DEVELOPMENT OF CHEMISTRY AT OHIO UNIVERSITY AND ITS FIRST WOMEN GRADUATES

Howard D. Dewald, Department of Chemistry and Biochemistry, Ohio University, Athens, Ohio 45701; dewald@ohio.edu

Abstract

In the first 100 years at Ohio University nearly 700 bachelor's degrees were awarded by the institution. Only two chemistry-related degrees were earned by women, both in 1903, who wrote Bachelor of Philosophy (Ph.B.) theses on derivatives of hydrocarbons. Why was this significant? A short background on the university, notable milestones, and the development of the chemistry curriculum is given prior to the discussion of the theses written by Ethel Riley and Nannie Nease and their subsequent lives. A discussion of baccalaureate origins of women in chemistry in Ohio shows a dearth of degrees prior to 1920 and thus the significance of the theses written by Riley and Nease.

Background and Introduction

Ohio University traces its origin to the Northwest Ordinance of 1787 and the settlement and government of the territory which provided in Article 3 that "Religion, morality and knowledge, being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged" (1). On January 9, 1802, the Ohio Territorial General Assembly chartered the American Western University and subsequently, on February 18, 1804, the Ohio General Assembly rechartered (2).

> the "Ohio University" for the instruction of youth in the various branches of liberal arts and sciences, for the promotion of good education, virtue, religion and morality, and for conferring all the degrees and literary honors granted in similar institutions.

The course of instruction was laid down on June 9, 1808, and instruction began in the Academy building on June 1, 1809, to three students (3). The first two degrees were conferred in 1815 to Thomas Ewing (1789-1871) and John Hunter. After practicing law in Lancaster, Ohio, Ewing served as a US Senator, Secretary of the US Treasury and the first US Secretary of Interior. Hunter died in Pickaway County, Ohio, in 1816.

Other notable milestones for graduates of Ohio University include the following. On September 17, 1828, the A.B. degree was conferred on John Newton Templeton (ca. 1805-?), an emancipated slave born in South Carolina, its first African American graduate and probably only the fourth in the nation. Templeton went on to become the first teacher, and later principal, of Pittsburgh's first African American school. Athens County native Margaret Boyd (1846-1905) received her B.A. degree on June 26, 1873, and became the first woman to graduate from Ohio University (3). She became a teacher for two years in Monroeville, Ohio, at Cincinnati Wesleyan College in 1875, and in Martinsville, Indiana, from 1880-1884. She returned to Athens as the high school assistant principal from 1884-1898. As enrollment of women increased, Miss Cynthia U. Weld (1838-1915), a New York native, was appointed the first female professor in 1883, teaching English literature, history and rhetoric. Less than a year later, she became the second woman on the faculty at Ohio State University in

Columbus and held the rank of assistant professor there for two years. Saki Taro Murayama from Japan played football and became Ohio University's first international alumnus on June 27, 1895, earning his B.S. degree (4, 5). After graduation Murayama returned to Japan where he became chief engineer of the Japanese branch of Siemens Schuckert (Berlin).

In 1822 the curriculum included science classes in anatomy, mineralogy, botany, and "chymistry" (5). The first professor of natural science was Samuel D. Hoge, A.M. (1792-1826) serving from 1823 to 1826. In 1831, seniors' study included chemistry among several moral and natural sciences (6). In the 1843 Catalogue a college course in chemistry was offered in the second term of the junior year with William Williams Mather, A.M. (1804-1859) as Professor of Chemistry and Natural History (7). Most alumni of Ohio University in the first three decades of degree granting became predominantly lawyers or ministers, with a few who entered teaching or business (8). The earliest known graduate who had an affiliation in chemistry was Zanesville, Ohio native James Merrill Safford (A.B., 1844; A.M. 1848; Ph.D., 1868, Yale; M.D., 1872, Nashville) (1822-1907) who was appointed Professor of Chemistry, Mineralogy, and Geology etc., at Cumberland University in Lebanon, Tennessee, in June 1848 (9).

Chemistry classes were taught in the central building (what is now called Cutler Hall). The labs had been upgraded during the mid-1880s by purchasing $3,500 in equipment (10). Electric room lighting and both hot air and electricity for the lab benches were added in the late 1880s (11).

In the mid-nineteenth century with the passage of the Morrill Land Grant Act of 1862 and the end of the Civil War, the classical curriculum began to be replaced. Agricultural and mechanical arts took hold. The Hatch Act in 1887 promoting agricultural research and the emergence of electrical engineering stimulated mathematical and science instruction. Graduate education and research emerged (12).

Chemistry at Ohio University, 1892-1903

At Ohio University, Wilbur Morris Stine (1863-1934), B.Ph., 1886, Dickinson College, who had been appointed an instructor in 1886 became the first distinct Professor of Chemistry in 1889. Stine was awarded the Sc.M. and the Sc.D. (*a examinatione*) in 1889 and 1893, respectively, also from Dickinson (13, 14). In 1893 Stine was awarded a Ph.D. for Merit from Ohio University and became Professor of Physics (15).

Stine left Ohio University in 1893 to serve as Director of Electrical Engineering at the Armour Institute of Technology in Chicago. Probably, the first identifiable degrees in chemistry were earned by William Alfred Westervelt (A. B., 1891; A. M., 1894) and John Edwin Snow (B. S. 1892, M.S. 1896, A.M. Honorary, 1904). Westervelt served as Demonstrator of Chemistry at the Medical College of Indianapolis from 1891-1893 and became a physician. With the establishment of the standalone Department of Chemistry in 1892-1893, the Board of Trustees was unsuccessful in hiring James H. Beal, Ph.D., as Professor of Chemistry (16). Thus, Snow was appointed to serve as Professor of Chemistry for one year during 1892-93. He then became Assistant Professor of Physics and Electrical Engineering for 1893-94 before joining Stine at the Armour Institute in Chicago.

In Fall 1893, Walker Bowman (1864-1946), Ph.D., 1888, University of Berlin, became Professor of Chemistry. Bowman had studied under Carl Liebermann with the thesis title "Ueber Reductionsproducte des Anthrachinons und dessen Derivate" (17). He came to Ohio from the Virginia Agricultural and Mechanical College, Experiment Station where he had worked on field tests with tomatoes and the composition and analysis of feed stuffs.

The use of students as laboratory assistants became a common practice with the establishment of the department. In 1895, Allen Bargus, Ph.B, 1893, was employed by Bowman (18). Further, students who were granted a university scholarship would be required to teach one hour per week, although it is not clear whether this was in the laboratory or a lecture (19). Bowman left Ohio University in 1896 to work as a chemist of a tobacco exporting company in Louisville, Kentucky.

Over the next four years, three men would be appointed as Professor of Chemistry. In 1896 Irving Wetherbee Fay (1861-1936), A.B., 1886, magna cum laude, Harvard; Ph.D., 1896, University of Berlin, was appointed Professor. During Fay's one year stay at the university, Hiram Roy Wilson, A.B., 1896, was employed as the student assistant in chemistry and German (20). Wilson would go on to become a noted Professor of English at Ohio University. Fay left the university for the Polytechnic Institute of Brooklyn where he was Professor of Chemistry.

Fay was succeeded by Professor William Edwards Henderson (1870-1962), B.A., 1891, College of Wooster, A.M., 1894; Ph.D., 1897, Johns Hopkins University. Henderson's advisor had been Ira Remsen on the subject of "A Further Investigation of the Symmetrical Chloride of Para-Nitro-Ortho-Sulpho-Benzoic Acid" (21). In his two-year stay, Henderson restructured the chemistry curriculum and instituted laboratory examinations.

Henderson left the university in 1899 for a position at Ohio State University where he moved through the professorial ranks and eventually served as Dean of the College of Arts and Sciences from 1921 to 1927. Henderson's replacement at Ohio University was an organic chemist, John Percival Sylvester, who had earned the Ph.D. in 1899 at Harvard University under Henry Barker Hill. Sylvester left after one year and became manager of the Sylvester Company in Massachusetts engaged in the manufacture of iron products.

In 1900 William Burdelle Bentley (1866-1945), A.B., 1889, A.M., 1890, Ph. D., 1898, Harvard University, arrived in Athens. Bentley's dissertation work had been completed under Charles Loring Jackson with the title "Tribrombenzol and Derivatives" (22). His thirty-six-year tenure at Ohio University stabilized the department while leading it into the mid-twentieth century.

In the 1900-01 Catalog, Bentley explicitly stated his two goals were to acquaint students with the general principles of chemistry and to give students laboratory experience. To accomplish these goals, he expanded the curriculum in both advanced practical and technical chemistry (23).

Since the time of Margaret Boyd, the enrollment of women students—at Ohio University, within the state of Ohio, and nationally—had increased significantly. At the turn of the twentieth century the student population at Ohio University was around two-fifths female out of an average total enrollment of 230, but the number of chemistry-affiliated men and women remained small, typically one or two. Thomas Henry Sheldon earned the B.S. in 1900 and Jacob Claire Evans earned the A.B. in 1901. Commencement in June 1903 saw the first women earn the Ph.B. degree having written chemistry-related theses.

Ethel Eleanor Riley and Nannie Louise Nease, Ph.B., 1903

Ethel Eleanor Riley (1880-11/5/1944) entered Ohio University in the Fall term 1894 in the Preparatory Department at the age of 14 years. Ethel was a native of Guysville in Athens County from a family of seven children, all but one of whom would attend Ohio University. The Preparatory Department was designed to prepare students for regular courses over a three-year period with Fall, Winter and Spring terms (with an optional summer term) each following either a classical, philosophical, scientific, or pedagogical path. Much of the instruction was given by the regular college faculty. At the matriculation of Riley, all paths required arithmetic, physical geography, algebra, and plane geometry. In addition, the classical, philosophical, and science paths required elementary physics, zoology or astronomy, while the pedagogical path required psychology, physiology, chemistry and botany which were taught in the third year (24). It appears that Riley mostly followed the pedagogical preparatory course. However, the sequence of course completion did not necessarily follow the order in the conspectus of classes. Also, it appears that she was absent for a few terms. Fall term 1899/Winter term 1900 appears to be the year Riley transitioned to the Collegiate Department. To earn the A.B. degree required one chemistry course, while both the Ph.B. and B.S. degree required two chemistry courses (25). The only known extra-curricular activity for Riley was as a member of the Zeta Chapter of Alpha Gamma Delta Sorority and she remained an active alumna (26).

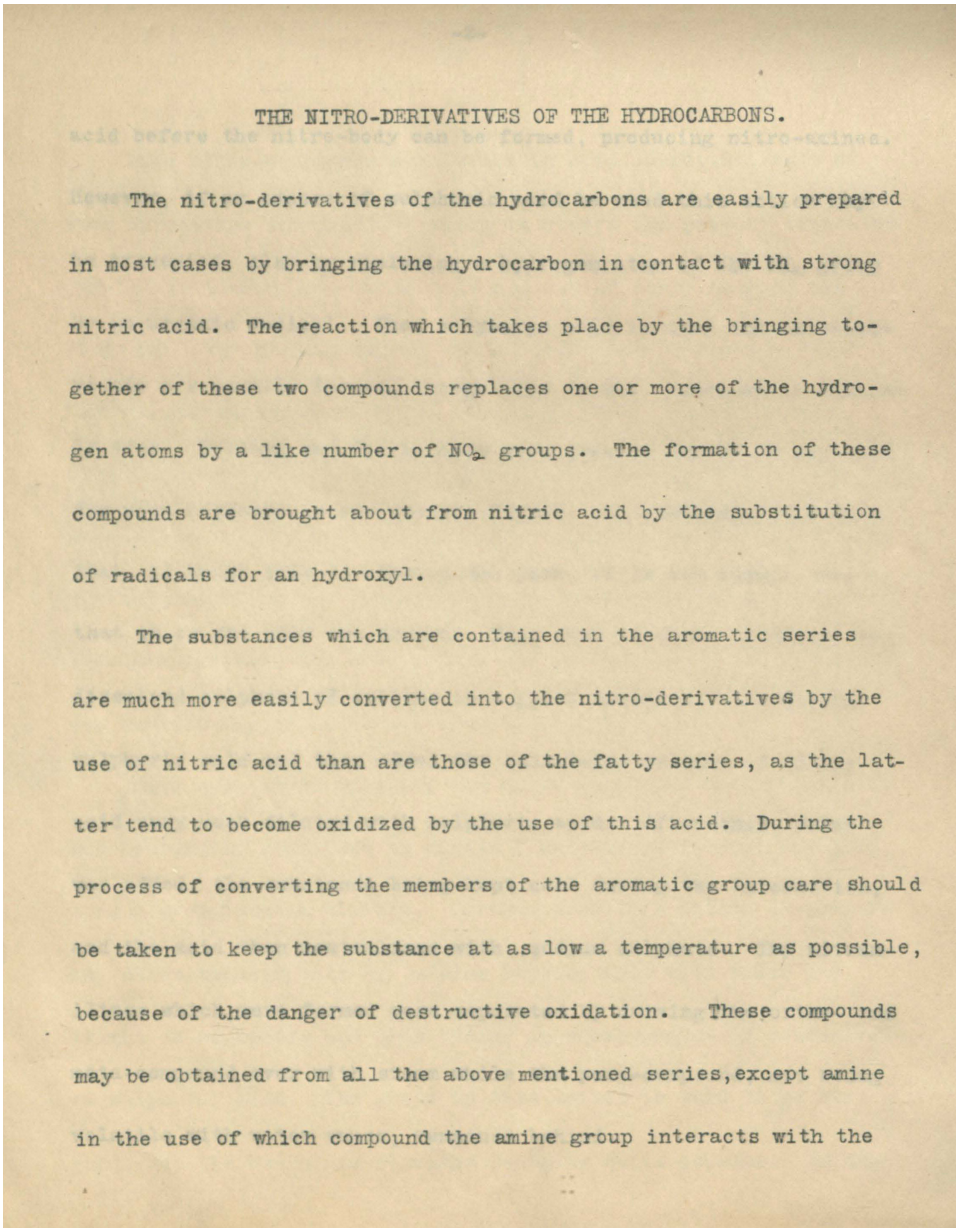
Nannie Louise Nease (10/29/1881-6/22/1945) entered Ohio University in the Fall term 1899. She was from Point Pleasant, Mason County, West Virginia, roughly 40 miles from Athens. Nease appears to have been the only daughter of Rebecca "Bettie" Jane Somerville and Hosiah Green Nease, a proprietor of a grocery and dry goods store. The only known extracurricular activity for Nease was pledging Pi Beta Phi fraternity for women (27). Nease's future husband, Horace McCord, also attended Ohio University for two years having matriculated in Fall 1898 and served as manager of the baseball team (28).

The Ph.B. was conferred to Riley and Nease on June 18, 1903. In total 16 bachelor's degrees were conferred in 1903, five with the A.B., one with the B.S., and ten with the Ph.B.

Ethyl Riley Thesis

Riley's eleven-page thesis entitled "The Nitro-Derivatives of the Hydrocarbons" (29) was submitted June 16, 1903, and received a "Satisfactory" from Professor Bentley. Spelling errors were frequent. Several researchers were named but only two literature references were

cited. The introductory page is shown in Figure 1.



THE NITRO-DERIVATIVES OF THE HYDROCARBONS.

The nitro-derivatives of the hydrocarbons are easily prepared in most cases by bringing the hydrocarbon in contact with strong nitric acid. The reaction which takes place by the bringing together of these two compounds replaces one or more of the hydrogen atoms by a like number of NO_2 groups. The formation of these compounds are brought about from nitric acid by the substitution of radicals for an hydroxyl.

The substances which are contained in the aromatic series are much more easily converted into the nitro-derivatives by the use of nitric acid than are those of the fatty series, as the latter tend to become oxidized by the use of this acid. During the process of converting the members of the aromatic group care should be taken to keep the substance at as low a temperature as possible, because of the danger of destructive oxidation. These compounds may be obtained from all the above mentioned series, except amine in the use of which compound the amine group interacts with the

***Figure 1**. Introductory page to the Ohio University Ph.B. Thesis submitted by Ethel Riley in June 1903 titled The Nitro-Derivatives of the Hydrocarbons.*

Riley first discussed the general substitution reactions of saturated hydrocarbons with nitric acid and of aromatic hydrocarbons with a mixture of concentrated nitric acid and sulfuric acids at low temperatures, except for aromatic amines which produce a mixture of nitroanilines. Riley then described several nitration reactions.

The general preparation of nitrobenzoic acid from a mixture of benzoic acid, saltpeter (potassium nitrate) and concentrated sulfuric acid was presented. A specific step-by-step formation and isolation of nitrobenzene and dinitrobenzene from nitric acid and sulfuric acid followed. She did not specify which isomer of dinitrobenzene was obtained and wrote the wrong formula—$(C_6H_4NO_2)_2$ instead $C_6H_4(NO_2)_2$.

The conversion of aniline through the diazo stage to form phenol by reaction in sulfuric acid and sodium nitrite was provided. A procedure for the preparation of nitrophenols was also described, with both *o*-nitrophenol and *p*-nitrophenol produced, but while an excellent yield was claimed, there was no characterization of the products obtained.

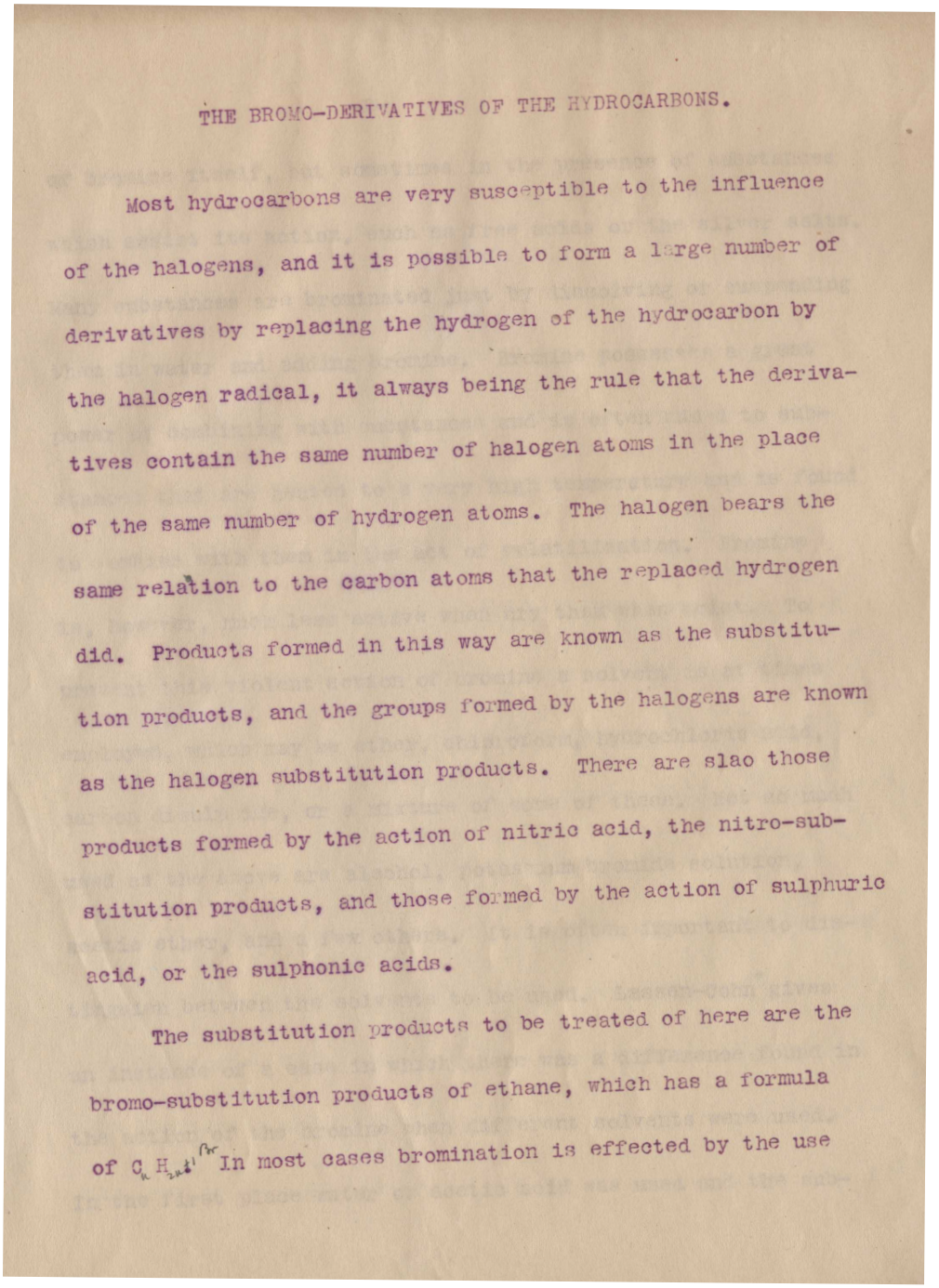
The final experiment described converting aniline in a solution of diluted nitric acid and sodium nitrate which was poured into a $CuSO_4$ solution producing nitrobenzene. Typically, the experimental characterizations of products were based on material color and melting point determinations, or distillation temperature, color and odors of liquids/oils obtained, such as nitrobenzene.

Nannie L. Nease Thesis

Nease's twelve-page thesis was entitled "The Bromo-Derivatives of the Hydrocarbons" (30). It shows no date of submission nor any grade notation. The copy contains several hand-written corrections throughout the text. As with Riley, several researchers were mentioned, but only one literature reference was cited. The introductory page is shown in Figure 2.

Nease described the bromination of ethane, ethylene, and aniline using liquid bromine. Bromine's dry volatil-

ity and uses with solvents (e.g., ether, chloroform, hydrochloric acid, and carbon disulfide and less so with alcohol or potassium bromide solution) and with "carriers" (e.g., iodine, iron, ferric bromide, ferric chloride, and phosphorus) were discussed. First, ethyl bromide was prepared from the reaction of ethanol with bromine in the presence of red phosphorus. After product formation, it was purified by shaking with NaOH to remove the HBr and redistilled. The boiling point of 40 °C was reported which compared with a literature value of 38.8 °C. The reaction process involving the formation of PBr_3 was discussed, Properties and other reactions of other halogenated hydrocarbons (ethyl chloride and ethyl iodide) and differences between them were given.



THE BROMO-DERIVATIVES OF THE HYDROCARBONS.

Most hydrocarbons are very susceptible to the influence of the halogens, and it is possible to form a large number of derivatives by replacing the hydrogen of the hydrocarbon by the halogen radical, it always being the rule that the derivatives contain the same number of halogen atoms in the place of the same number of hydrogen atoms. The halogen bears the same relation to the carbon atoms that the replaced hydrogen did. Products formed in this way are known as the substitution products, and the groups formed by the halogens are known as the halogen substitution products. There are slao those products formed by the action of nitric acid, the nitro-substitution products, and those formed by the action of sulphuric acid, or the sulphonic acids.

The substitution products to be treated of here are the bromo-substitution products of ethane, which has a formula of $C_n H_{2n+1}Br$ In most cases bromination is effected by the use

***Figure 2**. Introductory page to the Ohio University Ph.B. Thesis submitted by Nannie L. Nease in June 1903 titled The Bromo-Derivatives of the Hydrocarbons.*

Next, Nease discussed some differences between saturated and unsaturated hydrocarbons. The second reaction performed was a two-step preparation of ethylene bromide. First ethanol was heated with an excess of concentrated sulfuric acid. The gases produced were passed through a caustic soda solution to remove the SO_2 produced and then through an aqueous solution of bromine to form the ethylene bromide. The resulting mixture was neutralized with caustic soda. After separation of the aqueous and oil layers, calcium chloride was added to the organic layer before distillation. The boiling point of the ethylene bromide was reported as 127 °C. Neither the name of the compound as ethylene dibromide nor any formula were given.

After some background discussion about aniline and its natural sources and properties, the final compound prepared was "aniline bromide or tri-brom aniline."

The aniline was mixed with hydrochloric acid and then bromine was passed from a cylinder into the solution resulting in the initial formation of a white precipitate that became a deep yellow. After filtering, washing, and drying the boiling [*sic*, [melting] point was found to be 121 °C as compared to literature values between 118 and 120 °C.

Bound copies of both theses are held in the Special Collections of the Libraries of Ohio University. Originally, the Dewey catalogue entries were 378.771 0370ri and 378.771 0370ne, though both were re-catalogued in 2008 as Thesis BA 1903 RILE and Thesis BA 1903 NEAS instead of the Ph.B. degree.

Post-Graduation Lives of Riley and Nease

After graduation in 1903, Riley began a high school teaching career in Salt Lake City, remaining until 1917, when she moved to Washington, DC, and initially worked at the War Industry Board as a stenographer. After her government service she spent twenty-five years as a teacher in the business practice department of what was known as the Business High School which became Roosevelt High School. Besides her sorority alumna involvement, Riley was a member of the American Association of University Women and the New York Avenue Presbyterian Church. She also served as advisor to the Girl Reserves at Roosevelt. She died suddenly at her home in Washington on Sunday, November 5, 1944. She was buried in the Carthage Cemetery in Coolville, Athens County, Ohio (31).

Nease married Horace Minor McCord (4/3/1880-8/31/1943), a native of Pickaway County, Ohio, on October 22, 1906, in Point Pleasant, West Virginia. He was employed by the National Cash Register Company in Dayton, Ohio, at that time. As previously noted, McCord had attended Ohio University for two years, but did not graduate. He was the fourth child in a family of three boys and two girls. There was one daughter, Elizabeth "Betty" Lee McCord born on August 11, 1907, to Horace and Nannie McCord. In the 1920s, the McCords had moved to Columbus, Ohio. Horace worked as a salesman with several firms and served as the president of the McCord-Harris Company with James W. Harris as vice president. The McCord-Harris Company was a distributor of the Chandler Six and Cleveland Six motor cars before the brands were discontinued in the late 1920s (32, 33). Also, he was a member of the Ferris-McCord Tire Company. Horace died in Marion, Ohio, on August 31, 1943, after a brief serious illness (34). At the time of his death the McCords were living in Grove City, Ohio. Their daughter had graduated from Ohio State University in Columbus, Ohio, and became a journalist. She was married to William Smith Cunningham on August 9, 1930. After Horace's death, Nan lived with her daughter and son-in-law in Los Angeles, California; she died there on June 22, 1945 (35). Both Nan Nease McCord and Horace McCord were buried in the Lone Oak Cemetery, in Point Pleasant, West Virginia. Betty (McCord) Cunningham had no children; she died in 1990.

Significance

This section presents some information about the state of higher education, particularly in chemistry and for women, among other colleges and universities in the US, particularly in Ohio. It is intended to serve as a backdrop for comparison of the details presented above about Ohio University and its first two women chemistry graduates.

At the start of the nineteenth century, only six American universities (Columbia, Dartmouth, Harvard, Pennsylvania, Princeton, and William and Mary) offered separate courses in chemistry (36). As noted earlier, the classical curriculum and natural science study were replaced in the last quarter of the nineteenth century with more disciplinary focus. Further, the emergence of graduate programs began to provide designation beyond simply earning a B.A. or B.S. While women increasingly were being admitted to colleges and universities, few were in the sciences, especially chemistry. Often, they were unable to find employment or were refused "men's jobs," and a separate labor market emerged in the sciences for women, even if they had earned a Ph. D. "It was assumed that most women were seeking personal fulfillment and were planning to become better wives and mothers" (37).

There were a few notable women to earn academic degrees in chemistry in the last few decades of the nineteenth century. Ellen Henrietta (Swallow) Richards (1842-1911) was the first woman in America accepted to any school of science and technology, and the first American woman to obtain a degree in chemistry, which she earned from Vassar College in 1870. After failing to find work as an industrial chemist she enrolled at the Massachusetts Institute of Technology (MIT) as the first woman admitted there. She graduated in 1873 with the B. A. and with an M.A. from Vassar in the same year. She completed her Ph.D. at MIT in 1886 and later became its first women professor, but initially in unpaid programs especially created for women (38, 39).

Mary Engle Pennington (1872-1952) entered the University of Pennsylvania in 1890 and completed the requirements for a B.S. degree in chemistry in 1892. However, since the University of Pennsylvania did not grant degrees to women at this time, she was given a certificate of proficiency instead of a degree. Pennington received her Ph.D. under Edgar Fahs Smith from the University of Pennsylvania in 1895 (40, 41). As will be seen below, these were the most prominent American women chemists educated before the turn of the twentieth century.

Besides Ohio University, several institutions of higher education opened in Ohio in the nineteenth century. Miami University in Oxford had been chartered in 1809 and opened in 1824. This was followed by the present University of Cincinnati which was established in 1819. Private institutions emerged at Kenyon College in Gambier in 1824, Western Reserve College (now Case Western Reserve University) in Cleveland in 1826 and in the 1830s Capital University in Columbus, Denison University in Granville, Xavier University in Cincinnati, Oberlin College, Marietta College, and Muskingum University in New Concord all opened. Wilberforce University was founded in 1856 to educate African American students, and the co-located public Central State University opened in 1887. Ohio State University was founded in Columbus in 1870 as the Ohio Agricultural and Mechanical College. By the turn of the twentieth century, over 40 colleges and universities had opened in Ohio; 20% were public.

Women began to enroll in Ohio colleges before long, although not in great numbers. Oberlin is the oldest coeducational college in the US having admitted four women in 1837; three of whom graduated (42). Mary Jane Patterson (1840-1894) graduated in 1862, the first Black woman to earn a B.A. degree and became a pioneer in Black education (43).

At Ohio State University the first woman graduate was Mary Franc Morrison (?-1930). She studied microscopic chemistry and received the B.A. degree in 1879; upon which she taught natural science in Cincinnati before she married in 1881 (44, 45). At Ohio State University, there is no mention of women students registered in the chemistry courses in the first year in 1873, but an 1888 chemistry class photo shows at least eight women in a class of approximately 50 students (46). In 1897, a four-year course in chemistry, leading to the degree of Bachelor of Science in Chemistry was adopted. Of the first 10 students to earn the degree through 1901, none were women (47). Ohio State University began awarding the doctorate in 1891 and had awarded only one to a woman before 1900 (48).

At Miami, the Oxford Female College opened in 1856 and offered lectures on botany, chemistry, and natural philosophy in Miami University; the first baccalaureate degrees were conferred in 1886. In 1891 Miami admitted seventeen women students, and in 1900 three of sixteen women were awarded bachelor's degrees (49, 50).

In 1902-1903, nearly 30,000 bachelor's degrees were conferred in the US, with just over 6,000 awarded to women (51).

In the 1906 edition of *American Men of Science*, of the 1000 "starred" scientists (leaders in research in the science) 175 were chemists; but only 19 of the 1000 were women and only one was a chemist; it was Richards. By the time of the second edition in 1910 with an additional 250 starred scientists of which 55 were chemists, only six of the 250 added were women, and only one was a chemist; it was Pennington (52). Eighteen Ohio colleges and universities had produced starred male scientists by the 1940s. The leading institutions in Ohio for production of starred chemists by 1910 were Cincinnati with one, Miami with one, Oberlin with two, Ohio State with seven, and Wooster with one; none were women (53). The baccalaureate origins of women chemists before 1920 showed a total of 35 across 108 institutions, but none had come from any Ohio institution, including Oberlin and Ohio State and only Ohio State had employed women scientists (54).

The fact that Ethel Riley and Nannie Nease each wrote a chemistry-related thesis for their Ph. B. is the only way we know they were the "first" women at Ohio University to have earned a chemistry-related degree since no official designation existed in that period. The fact that both followed traditional career paths for women was not surprising either, even expected, for the time.

Conclusion and Epilogue

In the first 100 years of Ohio University, only a handful of students had graduated with a bachelor's degree with an affiliation in chemistry. Two of these were women, Ethel Eleanor Riley and Nannie Louise Nease, who earned the Ph.B. in 1903 writing theses on derivatives of hydrocarbons under the guidance of a Harvard University educated organic chemistry faculty member, William Bentley. Riley went on to a career as a high school business teacher; Nease married shortly after her graduation, bore a daughter, and supported the work of

her husband as a salesman. While several chemistry-related bachelor's degrees would continue to be earned by male students, Riley and Nease stood alone with their chemistry-related Ph.B. theses at Ohio University for over a quarter century until Harriet Maxine Paine earned the B.S.Ed., on June 9, 1930; followed by the A.B. degree in chemistry earned by Spanish-born Abelina Suarez on June 8, 1931, both of whom went on to long careers as high school science teachers.

Acknowledgement

The assistance of William Kimok, University Archivist and Records Manager in Alden Library at Ohio University, has aided in the discovery of materials and research in preparing and writing the manuscript.

References and Notes

1. An Ordinance for the Government of the Territory of the United States Northwest of the River Ohio, 1787, http://www.loc.gov/resource/bdsdcc.22501 (accessed 16 Sept 2022).
2. W. E. Peters, *Legal History of the Ohio University, Athens, Ohio*, Western Methodist Book Concern, Cincinnati, OH, 1910.
3. *Ohio University Annual Catalogue, 1875. General Catalogue, 1804-75*, Gazette Steam Printing House, Columbus, OH, 1876.
4. T. N. Hoover, *The History of Ohio University*, Ohio University Press, Athens, OH, 1954.
5. B. Hollow, *Ohio University, The Spirit of a Singular Place, 1804-2004*, Ohio University Press, Athens, OH, 2003.
6. *Catalogue of the Officers and Students in the Ohio University, 1831-32*, Maxon Printer, Athens, OH, 1831.
7. *Catalogue of the Officers and Students of the Ohio University, at Athens, 1843*, Wright & Legg, Columbus, OH, 1843.
8. *Catalogue of the Officers and of Those Who Received Any Degree in the Ohio University, at Athens, 1848*, N. H. & A. J. Van Vorhes, Athens, OH, 1849.
9. R. G. Stearns, "James Merrill Safford," *Earth Sci. Hist.*, **1984**, *4*(1), 38-48.
10. *Annual Catalogue of the Ohio University, for the Year 1883*, Hann & Adair, Columbus, OH, 1883.
11. *Catalogue of the Ohio University for 1888 and Circular of Information for 1888-'89*, Gazette Printing House, Columbus, OH, 1888.
12. M. Rothenberg, Ed., *The History of Science in the United States*, Garland Publishing, New York, 2001, pp 2-3.
13. *107th Annual Catalogue of Dickinson College for the Academic Year, 1889-90*, Dickinson College, Carlisle, PA, 1890, p. 10.
14. *111th Annual Catalogue of Dickinson College for the Academic Year, 1893-94*, Dickinson College, Carlisle, PA, 1894, p. 13.
15. *Catalogue of the Ohio University for 1892-3 and Circular of Information for 1894*, Laning Printing Co., Norwalk, OH, 1894, p. ix.
16. Senior Class of the Ohio University, *The Athena, 1893*, Journal Print, Athens, OH, 1893.
17. P. R. Jones, *Bibliographie der Dissertationen amerikanischer und britischer Chemiker an deutschen Universitäten, 1840-1914*, Forschungsinstitut des Deutschen Museums, München, 1983.
18. *Catalogue of the Ohio University for 1891-2 and Circular of Information for '93*, Hann & Adair, Columbus, OH, 1892, p.45.
19. *Catalogue of the Ohio University for 1894-5 and Circular of Information for 1895-6*, Laning Printing Co., Norwalk, OH, 1896, p. 9.
20. *Catalogue of the Ohio University, Athens, Ohio for 1896-7*, Laning Printing Co., Norwalk, OH, 1897, p. 6.
21. W. E. Henderson, A Further Investigation of the Symmetrical Chloride of Para-Nitro-Ortho-Sulpho-Benzoic Acid, Ph.D. Thesis, The Johns Hopkins University, 1897, ProQuest Dissertations, 0228623.
22. W. B. Bentley, Tribrombenzol and Derivatives, Ph.D. Thesis, Harvard University, 1898, ProQuest Dissertations, 0254260.
23. *Catalogue of the Ohio University, Athens, for 1900-1901 and Circular of Information for 1901-1902*, Messenger and Herald Printing Co., Athens, OH, 1901.
24. *Catalogue of the Ohio University for 1894-5, and Circular of Information for 1895-6*, Laning Printing Co, Norwalk, OH, 1895.
25. *Catalogue of the Ohio University, Athens, for 1899-1900 and Circular of Information for 1900-1901*, Laning Printing Company, Norwalk, OH, 1900.
26. "Alpha Gamma Delta," *Evening Star*, Washington, DC, Feb. 11, 1941, p B-4.
27. V. M. Houston, "Ohio Alpha—Ohio University," *The Arrow*, **1899**, *15*(3), 131-132.
28. "Used a Megaphone; Students of Ohio University in Rebellion; Loudly Voiced Unpleasant Opinions of Faculty on the Campus, and Five are Suspended," *Commercial Tribune*, Cincinnati, OH, May 3, 1900, p 1.

29. E. Riley, The Nitro-Derivatives of the Hydrocarbons, 1903, Ph.B. Thesis, Ohio University, Thesis BA 1903 RILE, Ohio University Libraries.
30. N. L. Nease, *The Brom[o]-Derivatives of the Hydrocarbons*, 1903, Ph.B., Thesis, Ohio University, Thesis BA 1903 NEAS, Ohio University Libraries.
31. "Miss Ethel E. Riley Dies; D.C. Teacher for 25 Years," *Evening Star*, Washington, DC, Nov. 8, 1944, p A-14.
32. McCord-Harris Co, *Columbus City Directory*, 1925, R. L. Polk & Co.'s, Columbus, OH, p 1021.
33. J. H. Lackey, *The Chandler Automobile: A History Including the Cleveland and Chandler-Cleveland Marques*, 2018, McFarland & Company, Jefferson, NC.
34. Horace M'Cord, *Columbus Evening Dispatch*, Columbus, OH, Sept. 1, 1943, p 3.
35. McCord Funeral is Held in Pt. Pleasant, *Athens Messenger*, Athens, OH, July 2, 1945, p 8.
36. Ref.12, p 115.
37. M. W. Rossiter, *Women Scientists in America: Struggles and Strategies to 1940*, Johns Hopkins University Press, Baltimore, MD, 1982, Ch. 3, pp 51-52.
38. E. M. Howe, "Ellen H. Richards," *Vassar Miscellany*, **1911**, *40*(6), 575-579.
39. C. Curtis, "Richards, Ellen Swallow (1842-1911)," in L. E. Ford, Ed., *Encyclopedia of Women and American Politics*, Facts on File Library of American History, New York, 2008, p 387.
40. A. Pierce, "American Contemporaries: Mary Engle Pennington, An Appreciation" *Chem. Eng. News*, **1940**, *18*(21), 941-942.
41. JCE Online, Biographical Snapshots of Famous Women and Minority Chemists, Mary Engle Pennington, archived at the Internet Archive from http://jchemed.chem.wisc.edu/JCEWWW/Features/eChemists/Bios/pennington.html (accessed 16 Sept 2022).
42. Oberlin College, https://en.wikipedia.org/wiki/Oberlin_College (accessed 23 Sept 2022).
43. Mary Jane Patterson, https://en.wikipedia.org/wiki/Mary_Jane_Patterson (accessed 26 Sept 2022).
44. Ohio State University Archives, The Ohio State University: A Historical Timeline, https://www.tiki-toki.com/timeline/entry/69886/The-Ohio-State-University-A-Historical-Timeline (accessed 16 Sept 2022).
45. Morrison Tower, https://library.osu.edu/site/buckeyestroll/morrison-tower (accessed 16 Sept 2022).
46. *An Encyclopedia of Pathbreaking Women at the Ohio State University*, https://criticaldifference.osu.edu/sites/default/files/documents/2017/10/womenpathbreakers_final_2017.pdf (accessed 16 Sept 2022).
47. W. McPherson, "A Brief History of the Department of Chemistry," in Thomas C. Mendenhall, Ed., *History of the Ohio State University*, Vol. 3, Ohio State University Press, Columbus, 1922, pp 384-396.
48. Ref. 31, p 36.
49. W. Havinghurst, *The Miami Years, 1809-1984*, G. P. Putnam's Sons, New York, 1984.
50. C. W. Ellison, Ed., *Miami University, 1809-2009: Bicentennial Perspectives*, Ohio University Press, Athens, 2009.
51. T. D. Snyder, Ed., *120 Years of American Education: A Statistical Portrait*, US Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics, 1993, Ch. 3, Table 28, p 82.
52. S. S. Visher, *Scientists Starred, 1903-1943, in "American Men of Science,"* Johns Hopkins Press, Baltimore, MD, 1947, pp 148-149.
53. Ref. 46, pp 209-211.
54. Ref. 31, pp 11-26

About the Author

Howard D. Dewald is Professor in the Department of Chemistry and Biochemistry at Ohio University in Athens, Ohio. He earned the B.S. from the University of Wyoming where he conducted undergraduate research under the guidance of John Howatson on the reactions of sulfur dioxide with the mineral nahcolite during thermal decomposition. His Ph.D. in analytical electrochemistry was received at New Mexico State University in Las Cruces as the first doctoral student under Joseph Wang. After two years of postdoctoral work at the University of Cincinnati performing EXAFS spectroelectrochemsitry under Professors Richard C. Elder and William R. Heineman, he joined the faculty of Ohio University in 1986. He has served in several administrative roles in the College of Arts and Sciences and as Associate Provost for Faculty and Academic Planning. His research areas have included applied voltammetry in clinical, environmental, and forensic chemistry, as well as fundamental electrochemical studies in chaos and lithium-ion batteries. Recent research has centered on using electrochemistry in conjunction with liquid chromatography-mass spectrometry in collaboration with Hao Chen. He is the author of History of Circle K International published in 1980 from his work with the collegiate organization.