FORGOTTEN CHEMISTRY TIME CAPSULE REVEALED THE STORIES OF TWO EARLY FEMALE CHEMISTRY PROFESSORS

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Abstract

On May 12, 2014, the Avery Hall cornerstone on the University of Nebraska-Lincoln campus was chiseled open to retrieve the time capsule inside. The capsule contained a collection of objects that summed up the Department of Chemistry as it was in 1916. Its historically most important object was the sole copy of a biography of Dr. Rachel Lloyd, the first American woman to earn a Ph.D. in chemistry. Shortly after earning her doctorate, she was hired as the second member of the Chemistry Department at the University of Nebraska. The biography was written by her brother-in-law in 1900 and it provided insights about Lloyd's life that were not recorded anywhere else. Prior searches of a dozen libraries and archives had not turned up a single copy of that book. Since many of the time capsule contents were related to the activities of Mary Louise Fossler, associate professor of physiological chemistry at the University of Nebraska, it is likely that she led the effort to create the time capsule. An examination of Fossler's life and career shows that she was at the height of her influence in the department. The looming world war, however, contributed to her decision to leave Nebraska within three years of compiling the time capsule. When the cornerstone was replaced in 2014, a new time capsule was set in place with items from the departments and programs that had occupied Avery Hall between 1916 and 2014.

Introduction

A time capsule is a unique blend of the past, present, and future. When time capsules are opened, those who open them learn how people in the past thought about their legacy (1). Our contemporary expectations about creating, caching, and then opening time capsules in the United States began with the 1876 World's Fair Century Safe in Philadelphia. In a well-publicized event, a selection of items was placed in a large iron safe, which was then locked and stored in a secure location for one century (2). After it was opened for the U.S. Bicentennial in 1976, the safe was replaced by another time capsule to be opened in 2076.

The term "time capsule" was coined in 1939 to describe the Westinghouse capsule, created with much fanfare for the 1939 World's Fair in New York (3, 4). It was a 7.5-foot long torpedo-shaped container of corrosion-resistant cupaloy (99.4% copper, 0.5% chromium, and 0.1% silver) holding 35 everyday objects, a collection of fibers and metals, microfilm, and other objects. After it was sealed, the capsule was buried in a prominent location on the fairgrounds and then covered with concrete. Its opening date is 6939, five millennia after its burial.

The custom of placing objects in building cornerstones has an ancient history in many cultures but placing time capsules in cornerstones became much more common in the U.S. after the 1876 World's Fair Century Safe (1). Since cornerstones are not associated with fixed

opening dates, most of the enclosed time capsules are forgotten long before they are discovered during renovation or destruction. Nevertheless, cornerstones continue to be such popular building features that guidelines have been published to help ensure the relevance and longevity of the time capsule and its contents (5, 6). For instance, there are many things that we now know should not be placed in a time capsule such as newspapers, rubber, and plastics because they are prone to rapid decay. It is also recommended that the cornerstone be placed on the northwest corner of the building where the temperatures and humidity experience the lowest daily fluctuations and not on the southeast corner where those fluctuations are greatest.

The contents of some time capsules have proven disappointing (1). For example, a copper box was retrieved in 1991 that had been buried on the University of Massachusetts Amherst campus under a tree in 1878 (7), two years after the Century Safe in Philadelphia. The box was discovered when the tree was damaged and had to be removed. It contained a collection of waterlogged paper items, such as a newspaper, that required special treatments before they could be examined. Another example is a time capsule from 1927 at the University of Washington whose contents were so uninteresting (8) that it became the subject of a satirical piece in *The Onion* (9). Its entire contents were newspapers, a student handbook, an envelope containing a building permit, and a 1927 dime. It was in this frame of reference that the University of Nebraska-Lincoln's (UNL) 1916 Avery Hall cornerstone was opened (Figure 1).

***Figure 1**. Avery Hall Cornerstone on the University of Nebraska-Lincoln campus is inscribed "1916" to indicate the year it was set in place. It is located on the building's southeast corner. The building was ready for occupation in 1919.*

Opening the Avery Hall Time Capsule

The UNL chemistry department was in Avery Hall from 1919 until 1970, when it moved to the newly constructed Hamilton Hall. The time capsule was not opened in 1970 because it had been forgotten. Instead, the journey to open it began in 2012 after an online newspaper search for articles about Rachel Lloyd revealed an article titled "Lays Cornerstone for New Building" in the 22 June 1916 issue of the *Red Cloud Chief* from Red Cloud, Nebraska (10):

> Prof. Benton Dales, head of the Chemistry department of the state university, laid the cornerstone of the new chemistry building Thursday afternoon. Dean Lyman, of the college of pharmacy, Prof. R. J. Pool, head of the Botany department, and a number of instructors and students were all who witnessed the laying of the cornerstone. Copies of city newspapers, the Daily Nebraskan, the 1916 Cornhusker, university catalog, and a number of photographs were sealed in the box placed within the cornerstone. Included in the photographs were pictures of Chancellor Avery, Prof. H. H. Nicholson, first head of the chemistry department, **Prof. Rachel Lloyd, the second head,** [emphasis added; Note: Lloyd served as acting chair of the department in Spring 1892] and photographs of the chemistry societies. A number of chemicals were also placed in the stone."

The statement that there was a photo of Dr. Lloyd in the box was intriguing because the nomination for her to become a National Historic Chemical Landmark (NHCL) was being assembled. As the first woman from the United States to earn a doctorate in chemistry, she became the first female faculty member at a co-educational research institution, the University of Nebraska, where her research contributed strongly to the construction of the Sugar Beet industry in Nebraska (11-14). Lloyd's other legacy is that she encouraged many young women to pursue chemistry graduate and undergraduate degrees. In the 1880s and 1890s, such encouragement was extremely rare at research institutions throughout the world. When she "retired" from the University in 1894 for health reasons possibly related to overwork, her numerous friends and colleagues were very sad to see her leave.

The American Chemical Society (ACS) created the NHCL program in 1992 "to enhance public appreciation for the contributions of the chemical sciences to modern life in the United States and to encourage a sense of pride in their practitioners" (15). More than half of landmarks (40 out of 69) have been for products or processes such as Bakelite and catalytic cracking, about one-third (19

out of 69) have been for the life's work of prominent historical figures such as Joseph Priestley and Percy Julian, and the smallest number (10 out of 69) have been for a place that was the site of numerous seminal findings or is an archive. It became desirable to find a high-quality photo of Lloyd because her only known photo was from the 1895 University of Nebraska yearbook that used the low-resolution dithering process (Figure 2a). Even so, it was reproduced in the important biographical sketch about Dr. Lloyd written by Creese and Creese (11) and then on a wide range of websites.

***Figure 2**. a) Rachel Lloyd's photo from the 1895* Sombrero*, the University of Nebraska's Yearbook. All the photos in the yearbook were reproduced using a method called dithering that relies upon different sized dots.*

b) Rachel Lloyd's much higher resolution photo found in the time capsule. It was the frontispiece of In Memoriam *published after her death by her brother-in-law Clement Lloyd in 1900.*

Soon after finding the 1916 article, the possibility of opening the cornerstone was explored. Besides knowing that it contained newspapers that are prone to decay, a major concern was that vapors or liquids from the chemicals might have escaped to oxidize or dissolve the photos. Since there is no established protocol for opening time capsules, a request for information was submitted to the UNL Chancellor's office. The response was encouraging because it included a protocol: identify funds for the removal and replacement of the cornerstone; provide a justification that is more substantial than planning a nomination; and obtain permission from the Chemistry Department and the units that were presently occupying Avery Hall (Table 1).

Table 1. Units Located in Avery Hall since 1919.

Program	**Years of Occupation**
Department of Chemistry	1919-1970
Department of Chemical Engineering	1958-2003
College of Journalism and Mass Communications	1972-2002
Women's Studies Program	1998-2003
Department of Computer Science and Engineering	2004-present
Department of Mathematics	2004-present
Center for Science, Mathematics, and Computer Education	2004-present

In late 2013, Dr. Rachel Lloyd was accepted to become a National Historic Chemical Landmark (16, 17). Her nomination had been submitted by the Executive Board of the ACS Nebraska Local Section because she was our earliest ACS member (she joined in 1891), had been an early faculty member at the University of Nebraska (from 1887-1894), had helped launch Nebraska's beet sugar industry (contributing to the state's economy ever since), was a founder of the Nebraska Local Section (in 1895), and had inspired many women to pursue chemical degrees. With the NHCL acceptance in hand, everything fell into place—the cornerstone was removed and the time capsule recovered (18-24).

Contents of the Avery Hall Time Capsule

The time capsule had dimensions of 15 in. × 15 in. × 10 in. and had been created by bending and welding several long copper metal sheets together. The top had to be pried open to gain access to the contents because all the joints were soldered and there was no latch. The

exterior of the box had a dusty verdigris oxidation while the interior had the characteristic red-brown color of copper metal. The contents were assembled in seven layers, each sending a different message.

The topmost layer identified the date and contemporary events when the capsule was sealed. It consisted of four newspapers (Figure 3): *Lincoln Daily Star* of 8 June 1916, *Lincoln Daily News* of 8 June 1916, *Nebraska State Journal* of 8 June 1916, and the *Summer School Nebraskan* of 7 June 1916. Some headlines were about the U.S. military build-up as the Great War stagnated in Europe. The U.S. entered the war one year later in April 1917. Other items in the box were also dated June 7th and 8th, giving a very good reckoning of the day the box was sealed. One problem associated with the practice of adding newspapers is that the acidic paper causes significant browning of the newspaper itself and adjacent items. Both outcomes had taken place in this time capsule. In addition, the topmost newspapers were also spotted with fungal growth.

***Figure 3**. a) Newspapers were the last items placed in the time capsule and the first to be removed.*

b) The headline of the Lincoln Daily News *describes military operations related to The Great War.*

The second layer was a yearbook, a bulletin, and a stack of envelopes. The yearbook and bulletin provide context about the university's operations. The yearbook was from the College of Pharmacy and is dated 1916. Mary Louise Fossler, Assistant Professor of Chemistry, helped found the School of Pharmacy in 1915. Her photo in the Pharmacy yearbook indicates that she taught organic chemistry. Of the ten pharmacy faculty, there were two other women—Elsie Day and Leva B. Walker. Day was an instructor of pharmacognosy, the knowledge associated with extracting therapeutics from plants, at the university since 1909. There was also a Pharmaceutical Garden on campus near the Chemical Laboratory building. Walker had been hired to teach botany by the pharmacy school in 1915. The College of Pharmacy and Department of Chemistry were both located in the Chemical Laboratory when the time capsule was created. When the Chemistry Department moved into the New Chemical Laboratory in 1919 (renamed Avery Hall in 1948 when the chemical engineering addition was completed), the Pharmacy School remained in the Chemical Laboratory until it was torn down in 1958 to make way for the Sheldon Art Museum. *The Bulletin of The University of Nebraska* was for the 1915-1916 academic year. There were five sealed envelopes, one of which is labeled "Colors of the Nebraska Section; American Chemical Society; Eosin Pink & Malachite Green." Although it is not known why these colors were chosen, both were synthetic dyes used in cell staining, a topic taught by Prof. Mary Louise Fossler in her organic chemistry course. The 2014 board of the ACS Nebraska Local Section was not aware that its early members had chosen specific colors—a hot pink and a bright green—but immediately began using them again.

The third layer in the box was the 20 May 1916 issue of *Chemical Abstracts* with several loose pages inserted. *Chemical Abstracts* was a periodical published by the ACS that was used by researchers to keep up with the literature because it contained a cross-referenced abstract of every published chemical article, meeting presentation, and dissertation. The stamp on the cover indicates that it was the property of the Chemistry Department Library. Apparently, the symbolism of its addition to the time capsule outweighed the loss of research productivity by its absence from the library. One of the loose pages inside the issue lists the final grades for several chemistry courses. Sixteen students took Chem 4, which was Organic Chemistry 2, taught by Fossler. The sole female in the Spring 1916 course earned the top score. Ten students took Chem 14, which was Food and Sanitary Chemistry taught by Fossler in Spring 1916. Only one student in that course was male. Four students earned grades in Chem 16, which was Advanced Organic Chemistry, taught by Fossler in Spring 1916. Two students earned grades

in Chem 34, which was Physiological Chemistry, also taught by Fossler in Spring 1916. The other loose pages were the final exams in Chem 3 and 4, basic organic chemistry, respectively taught by Fossler in Fall 1915 and Spring 1916.

The fourth layer contained photographs, communicating that it was about the people in the chemistry department. On top was a large print of Henry Hudson Nicholson, the Department's first chair. The script on the photograph doesn't give Nicholson's name but it does provide a distinguishing description, "Professor of Chemistry and Director of the Chemical Laboratories, 1882-1905." He hired Dr. Rachel Lloyd for the University in 1887.

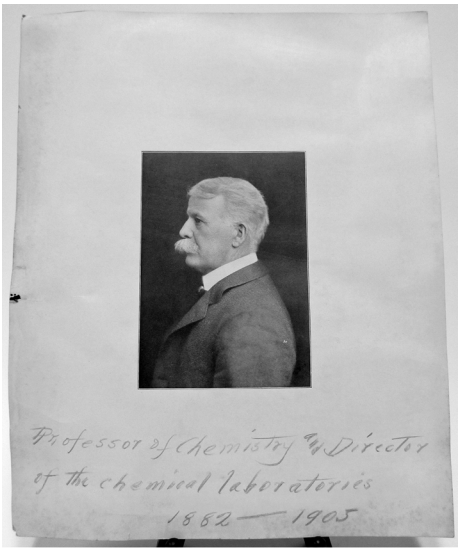
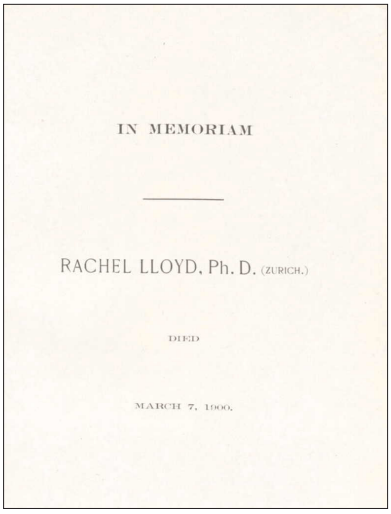


***Figure 4**. A photograph of Henry Hudson Nicholson as promised by the article in the* Red Cloud Chief *of 1916.*

A small white book was located immediately below Nicholson's photo. It was the world's only known copy of *In Memoriam: Rachel Lloyd, Ph.D*. (Figure 5), a biography by her brother-in-law Clement Lloyd (25). The book has now been digitized and is available online (26). Clement self-published the book after her death in 1900 and used an un-dithered image of her 1895 photo as the frontispiece (Figure 2b). It was the only photograph of Lloyd in the time capsule. The book provided insights and details about Lloyd's life that were not available anywhere else. For example, when she was on vacation in the Black Hills of South Dakota in summer 1892, she suffered partial paralysis on her right side from which she never fully recovered. Prior information indicated she had health problems (11, 12, 14) but there was no indication it was a debilitating stroke.


IN MEMORIAM

RACHEL LLOYD, Ph. D. (ZURICH.)

DIED

MARCH 7, 1900.

***Figure 5**.* In Memoriam: Rachel Lloyd, Ph.D. *title page privately published by Clement Lloyd in 1900.*

There were four photographs inserted between the pages of *In Memoriam*—portraits of Fossler and Samuel Avery (Figure 6), and two group photos of the Charter Members of Iota Sigma Pi (Figures 7 & 8). Fossler and Avery had known Rachel Lloyd when they were undergraduates and were now at the University as faculty in the chemistry department. In 1916, Fossler was an Assistant Professor of Chemistry while Samuel Avery had quickly risen to become Chancellor (27, 28). Avery earned his Chemistry B.A. from the University of Nebraska in 1892, his Chemistry M.A. in 1894, and then his Chemistry Ph.D. from the University of Heidelberg in 1896. He returned to Nebraska where he joined the Department of Agricultural Chemistry, became its Chair in 1902, and then the Chair of Chemistry when the two Departments merged in 1905. Next, he served as Chancellor from 1909 until 1927, making him the longest serving

***Figure 6**. Photographs of Mary Louise Fossler and Samuel Avery were inside the copy of* In Memoriam*. They had known Lloyd when they were undergraduates.*

Chancellor at the University of Nebraska. Unexpectedly, there are no photos of the other faculty from 1916—Chair Benton Dales or the new Assistant Professor Clarence Frankforter—perhaps because neither had ever met Lloyd. Also missing from the time capsule were photos of Rosa Bouton and John White, faculty who had been in the Department with Lloyd but were no longer at the University in 1916.

The Iota Sigma Pi chemistry honors society for women was created at the University of Nebraska during the Fall 1912 semester when Fossler and undergraduate Ruth Squires Winchester proposed its creation (29). Within a few months, the group had written a constitution and chose their name as an abbreviation that they translated as "Go, Scientists, Forward." Iota Sigma Pi gave fellowships to women who were pursuing a chemistry degree and encouraged women to become research assistants. The first officers were Edna Miller Gish as President and Ruth O'Brien as Secretary (Figures 7 & 8). The obverse of Figure 7 reads: "—Iota Sigma Pi—; Honorary Chemical Sorority for women. Founded at the University of Washington Oct. 7th, 1911. Charter granted to Nebraska Mar. 24th, 1914."

In Fall 1913, the Nebraska club reached out to Chi Alpha Pi at the University of Washington to propose forming a national society. Chi Alpha Pi was chartered on 7 October 1911 as a women's chemistry honors society. The women at UW were amenable and, on 24 March 1914, the two chapters merged. Nebraska became the Nitrogen Chapter because that element has the same symbol as the state, and Washington became the Oxygen Chapter because oxygen is important for combustion and they hoped to unite with many other chapters. The two chapters agreed to use Iota Sigma Pi as the name of their national organization and Chi Alpha Pi as their motto—because it stands for "Sisterhood for the Advancement of Chemistry."

In January 1916, three more chapters were added when Iota Sigma Pi merged with Alchemeia, a women's chemical honors society in California. The three new chapters were at the University of California in Berkeley (Hydrogen Chapter, for the mother of all elements), Stanford University (Carbon Chapter, "because we may be small but we are everywhere"), and the University of Southern California (Sulfur Chapter, because S also means south and because sulfur is found in nature). Since the Berkeley chapter had been formed earliest, in 1902, they became the mother house.

Figure 7*. Photo found between the pages of* In Memoriam *shows Fossler (wearing the hat) and the charter members of Iota Sigma Pi in front of the Chemical Laboratory, possibly taken on 24 March 1914. The obverse lists the women as (left to right): Etta Carpenter, Geraldine Kauffman, Susanne Parsons, Edna Miller Gish [President], Ruth O'Brien [Secretary], Mary L. Fossler [Faculty Advisor], Ruth Squires, Sylvia Smith, Nell Ward, and Barbara Osborne.*

Figure 8*. A second photo of the Iota Sigma Pi charter members in which they rearranged their positions compared to the first. This photo is not labeled on the back but they are (left to right): Barbara Osborn, Susanne Parsons, Catherine Kauffman, Ruth O'Brien (1915 M.A.), Prof. Mary Fossler, Edna Miller (1915 M.A.), Nell Ward (1915 M.A.), Ruth Squires, and Etta Carpenter.*

Three of Nebraska's Iota Sigma Pi charter members earned chemistry graduate degrees based on original research. Nellie Marguerite Ward earned her M.A. in 1915 working with Profs. Dales and Fossler on "Chrysophanic Acid as an Indicator [of pH]." President Edna Miller Gish earned her M.A. in 1915 working with Prof. Dales

on "The Magnesia Method for the Separation of the Yttrium Group Earths." Secretary Ruth O'Brien earned her M.A. in 1915 working with Prof. Fossler on "Synthetic Indigo and its By-products." Among all the charter members, O'Brien's career advanced the farthest when she ultimately became the USDA division head for Textiles and Clothing at the Bureau of Home Economics in 1923. In fact, O'Brien has been described as "a dynamic personality that rose up in wrath at the suggestion that 'girl chemists' learn how to type instead of aiming for jobs in laboratories" (30).

The fifth layer of the time capsule was packed with a clay brick (Figure 9), many objects wrapped in paper (Figures 10, 11, 12), and a large tube in the green box (not shown). This layer is about the student research and the objects demonstrate the skills and knowledge they learned. The brick (Figure 9) was made by George Borrowman who dated it June 8, 1916. Borrowman was the first graduate student to earn a Ph.D. from the department, a feat he achieved in 1916. He earned an M.A. in 1907 from the Department working for Prof. Avery on "Chemistry of the Disintegration of Cinder Concrete: Some Nebraska Sands." In 1912, he returned to the department to work on "The Clays of Nebraska," under the joint tutelage of Prof. Dales and Geology's Prof. George Barbour. While analyzing the Nebraska clays, Borrowman devised a way to create green sand that could be used to soften water, a process he patented in 1920 (U.S. Patent No. 1,348,977) and then sold to many cities across the United States, including Chicago where he set up his business (31).

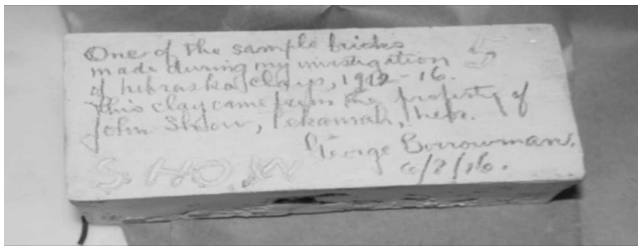


***Figure 9**. This brick was made by George Borrowman, who earned the Department's first Ph.D. in 1916. His message written in pencil says, "One of the sample bricks made during my investigation of Nebraska's Clays, 1912-1916. This clay came from the property of John Show, Tekamah, Nebr."*

George Borrowman.
6/8/16.

The wrapping paper around some of the bottles had been partially burned away by the chemicals, especially the bottle containing stannic alizrate [*sic*] (Figure 10, far right bottle). The alizarin ion complexes may have been contributed by Josephina Estella Graves who earned her master's in 1919 under Fossler's direction for her thesis "Processes with Nitrous Acid on Alizarin." The copy of Graves' thesis in the University of Nebraska Archives includes several pages of dyed cloth samples. Among the other items, a rubber stopper capping one bottle (Figure 11, top bottle) was now granular and emitted a sulfurous odor. The odor from the time capsule was quite strong at this level.

***Figure 10**. The fifth layer contained jars of chemicals wrapped in paper (top). When unwrapped (bottom), the bottle labels were: Ferric Alizarate, Synthetic Indigo, Cerium Rare Earths Fractionated, Alizarin, Chromic Alizarate, and Stannic Alizrate.*

***Figure 11**. Other objects that had been wrapped in paper were a bottle with a decayed rubber stopper that contained many test tubes and to which a note is attached with wire, a sealed glass tube with a note inside that says "G.E. Lewis," a sealed tube that says, "Theta of Alpha Chi Sigma," and a sealed tube that says "Mr. Donald D. Dow."*

The tube that read "G. E. Lewis" contained a photograph labeled "Spectra rare earths; G. E. Lewis" (Figure 12). Garland Edison Lewis was the second student in the

department to earn a Ph.D. His 1917 thesis on "Contributions to the Chemistry of the Rare Earths of the Yttrium Group" was guided by Dales. Four years earlier, in 1913, Lewis had earned his M.A. for "Products of Bacterial Action on Sugars." Even though his master's thesis advisor is not listed, this topic was in Fossler's area of expertise.

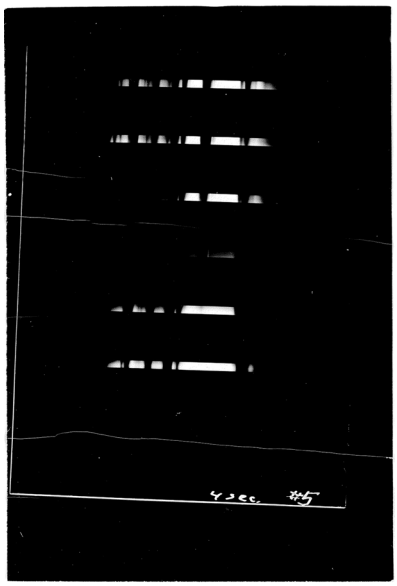
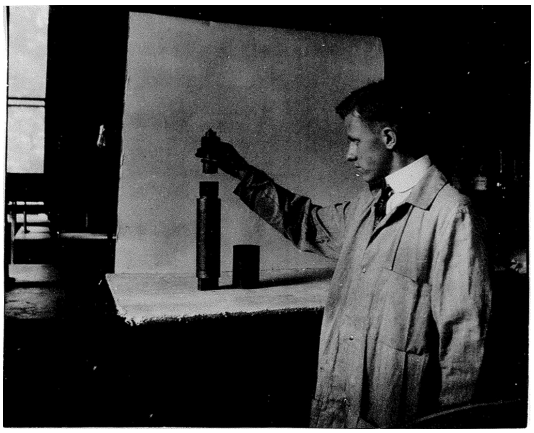


***Figure 12**. This photo was in the tube labeled "G. E. Lewis." The back of this photo says: "Spectra rare earths G. E. Lewis."*

The tube in the green box contained two photos (Figure 13) and an explanatory note, all from Herbert Giles Tanner, who earned an M.A. in 1916 for "Preparation of Anhydrous Yttrium Chloride" under the guidance of Dales. One of the photos is enigmatically titled "Oyster Soup" (Figure 13a) and another shows him with his reaction bomb (Figure 13b). The explanatory note gives a summary of his research:

> At present no very satisfactory method of separating the yttrium group earths is known. Dr. Dales thought an investigation of the addition products of the anhydrous chlorides with various organic substances might prove of value. Large amounts of the anhydrous chlorides are necessary. It was found that such could be prepared by heating the rare earth oxides with carbon tetrachloride under pressure. Since glass tubes are found insufficient to withstand the necessary high pressure a steel bomb, shown in the photograph, was constructed. 6/8/16; Herbert G. Tanner

***Figure 13**. a) This photo from the tube in the green box shows about thirteen young men and is titled, "Oyster Soup." The fellow closest to the camera appears to be Herbert Tanner.*



b) This photo is titled, "Herbert G. Tanner; June 8, 1916."

The sixth layer included a mimeographed list of Faculty in the Chemistry Department (not shown) and a copy of [*Wohler's*] *Organic Chemistry* that had been translated by Ira Remsen at Johns Hopkins (Figure 14). The textbook was signed one year earlier by "Mary L. Fossler" and is likely the one she used to teach her organic chemistry course. The textbook cover was in an advanced state of fungal decay and was a major contributor to the unique odor of the time capsule.

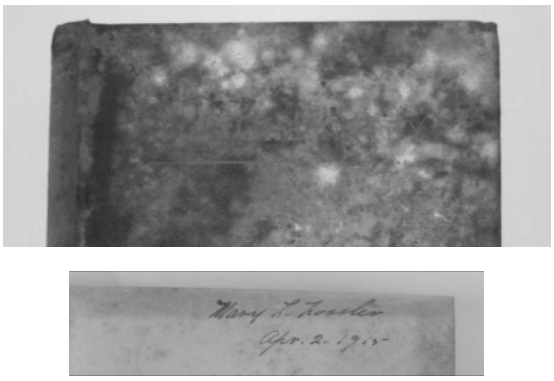


Figure 14*. a) The cover of Organic Chemistry was in a state of decay due to fungal growth. b) Mary Fossler signed her name on the textbook's first page on April 2, 1915.*

The seventh and bottom-most layer comprised an envelope and a business card. The engraved business card was from the University's construction supervisor, E. L. Goldsmith. The envelope was from B. J. Jobst, General Contractor for the New Chemical Laboratory, which was later renamed Avery Hall. Inside the envelope was a letter on Jobst's business letterhead dated June 7, 1916. Here is the letter reproduced with original spelling and punctuation:

> Gentlemen,:
>
> B.J. Jobst, member of St John,s lodge #25, and contractor of this building requests that when this box is opened the Hon. Board of Regents at this time forward same to my decendents.
>
> It is with a feeling of gratitude that the names hereto affixed join me in the hope that this building may serve as a monument to all modern construction of this time.
>
> B.J. Jobst was born in Peoria, Ill, May 12th-1862 to Emma S. Jobst. Emma Shertz His wife born Jan. 28th-1862 in Limestone, Township, Ill.
>
> Signed B. J. Jobst

Regrettably, Jobst's two children died 20-30 years ago without leaving any descendants.

Replacing the Avery Hall Time Capsule

Before the replacement cornerstone was cemented into place, a new time capsule was created to fill the void where the original had been. Items were collected from the programs that had occupied Avery Hall in the past 98 years (Table 1) with the suggestion to outline their past and present using objects and a few documents.

Mary Louise Fossler's Education and Early Career

If time capsules tell us about the people who assemble them, then this one certainly tells us about the University of Nebraska chemistry department. Perhaps even more so, however, this time capsule tells us about Prof. Mary Louise Fossler because more than half the items have a connection to her life as a student, teacher, researcher, or advisor. In 1916, when she assembled the time capsule, she had been active in the Department for over two decades. The lamentable part of her story is that she left the University of Nebraska within three years of creating this time capsule and probably never had a laboratory or office space in Avery Hall. In retrospect, 1916 was probably a high point in her career.

The Fossler family was among the earliest pioneers of Lancaster County (Figure 15). Her parents had immigrated separately with their parents in the 1850s from Germany to Lima, Ohio, where they met and married. After having two children, George and Mary Louise, the young family moved in 1868 or 1869 to a farm just north of Lincoln. The nearby town of Raymond was platted a decade later. In the earliest years, farm parents in the area took turns teaching the local children in their homes (32). By 1874, when Mary Louise was seven years old, the first schoolhouse was constructed. Unless they were educated at home by their own mother, the Fossler children would have been educated in this school until 1893 when a new two-room schoolhouse was built.

Figure 15*. The Christian and Katherine Fossler Family circa Summer 1886 in Lincoln. From the left: Christine 14, Christian 49, Mary 18, Margaret 8, Mabel 2.5, George 21, Kate 41, Anna 12.*

After growing up on the farm, Mary Fossler earned her Chemistry B.A. in 1894 (Table 2) and, as mentioned earlier, was an undergraduate laboratory assistant for Dr. Rachel Lloyd. The family obviously valued higher education because Fossler's sisters also earned degrees at the University of Nebraska—Christine, 1893 B.A. and 1904 M.A. Education; Anna, 1895 B.Sc. Zoology; Margaret, 1900 B.Sc. Education; and Mabel, 1907 B.A. Chemistry. Prior to his death in 1898, her brother George earned a teacher's certificate in 1888 at Nebraska State Normal School, taught school, took courses for two years in the University of Nebraska medical program, and then worked for several years at the Nebraska Experiment Station. The family moved to Lincoln around the time of son George's death.

Table 2. Mary Louise Fossler's Training and Career

Academic Training
1894, Chemistry B.A., University of Nebraska (Research Mentor: Dr. Rachel Lloyd)
1898, Chemistry M.A., University of Nebraska (Research Advisor: Dr. Samuel Avery)
Summer 1900, 1901, 1903, Attended University of Chicago
Summer 1902, Attended Northwestern Univ. Med. School, Evanston, Illinois
Positions Held
1894-1896, Weeping Water [*Nebraska*] High School Principal
1898-1900, Adjunct Professor of Chemistry, University of Nebraska
1900-1904, Lecturer in Chemistry, University of Nebraska
1904-1908, Assistant Professor of Chemistry, University of Nebraska
1908-1919, Associate Professor of Physiology, University of Nebraska
1919-1933, Assistant Professor of Biological Sciences, University of Southern California
1933-1938, Emeritus Assistant Professor of Biological Sciences, University of Southern California

After two years as the principal of Weeping Water School, located 30 miles east of Lincoln (Table 2), Mary Louise Fossler entered the University's chemistry graduate program. She also joined the ACS in 1897, which makes her the fourth woman to become an ACS member and the third from Nebraska. Fossler earned her Chemistry M.A. in 1898—the twelfth graduate degree awarded by the department but only the second to a woman. Her advisor was Dr. Samuel Avery and her research concerned the synthesis of phenylglutaric acids, which she published in the *American Chemical Journal* (33). Fossler played an active role in the ACS Nebraska Local Section, serving on the Executive Board eleven times (1900-1909, 1915, & 1919) and as Vice President in 1910 and 1914. The other early female Executive Board members were Rosa Bouton (serving eight times between 1895 and 1907; Bouton was the first woman to earn a master's degree from the University of Nebraska Chemistry Department and the third woman to become an ACS member) and Mariel Gere (serving four times between 1902 and 1906; Gere earned her master's degree in 1899, one year after Fossler).

After earning her graduate degree, Fossler was hired as an Assistant Professor, making her the Department's third female professor (Figure 16). For the four summers from 1900 to 1903, she attended graduate courses at the University of Chicago and Northwestern University Medical School (Table 2). At Chicago, she was listed as a student "not as yet admitted to candidacy" and at Northwestern as a "Special Student." Although her intentions are not clear, she did not earn a degree from either place. Fossler must have been taking classes in physiological chemistry (now called biochemistry) because that's what she taught when she returned to the University of Nebraska in 1904 and because she was promoted to Associate Professor of Physiological Chemistry in 1908. It was around this time that Fossler's father Christian died in September 1906 in Lincoln at age 68.

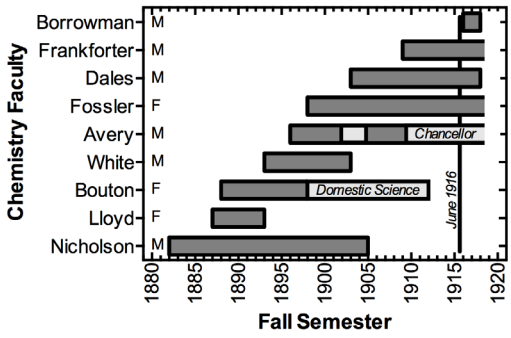


Figure 16. *Chemistry Faculty Timeline at the University of Nebraska, 1882-1918. Rosa Bouton left the Department in 1898 to found the School of Domestic Science at the University. Samuel Avery was Chair of the Agricultural Chemistry Department from 1902 to 1905 and became Chancellor of the University in 1909. The time capsule was assembled in June 1916.*

Fossler's second journal article was published in the *Journal of the American Chemical Society* about "A Safety Siphon" that was useful for preventing spillage

when transferring precise but small volumes from a medium or large container (34). She devised it for the students in her Food and Sanitary Chemistry laboratory. Fossler was also an active promoter of membership in science clubs. Although she was the only female member of the Chemistry Club when she joined in 1907 as a faculty advisor, there were several female members by 1912. Described earlier was her role in co-founding Iota Sigma Pi in 1912 and then serving at the Nebraska Chapter's faculty advisor until 1919 when she left the University of Nebraska.

Fossler was an active research advisor, especially for the young women. Between 1913 and 1919, thirty-two students earned master's degrees in the Chemistry Department, seven of them under Fossler's direction. There are an additional two students who do not list an advisor in their theses but whose projects are in Fossler's area of expertise. The only colleague who advised more students during this period was the Chair, Benton Dales—fourteen by himself and two as co-advisor. Of the six women who earned master's degrees during this period, four of them were advised by Fossler, one was advised by Dales, and one was advised by Fossler and Dales.

Fossler's Life and Career After 1916

Even though Fossler was at the top of her academic game in 1916, her clearly reasoned thoughts against the U.S. entry into the Great War had a negative impact on her career. By 1916, the federal government decided it would be best to join the war that had been raging in Europe since 1914 so it began a campaign to sway the public's opinion. As part of a wider dialog in newspapers and magazines during 1917, some faculty at academic institutions across the nation wrote about their sympathies for the German cause or about the unacceptable loss of young lives during any war. To clarify their position at the University of Nebraska, Mary Fossler co-wrote a peace petition that was signed by her and five faculty colleagues on April 2, 1917. Unfortunately, this was four days before the U.S. agreed to join its British, French, and Russian allies in fighting the war. Over the next months, several Nebraska newspapers and State legislators called for the University to pressure its faculty to support the war. Even though Fossler's graduate advisor was the Chancellor at this time, he did little to mediate this pressure on his faculty perhaps because he strongly felt they should support the U.S. government's actions (35). In fact, by 1918, Chancellor Avery was called to Washington DC to serve nine months as assistant chairman of the chemical committee of the National Council of Defense. When the University of Nebraska Board of Regents finally convened its first hearing in June 1918, the very first action was to dismiss the charges against Fossler because there was no evidence that she lacked "aggressive loyalty" (35). The charges against most of the other faculty were eventually dropped, most often because they had already made statements that they supported the government's actions after war was declared.

Also in June 1918, the Nitrogen Chapter of Iota Sigma Pi hosted the first national meeting of Iota Sigma Pi at the University of Nebraska (29). Besides discussing a range of constitutional issues, the assembled members elected Prof. Mary Louise Fossler to a three-year term as President. Unfortunately, Fossler's career was disrupted at just this moment and she was unable to perform her national duties very effectively.

In Fall 1919, Mary Louise Fossler was an Assistant Professor of biological sciences at the University of Southern California (36). There are no statements that explain exactly why she left the University of Nebraska but two factors seem most likely. The first factor is that she may have felt less welcome at a University that had not supported her stance in favor of peace over war. In fact, several of the faculty who were investigated by the Regents in June 1918 left the University of Nebraska within a few years afterward. The second factor was that she was the only member of her family still living in Lincoln.

Fossler's specific choice of USC, which is in Los Angeles, is justified by the presence of her mother and sisters in nearby Pasadena. Fossler's sister Christine was the first in the family to move to Pasadena. In 1912, Christine and her husband moved there to teach at two different schools. They never had children but their presence in Pasadena served as a nucleus for the rest of the family. In 1916, Fossler's mother and two sisters, Margaret and Mabel, moved to Pasadena where they bought a small house. Margaret was a school teacher and Mabel took some classes at USC while also caring for their mother. When Mary Louise Fossler joined them in Fall 1919, they moved into a new house. The family was finally reassembled when Anna joined them in Fall 1921. Anna moved there to become one of the earliest librarians at the Southern Branch of the University of California, which was founded in 1919 and is now known as the University of California at Los Angeles.

While at USC, Fossler taught microbiology and physiology and, in 1925, even created a pre-medical physiological chemistry course, the precursor to today's

biochemistry 2. She also maintained her focus on students. Soon after she arrived, the young women in the USC Chemistry program chose her to be the faculty advisor for the Sulfur chapter of the Iota Sigma Pi. Even when she retired in 1933 at age 65, she continued to teach as an emeritus assistant professor. She taught her final course in 1938. It was in these latter years that she developed USC's first course in ornithology. She was a member of the Cooper Ornithological Club and the Pasadena Audubon Society and gave public lectures in both clubs. In June 1935, Fossler presented a talk about the Pacific Coast Division of the American Association for the Advancement of Science about "The Death of Hundreds of Cedar-Waxwings" (37). Apparently, hundreds of these birds settled upon some date palms on the cold, wet morning of March 19, 1935. Shortly after they ate their fill, they hemorrhaged, died, and fell to the ground. An autopsy of several birds led Fossler to propose that the cause was hydrocyanic acid, which had built up in the fruit after prolonged rains and whipping winds.

Mary Louise Fossler died 22 January 1952 in Pasadena at age 84. She is buried with her mother and all four sisters in Mountain View Cemetery, Pasadena.

Mary Louise Fossler's biography was abstracted for two different compendia when she was still an active faculty member in 1921 and 1935 (38, 39). Shortly after her death in 1952, Fossler's scientific obituary was published in *The Auk*, the journal of the American Ornithological Union (40). Her career was summarized more recently in 1998 as part of Mary Creese's multivolume history of women chemists (12). Even so, these biographical sketches don't tell today's reader nearly as much about Fossler as do her selections for the time capsule of 1916. The contents of the time capsule tell us that she was inspired by Dr. Rachel Lloyd's example to use her considerable knowledge and skills to advance student research and interest in chemistry.

Conclusion

The Avery Hall time capsule provides a unique view of a maturing chemistry department in June 1916. It was created for the new and improved building that would house the chemistry department on campus. Unsealed in search of a photograph of Dr. Rachel Lloyd, the first woman to become a faculty member in the chemistry department at the University of Nebraska, its contents revealed so much more about the department's view of itself at the time. A few choice items about the chemistry department's origins, some contemporaneous items, and many unique items relating to the skills of its current graduate students were found. The departmental origins were signified by a list of all current and former faculty plus photographs of Hudson Nicholson, the first chair, Samuel Avery, a Nebraska chemistry student who was now chancellor, and Mary Louise Fossler, a Nebraska chemistry student who was now teaching organic and physiological chemistry. The photograph of Dr. Rachel Lloyd was inside a biography that described intimate details about her life that were not found anywhere else. As the world's first female chemistry professor at a research university, Lloyd's special legacy is that she and Nicholson created a culture in which both young men and young women were encouraged to earn chemistry degrees.

The bulk of the time capsule materials were connected to Fossler, strongly indicating that she assembled it. For example, she included a note saying she had been Lloyd's research assistant as an undergraduate. Fossler's German immigrant parents moved to a farm just north of the university when she was a child. All six of their children earned undergraduate degrees but Mary Louise was inspired to earn her master's degree in chemistry. Afterward, she joined the faculty to teach and mentor graduate research, which she did for almost 20 years. Ironically, Fossler never moved into the new chemistry building. Her public stance in support of peace right before the United States joined the Great War placed her at odds with the dominant sentiment, which must have been uncomfortable. She left Nebraska to join the Biology Department at the University of Southern California, undoubtedly because her mother and sisters were now residing nearby. The full impact of her Nebraska story was tucked away in the forgotten Avery Hall time capsule only to be discovered a century later.

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References and Notes

1. W. E. Jarvis, *Time Capsules: A Cultural History*, McFarland, Jefferson, NC, 2003.
2. *Centennial Safe*, two brochures (1 p. 7 pp), 1976, Office of the Architect of the Capitol: Art and Reference Division, Washington, DC.
3. G. E. Pendray, *The Story of the Time Capsule*, Westinghouse Electric & Manufacturing Company, East Pittsburgh, PA, 1939. Retrieved from archive.org/details/storyofwestingho00pendrich3 (accessed Nov. 3, 2017).
4. S. E. Hyman and S. C. McLelway, "Onward and Upward with Business and Science," *New Yorker,* Dec. 5, **1953,** *29*, pp 194, 196-206, 209-216, 219.
5. M. A. Brower, "How to Dedicate a Building," *AIA Journal,* Jan. **1972,** *57*(1), 27-29. Retrieved from www.ncmodernist.org/AJ/AJ-1972-01.pdf (accessed Nov. 3, 2017).
6. M. Cleveland, G. Goriesky, and A. N'Gadi, "Time Capsules," Smithsonian Museum Conservation Institute webpage, Washington DC, 1992, 2006, 2015. www.si.edu/mci/english/learn_more/taking_care/timecaps.html (accessed Nov. 3, 2017).
7. "A Time Capsule Helps Archivists to Look Back," *New York Times*, July 14, 1991, p 131.
8. P. Harrington, "UW [*University of Washington*] Time Capsule Spans Yawning Gap," *Seattle Times*, March 7, 1999, p B2.
9. "Newly Unearthed Time Capsule Just Full of Useless Old Crap," *The Onion*, Oct. 13, 1999. Retrieved from local.theonion.com/newly-unearthed-time-capsule-just-full-of-useless-old-c-1819565367 (accessed Nov. 3, 2017).
10. "Lays Cornerstone for New Building," *Red Cloud Chief* (Red Cloud, Nebraska), June 22, 1916, p 1.
11. M. R. S. Creese and T. M. Creese, "Rachel Lloyd: Early Nebraska Chemist," *Bull. Hist. Chem.,* **1995,** *17/18*, 9-14.
12. M. R. S. Creese, *Ladies in the Laboratory? American and British Women in Science, 1800-1900: A Survey of their Contributions to Research*, Scarecrow Press, Lanham, MD, 1998.
13. D. S. Tarbell and A. T. Tarbell, *The History of Organic Chemistry in the United States, 1875-1955*, Folio Publishers, Nashville, TN, 1986.
14. M. Rayner-Canham and G. Rayner-Canham, "Rachel Lloyd (1839-1900)," in *Women in Chemistry: Their Changing Roles from Alchemical Times to the Mid-Twentieth Century*, American Chemical Society & Chemical Heritage Foundation, Washington DC, 1998, pp 55-57.
15. American Chemical Society, "National Historic Chemical Landmarks,"www.acs.org/content/acs/en/education/whatischemistry/landmarks.html (accessed Nov. 3, 2017).
16. K. L. Lindblom, *Rachel Lloyd, Ph.D.: Pioneering Woman in Chemistry*, American Chemical Society, Washington, DC, 2014, 4 pp. Retrieved from www.acs.org/content/dam/acsorg/education/whatischemistry/landmarks/rachel-holloway-lloyd/rachel-lloyd-chemist-commemorative-booklet.pdf (accessed Nov. 3, 2017).
17. M. A. Griep, *Easy and Lucid Guide to a Knowledge of Rachel Lloyd*, Keepers Cottage Press, Lincoln, NE, 2014.
18. C. Dunker, "Time Capsule Pulled from UNL Building," *Lincoln Journal Star*, June 2, 2014. Retrieved from journalstar.com/news/local/education/time-capsule-pulled-from-unl-building-after-years/article_f3397473-3f3a-5504-b681-1c9588f49a26.html (accessed Nov. 3, 2017).
19. D. Gayman, "Rare Manuscript on Pioneering Female Faculty Member Found in Time Capsule," *UNL Today*, Oct. 14, 2014. Retrieved from news.unl.edu/newsrooms/unltoday/article/time-capsule-yields-rare-manuscript-on-pioneering-female-chemist/ (accessed Nov. 3, 2017).
20. M. A. Griep, "Chemistry Time Capsule," video, Lincoln, Nebraska, 2014, www.youtube.com/watch?v=toboeLOZJQ0 (accessed Nov. 3, 2017).
21. K. Howard, "Time Capsule Artifacts Put UNL Icon Rachel Holloway Lloyd in Her Element," *Omaha World Herald*, Oct. 19, 2014. Retrieved from www.omaha.com/news/metro/time-capsule-artifacts-put-unl-icon-rachel-holloway-lloyd-in/article_9f23afe9-98c9-577d-9698-82dc8c2b929c.html (accessed Nov. 3, 2017).
22. A. Ozaki, "UNL Professor Opens Time Capsule, Finds Treasure He Was Looking For," KETV news video,

Nov. 3, 2014. Retrieved from on.ketv.com/10n4WTO (accessed Nov. 3, 2017).

23. J. Sojico, "Who Is Rachel Lloyd?," Nebraska Educational Telecommunications broadcast, Oct. 1, 2014. Retrieved from netnebraska.org/article/culture/942293/who-rachel-lloyd (accessed Nov. 3, 2017).
24. R. Burks, "The Woman Who Saved the U.S. Space Race (and Other Unsung Scientists)," ACS Reactions video, Washington DC, 2015, www.youtube.com/watch?v=KFfdaWHRwTk (accessed Nov. 3, 2017).
25. C. Lloyd, *In Memoriam: Rachel Lloyd, Ph.D.*, privately published, Philadelphia, PA, 1900.
26. University of Nebraska Archives website, *In Memoriam: Rachel Lloyd, Ph.D,* unlhistory.unl.edu/legacy/rachell-loyd/rachellloyd.html (accessed Nov. 3, 2017).
27. R. N. Manley, *Centennial History of the University of Nebraska,* vol. 1, University of Nebraska Press, Lincoln, 1969.
28. R. E. Knoll, *Prairie University: A History of the University of Nebraska*, University of Nebraska Press, Lincoln, 1995.
29. A. T. Sherren and S. V. Vercellotti, *Centennial History of Iota Sigma Pi*, Iota Sigma Pi, 2005.
30. L. Przybyszewski, *The Lost Art of Dress: The Women Who Once Made America Stylish*, Basic Books, New York, 2014.
31. G. Borrowman, "Base Exchange Water Softening in the Chicago District," *Chem. Bull.,* **1931**(December), 299-300.
32. E. L. Brown, *History of Lancaster County: Then and Now,* privately published, Lincoln, Nebraska, 1971.
33. S. Avery and M. L. Fossler, "On α-Methyl-β-Phenylglutaric Acid," *Am. Chem. J.,* **1898,** *20*, 516-518.
34. M. L. Fossler, "A Safety Siphon," *J. Am. Chem. Soc.,* **1912,** *34*, 1398-1399.
35. "Chancellor Avery Says Few Faculty Members Passive: University Head Admits He Was Not Entirely Satisfied with Attitude of Instructors: Entertained Pacifist Views Months after America Entered the Struggle," *Lincoln Sunday Star*, June 2, 1918, pp 1 & 4.
36. University of Southern California, *USC Alumni Magazine*, December 1919.
37. M. L. Fossler, "The Death of Hundreds of Cedar-Waxwings," *Science,* **1936,** *83*, 185-186.
38. J. M. Cattell and D. R. Brimhall, Eds., "Fossler, Prof. Mary L(ouise)" in *American Men of Science: A Biographical Directory, Third Edition*, Science Press, Garrison, NY, 1921.
39. D. Howes, Ed., *American Women: The Official Who's Who Among the Women of the Nation*, Richard Blank Publishing Co., Los Angeles, 1935.
40. H. Howard, "Mary Louise Fossler," *The Auk,* **1952,** *69*, 493.

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