# EDA BACHMAN WALDEN: WHAT WERE HER CONTRIBUTIONS?

Anne M. Wilson, Butler University, Department of Chemistry & Biochemistry
Indianapolis, IN 46208; amwilson@butler.edu

## Abstract

One of the first women to graduate with an undergraduate chemistry degree from Butler University was Eda (Bachman) Walden. While her career as a scientist was brief, there is evidence that she was a talented researcher who may have contributed to the production of insulin. Her path as a researcher and scientist are presented here.

## Background

In the late 1800s and early 1900s, few women earned undergraduate degrees in the sciences, especially chemistry (1). In addition, smaller academic institutions awarded general BS or BA degrees, rather than stand-alone degrees in disciplinary subject areas. The first documented woman in the United States to earn an undergraduate degree in chemistry was Ellen Swallow Richards from Vassar in 1870, and she went on to teach at MIT (2). Richards was directly responsible for at least eight more women publishing research work and five of them earning undergraduate degrees from MIT (3). Many of the women listed in Creese's text either earned generalized BS degrees, degrees in allied fields (pharmacy, biology), or studied chemistry in Europe.

Indiana schools founded before the year 1900 also followed these national norms. State-sponsored institutions, like science-oriented Purdue University (founded in 1869) awarded its first chemistry degrees in 1875 (4). Purdue has the distinction of first female undergraduate chemistry major in the state of Indiana, Martha Doan, in 1891 (5). The flagship state school, Indiana University (founded in 1820), did not award chemistry degrees until 1890 (6), and there are no records of the first woman to receive one. Other state-sponsored schools did not award chemistry degrees until recently, like Indiana State University (founded in 1865), which was the state teachers' college, and Vincennes University (founded in 1801), which was rechartered in 1889 as a two-year institution. Large private institutions such as the University of Notre Dame (founded in 1842) established the College of Science in 1865 with chemistry degrees awarded two years later (7), but it did not become co-educational until 1972, which finally allowed women the opportunity to earn science degrees (8).

Several smaller Indiana schools may also have had early women science graduates as many of them were founded as coeducational institutions. DePauw University (founded in 1837) became coeducational in 1867, and defined the courses required to earn a chemistry degree in 1896 (9). Earlham College (founded in 1847) was the second school in Indiana to be founded as coeducational (10). Franklin College (founded in 1834) was the second school in the country, and the first in Indiana, to be founded as a coeducational institution behind Oberlin College, Ohio (founded in 1833) (11). Huntington University (founded in 1897), was also coeducational, and it highlighted applied sciences in its early curriculum (12). St. Mary's College (founded in 1844) and St. Mary-of-the-Woods College (founded in 1840) were

both all-women schools, but early records indicate that physical sciences were not part of the curriculum (13, 14). Taylor University (founded in 1846) had a medical school for a time. Alice Hamilton, the first female faculty member at Harvard University, took courses at Taylor's medical school, but did not graduate from there (15). The University of Evansville (founded in 1854) was the fifth coeducational college in the US (16). Valparaiso University (founded in 1859), also founded as a coeducational institution, was well regarded for engineering and medicine (17). While these schools clearly had women in their programs, there is not substantive evidence for women graduating from their programs with science degrees in the late 1800s to early 1900s.

Other Indiana institutions founded before 1900 were unlikely to have had female chemistry graduates during this time period. Some of these schools identified as teachers' colleges (Marian University, Trine University, and the University of St. Francis). One school identified as a bible college (Manchester University). One school presently has sciences as minors (Oakland City University). One identified as an agricultural institution (Goshen College). Three institutions were all-male at that time: Hanover College, Wabash College, and Rose-Hulman Institute of Technology. In addition, Rose-Hulman offered a degree in chemical engineering, but did not award its first undergraduate chemistry degree until 1958 (18).

Butler University (founded in 1855) was the third school in Indiana to be founded as a coeducational institution. Butler began to see declarations of majors on academic transcripts starting in 1910, rather than a BA through the "general course," the "general course 2" (which was more science heavy), or the "premed course" (which included more biology) (19). Butler University's first official chemistry major, Newton Clarence Browder, graduated in 1916, though most of his classmates were awarded the general BA degree (20).

Any student that entered Butler after June 15, 1917, was required to declare an academic major (21). Chemistry majors, both men and women, appeared regularly amongst the graduating seniors from this point forward. Eda Bachman was the first woman to graduate from Butler with a BA in chemistry in 1918 (20).

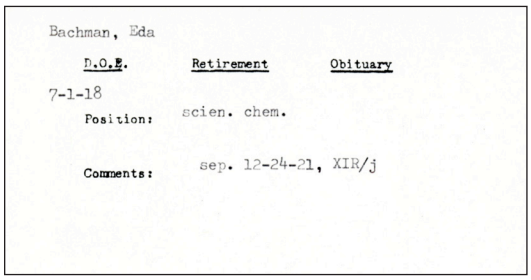
## Early Life

Eda Bachman was born on January 3, 1897, in Indianapolis, Indiana, to German immigrant Valentine Bachman and Carolina "Lina" von Königslöw of Cleveland, Ohio. Valentine was a miller by trade and by 1910 he owned a residence in Woodruff Place (22), an Indianapolis neighborhood of Victorian homes (23). Eda was the youngest of four daughters (Elsa, Irma, and Charlotte). The Bachmans engaged in local social events, with Eda and Charlotte participating as milkmaid dancers in May Day festivities (24). Elsa had a degree in jewelry making from Pratt Institute (25). Irma, Charlotte, and Eda all attended Butler College, which became Butler University. Irma and Charlotte went on to become teachers (26). Eda enrolled at Butler in the fall of 1914 and pledged the Kappa Alpha Theta sorority (Figure 1) (27). In 1918, she graduated with highest honors, and was the first woman to earn a degree in chemistry from Butler University.

***Figure 1****. Eda Bachman's Pledge Photo (courtesy of the Kappa Alpha Theta archives).*

## Worklife

Soon after graduation, in July of 1918, Eda was hired by Indianapolis-based Eli Lilly & Co. as a research chemist (Figure 2). This hire date indicates that she would have been the first female research scientist to be hired by Lilly. This was not unique to the chemical industry as many companies were hiring women scientists in 1917 and 1918 (28). Eda worked under the prominent research scientist, Dr. George Henry Alexander Clowes (29). Clowes was the first Research Director at Eli Lilly & Co. Her employment card also indicates that she was "separated" from Lilly in December 1921. She married coworker and fellow chemist, George Walden, on January 11, 1922. It was common at that time (and later) for women to stay at home once they were married.


Bachman, Eda

D.O.E. Retirement Obituary

7-1-18

Position: scien. chem.

Comments: sep. 12-24-21, XIR/j

***Figure 2**. Eda Bachman's employment card (courtesy of Eli Lilly & Co. archives).*

In addition to his employment and research at Lilly, Clowes had an arrangement that he would conduct research at Woods Hole (Massachusetts), the scientific center now known as the Woods Hole Oceanographic Institution, during the summer months. Several members of his Lilly research team joined him during the summer, including Eda for the summers of 1920, 1921, 1922, 1924, and 1925 (30). During this time, she and Clowes published research on sea urchins (31). Notably, Eda is listed as either a chemist or research chemist with Eli Lilly & Co. for the summers of 1922, 1924, and 1925—after her separation from the company.

***Figure 3.** Eda at work (courtesy of the Walden family).*

## Insulin

The discovery, purification, and the US distribution of insulin by Eli Lilly & Co. has been well documented (32-35). There is no doubt that Clowes and George Walden were the chemistry team that worked with the Canadian team to purify insulin. What is not clear is the role, if any, that Eda had in this process with Walden and Clowes.

### Arguments for Intimate Involvement of Eda with Insulin

There is the possibility that Eda was involved as a research scientist on the insulin project, under her married name, and the record has been lost. Her husband was appointed to work on this project in the spring of 1922, after they were married (32-35). Several sources point to her being a member of the scientific team involved in the research effort.

> Among the principal laboratory technicians at Lilly who were assigned to the project was a research chemist, George B. Walden, and his wife, Eda Bachman Walden, who was also a chemist (36).
>
> George Walden headed insulin research at Lilly, and Harley W. Rhodehamel, Jasper P. Scott, and Walden's wife, Eda Bachman, all chemists, assisted in the project (37).
>
> The team at Eli Lilly began its work immediately, led by George Walden, Harley Rhodehamel and Jasper P. Scott, as well as Eda Bachman, a chemist who would later marry Walden…Walden's research with Bachman also included a basic science program focused on determining the isoelectric points of materials in several of Lilly's products. (The isoelectric point was a well-known chemical principle, defined by the pH of a medium at which a protein carries no net charge and thus will not migrate in an electric field. Proteins precipitate—fall out of solution—most readily at their isoelectric points, a property that can be utilized to separate mixtures of proteins or amino acids) (38).
>
> Lilly's husband-and-wife team, George B. and Eda Bachman Walden, both chemists, solved this problem by adding a special isoelectric precipitation step that ensured a potent product of standard purity (39).

Several of these come from the same source material, Khan in particular. However, there are records from McCormick, who was the Lilly historian, and a letter from J. K. Lilly to Clowes that seem to corroborate this involvement by Eda (36). Several other references do not point to source material, but likely could have been propagated from already referenced items (38, 39).

### Arguments for Ancillary Involvement of Eda with Insulin

Annual reports from the archives at Woods Hole makes it clear that Eda was a researcher there summers from 1920 through 1925 (with the exception of 1923). It is also clear that the use of the isoelectric point for precipitation of proteins came from the synergy of work between Clowes, researchers at Woods Hole, and the team at Lilly (40):

> Walden decided to make use of the isoelectric protein precipitation method, which he had learned while working at Woods Hole in the summer of 1921. A colleague, Jacques Loeb, had shown him the relative positive and negative charges of a particular protein depend on the pH of the solution…Walden had successfully applied this principle to a series of Lilly protein products.

However, in 1921, there is no record of Walden performing research at Woods Hole. Jacques Loeb is noted on the annual report (41), as well as Clowes, Eda, Irvine H. Page, Homer W. Smith, and Carlotta G. Smith from Eli Lilly & Co. Walden is listed as a researcher in 1924 and 1925 (42). It is possible that Walden came for a short period in the summer of 1922 (Loeb was present this summer as well), which is likely as Eda and Walden were newlyweds, but not the entire summer. As the contract to make insulin was awarded in May, it is highly likely that Walden, as head chemist, was dedicating most of his summer supervising the work in Indianapolis. It is also possible that Eda, or another member of the Lilly team, had worked on this technique with or without Walden in previous years at Woods Hole. This is supported by the following quotes:

> Fortuitously, Lilly chemists George Walden and his future wife Eda Bachman were conducting independent research on proteins at Woods Hole. The Walden team's basic science program on isoelectric precipitation involved new applications of a well-known principle (43).

> It should be emphasized that Walden's isoelectric precipitation technique emerged from a basic science program started by Clowes in Woods Hole that had nothing to do with insulin (44).

The meaning of the listings of the Lilly team in the Woods Hole annual reports are not clear. In 1920, Eda is listed as a "research chemist" along with Lucille G. Keith. In 1921, Eda is again a "research chemist," while Irvine Page is a "chemist," and Homer and Carlotta Smith are simply affiliated with Lilly without titles. Mabel T. Studebaker was not listed as a chemist in 1922 (Eda and Page were). In 1924, Eda and Walden were listed as a "research chemists," while Page was labeled "research" and Studebaker was labeled "chemist." In 1925, Page is a "research worker," Walden is a "research chemist," and Eda is a "chemist." It is not clear if Eda was granted the same research privileges at Woods Hole as a non-employed chemist, or she continued to work at Lilly under her married name and there are no records of this, even after an extensive search, in the Lilly archive.

Rather than a scientific role, Eda could also have served as an archivist of the insulin data (45):

> Information about early insulin production at Lilly was obtained from a six-volume series of laboratory data entitled "Insulin Research" for the years 1922 to 1925. The entries, mostly recorded by Mrs. George B. Walden, who was an employee at the time, noted the date of each lot, the numbers assigned to it, the extraction procedure, and the assay results. The volumes are in the Lilly Archives.

It was common for women's roles in the chemical industry to change over time from researchers during World War I to "'chemical librarians,' 'chemical secretaries,' bibliographers, and abstractors" (46). In this role, she may not have been an official employee of Lilly, or she may have been classified as secretarial.

**Arguments Against Eda's Involvement with Insulin**

Insulin production by Eli Lilly & Co. did not begin until the agreement was signed with the Canadian researchers in the late spring of 1922 (32-35). Her husband, George Walden, who was hired in 1917, was the chemist in charge of the project working directly with Clowes. This was after Eda's documented separation.

Several of the documented histories about the production of insulin did not include Eda on the team of researchers. Cooper and Ainsburg list Jasper P. Scott and Harley W. Rhodehamel along with Walden, and there is no mention of Eda on any of the pages referencing Walden (47). Rosenfield lists no team at all, but does include a timeline of critical development in the insulin project between October and December of 1922 (48). Bliss states that "A team of chemists, headed by George Walden, devoted their full time to the insulin work" (49), but there is no mention of Eda. In the biography of his grandfather, Alexander W. Clowes does not include Eda on the team either. "…The Lilly team comprising George Walden, Harley Rhodehamel, and Jasper P. Scott…" (50) are the only ones included. Of these three scientists, only Walden could have spent time at Woods Hole, where the critical method of isoelectric precipitation was shared. There is no record of Scott or Rhodehamel traveling to Woods Hole.

It would be easy to assume that Eda had no part in the production and/or purification of insulin. Why would one think she would have been included? Employment records show that she was separated. Women were often viewed as assistants, but not as equal scientists (28). Several of the accepted authorities on the discovery and

production of insulin do not mention any contribution by her.

## Conclusion

Despite the arguments against her direct involvement, there seems to be some consensus in the literature that Eda Walden Bachman had some role in the purification and production of insulin by Lilly. Exactly what that role was may be lost. It could easily be a case of a woman researcher overshadowed by her more famous, more accomplished spouse who went on to become the vice president for Biochemical Manufacturing.

The Waldens settled in a farm home on the South side of Indianapolis and raised their two sons George Jr. (1923-2014) and Philip (1929-2016). George Jr. was a mechanical engineer (51). Philip was a broadcast engineer at Purdue University (52). Walden retired from Lilly in 1960 (51). He died in August of 1982, and Eda died in January of 1988 (53).

Even though her career as a working scientist was brief (1918-1925), she contributed a significant amount to the field during this time. Apportioning credit for individual scientists' contributions to large scientific efforts like insulin are challenging due to the lack of surviving documentation and differing perspectives of researchers on the project, as evidenced by the multiple investigations on this topic (29, 32-38). Compounding this challenge, the role(s) of women in research was often underrecognized (54). Regardless of Eda's role in insulin research, she has several incontrovertible credentials in science. She was the first woman to graduate with a chemistry degree from Butler University, she was the first documented female research chemist at Eli Lilly & Co., she was a multi-year visiting researcher at Woods Hole, and she was a coauthor on a publication with G. H. A. Clowes, a famous scientist of his time. On these merits alone, she should be lauded as an extraordinary and impactful female chemist.

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## About the Author

Anne M. Wilson has been a faculty member in the chemistry department at Butler University for over twenty-five years. Her research interests include small molecule synthesis, historic and novel dyes, teaching pedagogy, food chemistry, archival documentation of scientific discoveries, and the history of science.