, Gilbert. "Hydroboration-Oxidation of Alkenes." *UC Davis Library.* Accessed March 7, 2019 through https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Alkenes/Reactivity_of_Alkenes/Hydroboration-Oxidation_of_Alkenes

[28] Brown, Herbert C., and Purdue University. Dept. of Chemistry. Herbert C. Brown : A Life in Chemistry. West Lafayette, Ind.: Department of Chemistry, Purdue University, 1980.

[29] The Exponent, May 10, 1950, Purdue University Archives and Special Collections, Purdue University Libraries

wife, he also touched on the fact that his entire Nobel Prize-winning research started with "the most economical book ($2.06) in the University of Chicago bookstore." A quote he made about his views of organic chemistry when he received his first PhD best demonstrated his character. He called the discipline a "relatively mature science, with essentially all of the important reactions and structures known," and that future work could only pertain to better understand reaction mechanism and improve reaction products. He turned this into a lesson of hope for future chemists. Brown believed that he never thought his work could result in a Nobel prize, but he did. He also believed that future chemists had plenty to discover.[30]

Upon his return to campus, a large party welcomed Brown home. Purdue President Arthur G. Hansen personally welcomed brown back, and the Purdue Glee Club presented him with a musical welcome. Congratulatory notes from a wide range of people and organizations flooded into his office. Students, staff, and faculty, even ones he did not know personally, stopped by his office just to congratulate him.[31]

Media outlets all over the United States covered Brown, but in very different ways. Purdue papers, including the campus-wide Exponent and the college of science Sequel, tended to focus on Brown himself. These sources often discussed Brown in a biographical sense, focusing on his life and research and talked about how much Brown's award meant to Purdue[32]. Local papers, primarily the Lafayette Journal & Courier, did similar pieces, but tended to focus more on Purdue and what the prize meant for the university. The October 20th edition of the paper discussed Brown winning the prize in an article entitled *Nobel Prize Helps Purdue's Scientific Prestige*. When commenting on Brown winning the prize, the graduate school dean and vice president of research for the Purdue college of science, Frederick Andrews, said that Brown would have won the prize wherever he conducted the research. Andrews went on to call Brown a "real, honest-to-God Purdue professor" due to the extensive time Brown lived and researched at Purdue[33]. When national papers, including the New York Times, discussed Brown winning the prize, they placed a much heavier emphasis on the prize itself. The New York Times wrote about both Brown and Glashow, the winner of the 1979 Nobel Prize in physics, in the same article. While they touched on Brown's work and how it related to Georg Wittig's, They placed heavier emphasis on Brown's research and backstory[34].

Brown's Prize: A Prize for Purdue and the Common Man

When Brown won the Prize in 1979, he became the first actively working Purdue professor to win a Nobel Prize. The significance of his prize was best summarized by William Dale Margerum, the head of the chemistry department at the time, who stated in the Exponent

[30] Brown, Herbert C. (Herbert Charles). *From Little Acorns to Tall Oaks- From Boranes to Organoboranes*. Accessed March 7, 2019 through http://www.chem.purdue.edu/hcbrown/nobel.pdfp
[31] Sequel- Purdue University, 1980
[32] The Exponent, October 16, 1979, Purdue University Archives and Special Collections, Purdue University Libraries.
[33] Journal and Courier, Volume 60, Number 288, October 20, 1979, Box 62, Folder N, Herbert C. Brown Papers 1928-2005, Purdue University Archives and Special Collections, Purdue University Libraries.
[34] Browne, Maclom W. "Americans at Harvard and Purdue Win- German and Pakistani Cited," *The New York Times*, October 16, 1979, accessed March 7, 2019 through https://www.nytimes.com/1979/10/16/archives/americans-at-harvard-and-purdue-win-german-and-pakistani-cited-aid.html

that Brown winning the prize "showed that the [Nobel] Prize could be won [at Purdue]."[35] Brown's prize also belonged to Purdue. He spent over half of his life at Purdue, which had provided him with almost all of the necessary resources with little trouble over the years. The only other Purdue professor who had won the prize up until then was Julian Schwinger in 1965, who was an associate professor at Purdue during the 1940s, where he spent much of his time absent working on projects at MIT and the University of Chicago. Schwinger had left Purdue in 1943, only a few years after he had arrived, to take a position at MIT.[36] Unlike Schwinger, who left when given the opportunity, Brown stayed at Purdue and made a life in West Lafayette, despite the other offers he received. Brown also won the prize while actively conducting research at Purdue, strengthening the idea that prize also belonged to Purdue. After Brown won the prize, Purdue could say that it had a Nobel-prize winning department, which they still use today when discussing the chemistry department.[37] When Ei-ichi Negishi won the prize in 2010, Purdue rose in the U.S. News college rankings from 62 to 56.[38] Although Brown received the prize and funds that came with it, the win brought Purdue huge attention. After 110 years, Purdue could finally claim a Nobel laureate. 10 years before Brown's win, Neil Armstrong's first steps on the moon strengthened the practical engineering department. Brown's win strengthened their scientific research base. From a school founded on the ideas of technology and agriculture came an entirely new field of chemistry that researchers still build upon and research to this day.

Brown's Nobel Prize win also provided a win for the common man. Academia has always held Purdue in high regards, but not to the extent given to MIT, Harvard, or the University of Chicago.Year after year, Purdue has ranked below these universities in an overall ranking system.[39] The 1979 Nobel Prizes in Science saw recipients from Oxford, Harvard, the University of Chicago, Princeton, Tufts, and the Central Research Laboratory of London.[40]During the 1970s, the Nobel Prize in Chemistry saw recipients from organizations and universities considered more prestigious than Purdue including the Institute for Biochemical Research in Buenos Aires, the National Research Center of Canada, the National Institute of Health, Rockefeller University, the Technical University of Munich, the Imperial College of London, Stanford University, the University of Sussex, Milstead Laboratory of Chemical Enzymology, ETH Zurich, Harvard University, the Free University of Brussels, University of Texas at Austin, and Glynn Research Laboratory. Many of these institutions receive renown for performing at the peak level in research and knowledge. Brown's win for Purdue, a midwestern school surrounded by farmland, symbolized a victory for the common man.

Brown's ability to win the Nobel Prize represents the American Dream in its finest form. He came from an impoverished, immigrant family and never aimed to win anything with such high renown. He struggled growing up, lacking confidence in his ability to achieve greatness. He grew up during one of the worst economic downturns in the history of the world and still

[35] The Exponent, December 11, 1979.
[36] "Julian Seymour Schwinger: Honorary Degree Recipient." *Purdue University Department of Physics and Astronomy.* Accessed March 7, 2019 through http://www.physics.purdue.edu/alumni/hondegree/schwinger.html
[37] "About Us." *Purdue University Department of Chemistry.* Accessed March 7, 2019 through https://www.chem.purdue.edu/about_us
[38] "U.S. News National University Rankings, 2008-2015" *Public University Honors.* Accessed March 7, 2019 through https://publicuniversityhonors.com/2015/06/13/u-s-news-national-university-rankings-2008-present/
[39] "National University Rankings." *U.S. News and World Report.* Accessed March 7, 2019 through https://www.usnews.com/best-colleges/rankings/national-universities.
[40] "All Nobel Prizes." *The Nobel Foundation.* Accessed March 7, 2019 through https://www.nobelprize.org/prizes/lists/all-nobel-prizes/

overcame the challenge to win one of the most prestigious awards to have ever existed. His persistence and determination eventually led him to Stockholm, where he received the Nobel Prize. Brown achieved the American Dream so many people sought. Brown's accomplishment solidified this dream, granting hope and inspiration to others.

Life after Purdue: Brown's Legacy at Purdue and Beyond

After winning the prize, Brown returned to his home in the Hills and Dales historic neighborhood in West Lafayette, where he spent the rest of his life with his college sweetheart, Anne Baylen. He continued doing research at Purdue, working on topics including steric strains and the nonclassical ion problem. In 1981, he received the American Chemical Society's Priestly Medal, one of the ACS's most prestigious medals, recognizing distinguished service to chemistry. In 1984, Purdue dedicated an annual series of lectures to him, titling these lectures the Herbert C. Brown Lectures in Organic Chemistry[41]. In 1987, Purdue renamed a chemistry lab to the Herbert C. Brown Laboratory of Chemistry, which still stands today[42]. In 1997, the American Chemical Society awarded him with the inaugural Herbert C. Brown Award for Creative Research in Synthetic Methods, which the organization uses to "recognize & encourage outstanding and creative contributions to research in synthetic methods.[43]" On December 19, 2004, Brown passed away from a heart attack. His wife followed shortly after on May 29, 2005. Shortly after his death, the Purdue University Library Archives and Special Collections received a donation of items from his office, establishing the Herbert C. Brown Collection.

While much of Brown's legacy came resulted of his own actions, some of his students played a role in keeping it alive. When Brown still worked full-time at Purdue, he supervised hundreds of graduate students and postdoctoral students on their research. His wife joked that even if he forgot their names, Brown always remembered where they went after they left his lab and what they worked on in his lab. During the 1960s, he supervised two post-doctoral students named Akira Suzuki and Ei-Ichi Negishi. Inspired by Brown's book *Hydroboration*, Suzuki moved to Purdue to study under Brown as a post-doctoral student in 1963, working largely on helping further develop the recently discovered process. Suzuki left Brown's lab in 1965 to take a position at Hokkaido University in Tokyo, Japan, where he continued to study the creations and use of organometallic reactions[44]. Wanting to explore organometallic chemistry and its relation to organic synthesis, Negishi joined Brown's group as a postdoctoral associate in 1966; he remained in the position until 1968 when he earned the promotion of Brown's assistant, where he stayed until 1972. During his time with Brown, he examined the role of d-block transition metals as catalysts in organometallic chemistry. He left Purdue in 1972 to take an assistant professor job at Syracuse University, where he stayed until returning to Purdue in 1979 to take a

[41] Brown, Herbert C., and Purdue University. Dept. of Chemistry. Herbert C. Brown Lectures in Organic Chemistry., 1984.

[42] The Exponent, April 6, 1987, Purdue University Archives and Special Collections, Purdue University Libraries.
[43] "Herbert C. Brown Award for Creative Research in Synthetic Methods." *American Chemical Society.* Accessed March 7, 2019 https://www.acs.org/content/acs/en/funding-and-awards/awards/national/bytopic/herbert-c-brown-award-for-creative-research-in-synthetic-methods.html
[44] "Akira Suzuki– Biographical." *NobelPrize.org. Nobel Media AB 2019.* Accessed March 7, 2019 through https://www.nobelprize.org/prizes/chemistry/2010/suzuki/biographical/

full-time professor job, the same year Brown won the prize[45]. Negishi has stayed at Purdue since then, but recently reduced involvement due to health issues. In 2010, these two followed in Brown's footsteps, winning the Nobel prize in chemistry for "palladium-catalyzed cross couplings in organic synthesis." Their prize-winning idea synthesizes chemicals that find use in medicine, agriculture, and electronics.

Conclusion

When Brown won the Nobel Prize in 1979, he solidified his name in world history. Today, introductory organic chemistry classes and various parts of the industrial sector teach and use his methods. Looking back on his accomplishments, Brown's discovery of hydroboration remains amongst the most important discoveries in the field of organic chemistry. Forty years after he won the Nobel Prize, his legacy still survives amongst those who study his work. On Purdue's campus, other accomplishments, particularly those in the field of engineering, have shrouded over Brown's legacy. Perhaps this fits Brown's personality better. Brown lived a humble life, never seeking glory or recognition. Brown's legacy lives on through his ideas and students. His accomplishments have allowed him to cement his name in Purdue, chemistry, and world history. While Purdue's other accomplishments cloak Brown's successes, he remains the first Boilermaker to win the Nobel prize, not just for himself, but for Purdue and the common man.

[45] "Ei-Ichi Negishi – Biographical." *NobelPrize.org. Nobel Media AB 2019.* Accessed March 7, 2019 through https://www.nobelprize.org/prizes/chemistry/2010/negishi/biographical/

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