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ANNA JOHNSON PELL WHEELER: HER LIFE AND WORK

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Anna Johnson Pell Wheeler
(1883-1966)

SUMMARIES

This article describes the life, career, and research of the American mathematician Anna Johnson Pell Wheeler (1883-1966).

Cet article décrit la vie, la carrière, et les recherches mathématiques de la mathématicienne américaine Anna Johnson Pell Wheeler (1883-1966).

Dieser Artikel beschreibt das Leben, die Karriere und die mathematische Forschungen der amerikanischen Mathematikerin Anna Johnson Pell Wheeler (1883-1966).

Este artículo describe la vida, la carrera, y las investigaciones de Anna Johnson Pell Wheeler (1883-1966), matemática norteamericana.

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1. EARLY LIFE AND UNDERGRADUATE EDUCATION

Anna Johnson (later, Anna Johnson Pell Wheeler; she will be referred to hereafter as Pell Wheeler) was born in Calliope (now Hawarden), Iowa, on May 5, 1883. Her parents, Andrew Gustav and Amelia (Friberg) Johnson, were Swedish immigrants who came to the United States in 1872 and were subsequently married. The father, initially a farmer, later became a furniture dealer and undertaker in the small town of Akron, Iowa. Pell Wheeler was the youngest of three surviving children, the others being Esther, four years older, and Elmer, two years older.

It has been possible to trace Pell Wheeler's ancestry on her father's side; but all that is know about her mother, Amelia Friberg, is that she came from the same Swedish parish as her husband, Lyrestad in Skaraborglän, Wästergötland.

Pell Wheeler's parents, together with the rest of the Johannes Anderson family, settled originally at Union Creek in Dakota Territory. At Union Creek the extended family lived in a dugout hollowed from the side of a small hill.

Sometime in 1882 her parents moved across the Big Sioux River and a dozen miles north to Calliope (now Hawarden), Iowa. There are no extant school records to indicate whether Pell Wheeler entered school there. In 1891 or 1892 the Johnson family moved to Akron where she attended the Akron public school, which at that time offered instruction through the 11th grade.

In the fall of 1899 she entered the University of South Dakota, where her sister had already spent a year. After one year as a "sub-freshman" completing entrance requirements, she spent only three years to fulfill degree requirements. Her college transcript shows B's in English, physical culture, and history, and A's in German, Latin, French, chemistry, physics, and mathematics. The mathematics courses she took included:

1899-1900	College Algebra (3 cr.); Trigonometry (3 cr.).
1900-1901	Modern Geometry/Theory of Equations (3 cr.); Solid Analytic Geometry (3 cr.).
1901-1902	Calculus (6 cr.); Analytical Mechanics (6 cr.); Plane Analytic Geometry (passed by examination).
1902-1903	Theory of Substitutions and Potential (6 cr.); Partial Differential Equations and Fourier Series (6 cr.); Differential Equations (passed by examination).

Pell Wheeler and her sister, to whom she was very close, were in many of the same classes. Although Pell Wheeler was impatient with organizations, she participated in some extra-curricular activities, being secretary-treasurer of the French

club and class historian. As early as January 1900, however, her main interest lay in mathematics, for she wrote to her sister:

> *Sure, I would like to go to Europe. I could easily stay in Germany to study Mathematics since I know so much German already.* [Pell Wheeler et al. 1898-1912, A. Johnson to Esther Johnson, January 1900]

The inscription beneath her senior yearbook picture reads, "I know mathematics better than my own name" [*Coyote* 1904].

It was one of her mathematics teachers at South Dakota, Alexander Pell (1857-1921), who recognized that her mathematical ability was out of the ordinary and took an active interest in coaching her into a mathematical career [1]. The Johnson sisters roomed with Pell and his wife, Emma, who were both very popular on campus.

2. GRADUATE STUDY

After graduating from South Dakota in 1903, Pell Wheeler won a scholarship to the University of Iowa. In addition to taking five mathematics courses and a philosophy course, she taught a freshman mathematics course and wrote a master's thesis, entitled *The Extension of the Galois Theory to Linear Differential Equations* [Pell Wheeler 1904]. Her work won her election to the Iowa chapter of *Sigma Xi*. Obtaining a scholarship to Radcliffe, she earned a second master's degree in 1905. She stayed there an additional year on scholarship, continuing to take courses from M. Bôcher (1867-1918), C. L. Bouton (1869-1922), and W. F. Osgood (1864-1943). In 1906 she was one of five women who applied for the Alice Freeman Palmer Fellowship offered by Wellesley College to a woman graduate of an American college. Winning it, Pell Wheeler used the money to finance a year's study (1906-1907) at Göttingen University. One of the conditions of the fellowship was that the holder remain unmarried throughout her tenure.

While at Göttingen Pell Wheeler attended lectures given by D. Hilbert (1862-1943) and F. Klein (1849-1925), as well as H. Minkowski (1864-1909), G. Herglotz (1881-1953), and the astronomer K. Schwarzschild (1873-1916) [Pell Wheeler 1910a]. The field of integral equations was very active at the time, with Hilbert a leading figure, and it was in this field that most of Pell Wheeler's subsequent research was focused.

The Pells followed Pell Wheeler's career and kept in contact with her and her family. Pell was very proud of his former student, writing to her sister Esther:

> *I consider her something like a demi-goddess now, for whatever she wants she gets and whatever she studies she makes a success of.* [Pell Wheeler et al. 1898-1912, A. Pell to Esther Johnson, 1906]

In 1904 Pell's wife Emma died suddenly. Pell and Pell Wheeler continued to correspond; and finally, despite family objections to the age differential (25 years), they decided to marry.

In July 1907, upon the expiration of her fellowship, they were married in Göttingen. The couple returned to South Dakota, where by now Pell had become the first dean of the College of Engineering. Pell Wheeler taught two courses, theory of functions and differential equations, during the fall term of 1907-1908.

Pell Wheeler had not finished her doctoral work in Germany, and she returned there alone in the spring of 1908 hoping to complete it. Pell was quite lonely without her, but financial considerations prevented him from joining her for the summer.

> *I am awfully sorry I cannot go this summer to Germany but we must pay our debts and then we can live a little bit better, i.e., we may go to Germany next summer together.* [Pell Wheeler et al. 1898-1912, A. Pell to Esther Johnson, April 1908]

Pell Wheeler's parents came to accept Pell, and he spent time with them during the summer while she was away. By late fall Pell Wheeler was preparing to take her examination for the degree, for Pell wrote to her sister in November:

> *I send you the sample of Anna's dress goods--she has to appear before the examiner in a black dress. Oh, I wish this was all over and I could have her with me again. It is now 8 months since she is gone and I feel very, very lonesome.* [Pell Wheeler et al. 1898-1912, A. Pell to Esther Johnson, November 1908]

Pell had even more reason than his wife's absence to feel lonesome. A falling-out with the president of the University had resulted in Pell's resigning during the summer, and he was now in a new position at the Armour Institute of Technology in Chicago, in unfamiliar surroundings.

Apparently the final examination for the Ph.D. was imminent, and Pell Wheeler, according to her own description of the degree process, had almost completed the requirements [Pell Wheeler 1907/1908, 20:9]. However, for reasons unknown to the authors,

she did not complete the degree at Göttingen. In December her father wrote to tell her sister:

> *I donat know what Anna has wrote you, she send a card that she be her for Xmas.... I am disapointed over that Pell had Anna to com hom befor she was trough. I supose she got lonsom, when I got the card from Anna I mistrusted something just as it turn out. When you get hom I tell you what I think. Pell has not writen for a long time.* [Pell Wheeler et al. 1898-1912, A. G. Johnson to Esther Johnson, December 1907]

Later Pell Wheeler wrote to Mary Coes (1861-1913), Dean at Radcliffe (1909-1913):

> *In Göttingen I had some trouble with Professor Hilbert and came back to America without a degree.* [Pell Wheeler 1910c]

Whatever the reasons for her return without a degree, Pell Wheeler enrolled January 4, 1909, at the University of Chicago. There she pursued studies under E. H. Moore (1862-1932), the astronomer F. R. Moulton (1872-1952), and the astronomer and mathematician W. D. MacMillan (1871-1948). She took courses at Chicago for only a little more than a year:

Winter 1909 Spring 1909	General Analysis; General Seminar; Periodic Orbits.
Summer 1909	Observatory Work.
Autumn 1909	Theory of numbers; Integral Equations in General Analysis; Modern Analysis applied to Celestial Mechanics.
Winter 1910 Spring 1910	Theory of Algebraic Numbers; Integral Equations in General Analysis.

As she related to Coes:

> *Since my thesis had been written independently of Hilbert, I had a right to use it at C.U. And so after a year of residence I took my degree under Professor E. H. Moore with magna cum laude. I was the second woman to receive a Ph.D. in mathematics at the University of Chicago and the first woman to receive it under Professor Moore.* [2] [Pell Wheeler 1910c]

3. TEACHING: "...THERE IS SUCH AN OBJECTION TO WOMEN..."

After receiving the Ph.D., she sought a teaching position:

> *I had hoped for a position in one of the good univ. like Wisc., Ill. etc., but there is such an objection to women that they prefer a man even if he is inferior both in training and research. It seems that Professor Moore has also given up hope for he has inquired at some of the Eastern Girls' Colleges and Bryn Mawr is apparently the only one with a vacancy in Math.* [Pell Wheeler 1910c]

It was not then, however, that she went to Bryn Mawr. In the fall of 1910 she taught a class at the University of Chicago. During the spring term of 1911 her husband suffered a paralytic stroke and she substituted for him at the Armour Institute of Technology. Of this experience she wrote:

> *Mr. Pell was sick and they were practically forced to take me for they could not get a man. After a couple of weeks they told Mr. Pell he need not return this semester but take a good rest. I have fifteen hours of subjects in Math and have shown them that a woman is capable of doing a man's work in a technical school. The math men at the Univ. of Chicago were very much pleased that at last a woman had the chance to show her ability in such a place as Armour Inst. But I know it will take a great number of years, to break down the prejudice.* [Pell Wheeler 1910c]

Earlier in her career, Pell Wheeler had already earned a reputation for being a fine teacher. An unsolicited letter of recommendation from a former president of the University of South Dakota bore the following praise:

> *She gives all her mind and energy to her teaching and is always willing to assist individual students out of hours. She is instinctively kind and interested thus winning her students to her cause--and her own enthusiasm soon communicates itself to her students.* [Droppers 1910]

In the fall of 1911 she accepted a teaching position at Mount Holyoke College, where she remained until 1918. Hired

initially as an instructor, she was promoted to associate professor in 1914. In the same year she published a paper on linear equations in infinitely many unknowns [Pell Wheeler 1914/1915]. She also published a joint paper with Ruth L. Gordon on the highest common factor of two polynomials [Pell Wheeler & Gordon 1916/1917]. Despite his illness, her husband remained active mathematically, presenting research papers at meetings of the American Mathematical Society in April 1915 and April 1917. His only teaching, however, was a semester at Northwestern University during the academic year 1915-1916.

Pell Wheeler resigned her position at Mt. Holyoke in 1918 to accept an associate professorship at Bryn Mawr. Among the attractions at Bryn Mawr were its Ph.D. program and the prospect of becoming chairwoman when Charlotte A. Scott (1858-1931) retired [Pell Wheeler 1898-1912 et al., undated letter from Pell Wheeler to her sister Esther Johnson Hoagland]. She succeeded Scott as chairwoman in 1924 and was promoted to professor in 1925. Except for short periods, Pell Wheeler remained at Bryn Mawr as chairwoman until her retirement in 1948. Between 1922 and 1940 she supervised seven doctoral dissertations: Margaret Buchanan [-Cole] [1922]; Marion Cameron Gray [1926]; Laura Guggenbühl [1927]; Rose Lucile Anderson [1930]; Olive Margaret Hughes [1934]; Vera Ames [-Widder] [1938]; Dorothy Maharam [-Stone] [1940].

Pell Wheeler's early years at Bryn Mawr were marked by tragedy and only brief happiness. Her father died in 1920, followed three months later by Pell. In 1925 she married Arthur Leslie Wheeler, a classics scholar of note. Widowed in 1915, he had been at Bryn Mawr College for many years. He became professor of Latin at Princeton University just before their marriage. The couple moved to Princeton, and Pell Wheeler continued to lecture at Bryn Mawr College on a part-time basis. With reduced teaching, she was able to devote more time to her own research and to participate in the mathematical activities at Princeton.

The Wheelers purchased land in the Adirondacks and built a summer home there. In deference to both their academic interests, they named the place "Q.E.D." Pell Wheeler spent many happy hours there, enjoying the natural surroundings. Unfortunately the years with Wheeler were of short duration, for he died suddenly in 1932 of apoplexy. Pell Wheeler moved back to Bryn Mawr and took up full-time teaching duties.

4. RESEARCH: LINEAR ALGEBRA AND INTEGRAL EQUATIONS

Pell Wheeler considered her work to be centered on "linear algebra of infinitely many variables," a branch of what is known today as functional analysis. Her interest in it derived

from applications to differential and integral equations. Although she also pursued some purely algebraic results, her training was mainly in analysis, and she began her investigations at a time when functional analysis was emerging as a distinct area of mathematics.

Pell Wheeler investigated the linear integral (or *Fredholm*) equation of the second kind, $u(s) = f(s) + \lambda\int K(s,t)\ u(t)\ dt$, where f and K are known continuous functions, λ is a parameter, and the unknown is a continuous function u. (Her theorems also cover the more general case of L^2 functions.) The function K is known as the *kernel* of the equation, and the equation is *homogeneous* if $f = 0$. Taking up a technique suggested by Liouville and developed by Neumann and Volterra, Fredholm conceived of the equation as the limiting form of an $n \times n$ linear system of algebraic equations as $n \to \infty$. Cramer's rule then suggested to him the form of the solution to the integral equation (this was in 1900, when Pell Wheeler was in college). Fredholm's success encouraged Hilbert to investigate integral equations; and the next 10 years saw Hilbert lead his students, including Pell Wheeler, into the field [Steen 1973, 362-367].

Hilbert reconceived Fredholm's analogy by representing u, f, and K, in terms of an arbitrary complete orthogonal system of functions. Purely formal substitution followed by equating coefficients leads to the infinite linear system, $x_i + \Sigma_j K_{ij}\ x_j = f_i$, with i, j in N; the x_i are the Fourier coefficients of u relative to the orthogonal system, as are the K_{ij} and f_i for K and f. In 1904-1905 Hilbert and Schmidt employed properties of symmetric matrices to prove special results for a kernel that is symmetric, that is, $K(s,t) = K(t,s)$ for all s,t in $[a,b]$. In particular, the homogeneous integral equation is solvable for at least one real λ, called an *eigenvalue* of K; all countably many eigenvalues of K are real, and to each there corresponds a finite number of orthogonal solutions (*eigenfunctions*); and (the expansion theorem) any function representable as $f(s) = \int K(s,t)g(t)dt$, for some g, can be expanded in an absolutely and uniformly convergent series of orthogonal eigenfunctions w_i as $f(s) = \Sigma w_i(s)\int f w_i$. Biorthogonal systems and operators allowed Pell Wheeler to extend these results to a wider class of kernels, including what are now known as *symmetrizable* ones.

Pell Wheeler's doctoral thesis was published in two parts [Pell Wheeler, 1911a,b]. The first develops the theory of biorthogonal systems of functions, independent of its connection with differential and integral equations. In the second part the theory is applied to the theory of integral equations.

If $\{u_i\}$ and $\{v_j\}$ are subsets of L^2, the class of Lebesgue-square-integrable functions on an interval $[a,b]$, then $\{u_i\}$ and $\{v_i\}$ form a *biorthogonal* system if and only if $\int u_i v_j = 1$, whenever $i = j$, and 0 otherwise; the integration is from a to b. Each of the sequences of functions, $\{u_i\}$ and $\{v_i\}$, is referred

to as an *adjoint* system of the other. Biorthogonal systems were introduced by R. Murphy in 1833, and in 1905 E. Schmidt showed that they arise as the solutions of naturally associated ("adjoint") pairs of integral equations. In 1908 G. D. Birkhoff showed that they also arise as solutions of pairs of differential equations.

In [1911a] Pell Wheeler established necessary and sufficient conditions for associating an adjoint system with a system of linearly independent functions, gave conditions for a generalized principal axis theorem, $\int fg = \Sigma \int f v_i \int u_i g$, to hold, and classified biorthogonal systems into equivalence classes. The second result proved useful in [Pell Wheeler 1911b], where it afforded an expansion theorem for functions in terms of solutions to an integral equation. The definitive feature of the equivalence classes is a one-to-one correspondence with linear operators $T: L^2 \to L^2$ satisfying $\int f_1 T(f_2) = \int f_2 T(f_1)$ and $\int f T(f) = 0$, with $T(u_i) = v_i$. Each T, in turn, corresponds to a positive definite "limited" (bounded; see [Kline 1972, 1065]) quadratic form in infinitely many variables, so that the functional equation $f = \lambda T(f)$ has a solution exactly when the quadratic form corresponding to T has an eigenvalue.

Particular operators singled out for mention in [Pell Wheeler 1911b] include $T(f) = f$, $T(f) = f - (p\int pf)/\int p^2$ (p in L^2), and $T(f) = \int K(s,t) f(t) dt$. The first of these corresponds precisely to the Hilbert-Schmidt theory for symmetric kernels. Pell Wheeler used the second in [1909/1910a] to solve an integral equation with side condition, the operator transforming it to an equivalent equation with symmetric kernel. The third is used in [Pell Wheeler 1911b], and in slightly greater generality in [Pell Wheeler 1909/1910b], to yield the following result on symmetrizable kernels: if L is a kernel for which $M(s,t) = T_s L(s,t) = \int K(s,r) L(r,t) dr$ is symmetric, then L itself has all the desirable properties of a symmetric kernel.

Most of Pell Wheeler's further work followed from fundamental results appearing in [Pell Wheeler 1919a], which was presented to the American Mathematical Society in September 1910. This paper generalizes the results of [Pell Wheeler 1911b] to the context of infinite linear algebraic systems. The methodology is the same: to use a biorthogonal system of functions to reduce a given system of equations to one with a symmetric (infinite) matrix of coefficients. The main theorem asserts that if A is a "limited" (bounded; see [Iyanaga & Kawada 1977, 269, 854]) matrix for which there is a positive definite "limited" (bounded) symmetric matrix T such that AT is symmetric, then A has a nonempty set of eigenvalues, all of which are real. This result was applied in [Pell Wheeler 1919b] to a theorem on the Radon integral; in [Pell Wheeler 1922] to a particular pair of linear systems in two parameters; and in [Pell Wheeler 1927a] to establish a direct correspondence between linear algebraic

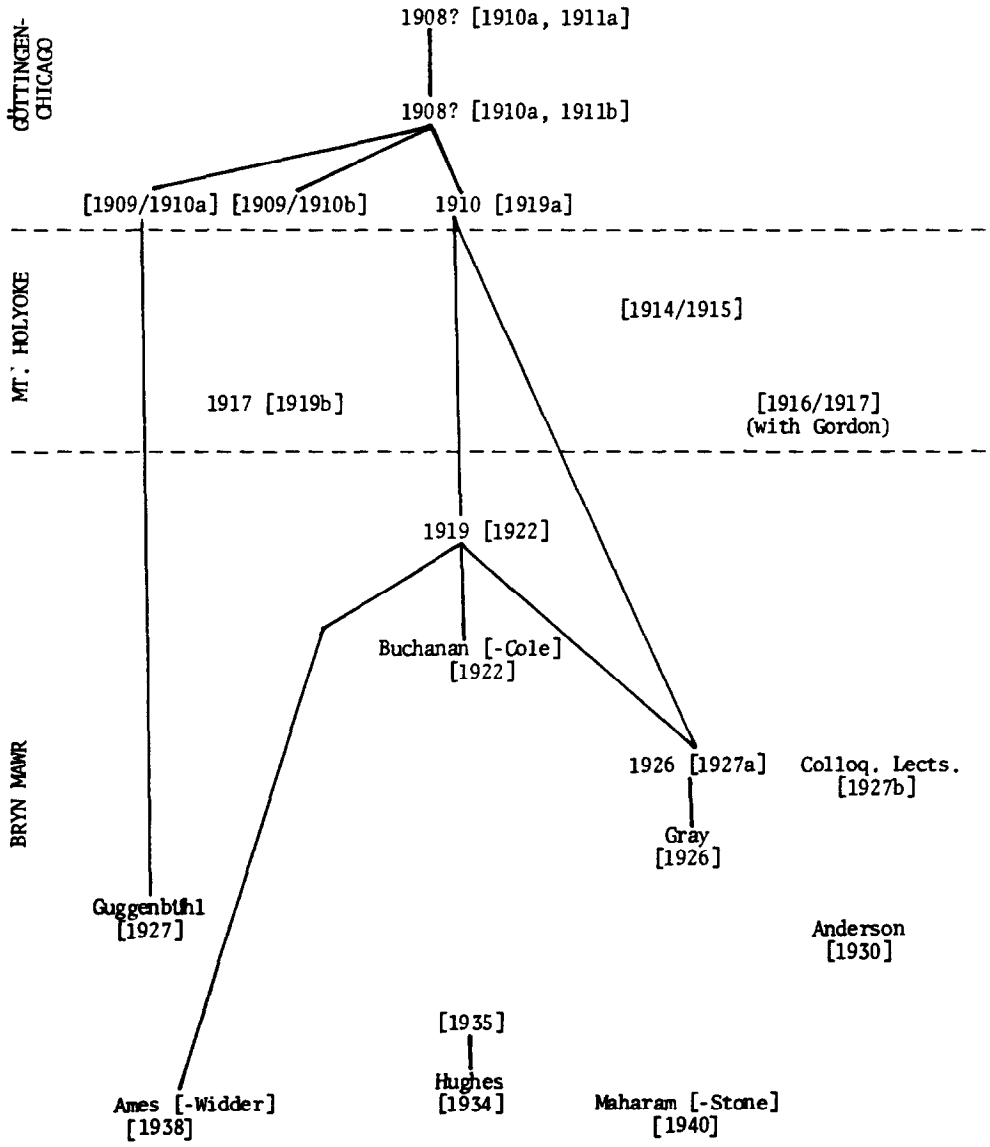

Fig. 1. Diagram of papers by AJPW and her students' theses. Unbracketed date: work done or announced.

equations and linear differential systems of the second order; and by her student, M. C. Gray, in a thesis on singular differential equations [Gray 1926].

Pell Wheeler's remaining papers are out of the mainstream of her work: [Pell Wheeler 1914/1915] is flawed by a false lemma; [Pell Wheeler 1935] investigates the spectrum of a special real matrix; and [Pell Wheeler & Gordon 1916/1917] patches up an algorithm of Van Vleck's for calculating the greatest common denominator of two polynomials. Several of her papers were followed by theses in the same area written by students. For example, [Pell Wheeler 1909/1910a] was followed by [Guggenbühl 1927], [Pell Wheeler 1922] by [Buchanan [-Cole] 1922], [Pell Wheeler 1927a] by [Gray 1926], and [Pell Wheeler 1935] by [Hughes 1935]. (See Fig. 1.) A few other papers were presented by Pell Wheeler but were not published.

Pell Wheeler was invited to give the Colloquium Lectures at the American Mathematical Society meeting in September 1927, the only woman so honored until Julia Robinson in 1980. The lectures, on the theory of quadratic forms in infinitely many variables and its applications, summarized and surveyed the broader scene in which her own work had contributed during the previous 20 years. The lectures were not published, but a detailed outline of topics is given in [Pell Wheeler 1927b].

5. RECOGNITION

Pell Wheeler was active both in the American Mathematical Society and in the Mathematical Association of America. She was appointed to the Board of Trustees of the former organization in 1923-1924, elected to the Council in 1924-1926, appointed to a committee on the use of accrued income from special funds in 1939, and presided over a section meeting on analysis in 1939. In 1926 the Association invited her to serve on a three-person committee to select the winner of the first Chauvenet prize for excellence in mathematical exposition. She participated in the Philadelphia Section of the Association, serving as its chairwoman in 1943-1944. From 1927 to 1945 Pell Wheeler was an editor of the *Annals of Mathematics*. In 1933-1935 she served on a College Entrance Examination Board Committee which formulated basic guidelines. In 1939 she was among those who petitioned for the establishment of an American analog of the German abstract and review journal *Zentralblatt für Mathematik und ihre Grenzgebiete* [Dresden et al. 1939].

Her professional achievements did not go unnoticed. The third edition of *American Men of Science* (1921) starred her name, indicating that she was considered prominent among American mathematicians. In 1926 she was elected to *Phi Beta Kappa*, and subsequently received honorary doctorates from the New Jersey

College for Women (now Douglass College of Rutgers University) (1932) and Mount Holyoke College (1937). In 1940 she was one of the 100 American women acclaimed by the Women's Centennial Congress as having succeeded in careers not open to women a century before.

Her teaching continued to draw accolades. She gave generously of her time, her money, and herself to her students. Needy students would often receive copies of books she claimed she no longer used. (New copies would appear forthwith on her shelves.) She would take graduate students with her to Q.E.D., her summer home, where she provided them with needed encouragement and necessary research time. Students felt free to talk to her about problems of all kinds that troubled them. Typical of their reactions are the following excerpts from letters:

> *I was deeply impressed by your interest in your students and even more by your feeling for mathematics.* [Bryn Mawr Archives 1948, letter of Vera Ames Widder]

or

> *I hope I will be able to pass on to some of my students a bit of the feeling for mathematics which you have given yours.* [Bryn Mawr Archives 1948, letter of Annita Tuller Levine]

She took students along to professional meetings at surrounding colleges and universities. As one student expressed it:

> *I like to recall the many meetings to which you took us and the advice and direction you gave us for entering into the meetings on an equal basis with the men instead of getting into a corner for a little hen party.* [Bryn Mawr Archives 1948, letter of Vera Ames Widder]

As an administrator, Pell Wheeler worked to enhance the national reputation of the Bryn Mawr mathematics department. Despite the financial effects of the Depression on the college, she tried to create an atmosphere for students and faculty in which there was ample opportunity for professional growth and development, as well as for free interchange of ideas. In the words of one of her colleagues:

> *I shall always look back on those years with deep gratitude that the opportunity was given me to share them with you. You never wavered. The shrine of*

> *mathematics didn't need any apologies. There was no compromising. There was work to be done and you kept the path free from pitfalls and blind alleys.*
>
> *You know,--when it comes right down to it,--you have not only been a mathematician and mathematics teacher,--you have been a sort of Institute for Advanced Study.* [Bryn Mawr Archives 1948, letter of Gustav A. Hedlund]

During her tenure as chairperson Pell Wheeler was instrumental in offering professional and political asylum at Bryn Mawr College to the eminent German-Jewish algebraist, Amalie Emmy Noether Pell Wheeler strove to get Noether an appointment in which the latter would be free to do research and consult with advanced graduate students. A group of Bryn Mawr students who were qualified to take part in advanced algebraic seminars was organized. Pell Wheeler laid plans to involve Noether in an exchange of graduate mathematics courses between Bryn Mawr and the University of Pennsylvania.

Unfortunately, Noether's association with Bryn Mawr was relatively brief. She died unexpectedly in 1935, following surgery, less than two years after her arrival in America. The Bryn Mawr community as a whole, and Pell Wheeler in particular, was deeply shocked by her death.

Pell Wheeler retired in 1948. Many of her students, colleagues, and friends contributed remembrance letters to the scrapbook [Bryn Mawr Archives 1948] presented to her at a testimonial dinner. In 1964 a mathematics graduate seminar room was set up at Bryn Mawr College and named after her. Retirement for Pell Wheeler, however, did not mean complete withdrawal from mathematics. As long as she was physically able, despite recurring severe bouts of arthritis, she attended mathematical meetings. She kept in touch with many of her students, taking great pride in their achievements. She also traveled, spending most of her summers at Q.E.D. Throughout her life she always enjoyed the out-of-doors. Bird watching, hiking, fishing, wildflowers--all of these gave her great pleasure.

Her continuing activity in retirement is related by one of the new friends she made:

> *I first met Anna Pell Wheeler at a colloquium at the University of Pennsylvania in the Fall of 1951.... An attractive woman of dignified bearing walked up, stood directly in front of me, and said, "Who are you?" I introduced myself, and she said again, "Who are you and what are you doing here at this colloquium?" When I explained my background she told me that she was Anna*

> *Pell Wheeler, a faculty member at Bryn Mawr College, and she was interested in women who were graduate students....*
>
> *During the academic year 1954-1955, ... Mrs. Wheeler came up* [to me at colloquium] *and with a smile said, "Have you had any interesting correspondence lately?" ...* [I replied] *"Yes, I have a letter from Wellesley asking if I would be interested in applying for a position, but of course I can't because John and I will be in New Haven next year." She smiled broadly and said, "They wrote and asked me if I knew a young woman who would be a good faculty member for them. They did not ask me whether or not she would be available. I wrote and suggested you. I think you need to know the women at Wellesley, and I think they need to know you."* [Barrett 1979]

Pell Wheeler suffered a stroke early in 1966 and died a few months later on March 26, at the age of 82. According to her wishes, she was buried in the Lower Merion Baptist Church Cemetery at Bryn Mawr beside Alexander Pell. A memorial service was held at Bryn Mawr College in which she was eulogized by her colleague John Oxtoby.

NOTES

1. Alexander Pell (1857-1921) had been a civil engineer in the Russian military. After emigrating from Russia he enrolled at Johns Hopkins in 1895, from which he received a Ph.D. in mathematics in 1897. After an additional year there as a Fellow, he came to South Dakota. He was very active in research for the next several years, reading papers at meetings of the American Mathematical Society and publishing in its journals. In fact, he was at the peak of his powers during the years Pell Wheeler was a student. While he was at South Dakota, little was known publicly of his background other than the fact that he had been a Russian revolutionary who sought sanctuary in the United States [Akeley 1921]. It was not until long after his death that the University community realized that Alexander Pell had formerly been a Russian double agent forced to leave Russia, fleeing not only the Russian government but also his revolutionary compatriots. For further details of his life, see [Akeley 1921; Hardesty & Unruh 1972; Ulam 1977].

2. The first was Mary Emily Sinclair (1878-1955), in 1908.

3. The authors are particularly indebted for family information to the following relatives of Professor Pell Wheeler: Esther Carolina Johnson Hoagland (1879-1979) (sister), Ruth Jean Hoagland Owens (niece), and Eleanor Anderson Wedmark (cousin).

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