FILE

ASSOCIATION FOR WOMEN IN MATHEMATICS
NEWSLETTER

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ANNOUNCEMENT OF AWM MEETING IN ST. LOUIS

In conjunction with the joint mathematics meetings in St. Louis in January, 1977, the AWM will hold its annual winter meeting. AWM events include:

Panel discussion: choosing our lives.
moderator: Judy Roitman
Saturday, Jan. 29, 4:30-5:30 p.m.
Bel-Air West Hotel.

Open executive committee meeting.
Saturday, Jan. 29, 5:30-6:30 p.m.
Bel-Air West Hotel.

General meeting: more history of women in mathematics.
moderator: Lenore Blum
Sunday, Jan. 30, noon
Chase Club Room, Chase-Park Plaza Hotel.

As always, there will be an AWM table for old friends and new to drop by. The next newsletter will have more information on speakers, rooms, and how to help out.

Other mathematical organizations meeting in St. Louis that week include the American Mathematical Society, the Mathematical Association of America, the National Council of Teachers of Mathematics, and the Association for Symbolic Logic. We hope to see you there.

EMMY NOETHER: TWENTIETH CENTURY MATHEMATICIAN AND WOMAN

by Emiliana P. Noether

(Emiliana P. Noether is a professor of modern European history at the University of Connecticut. She has taught at N.Y.U., Douglass College, Regis College, and Simmons College, and has done research at MIT, the Radcliffe Institute, and as a Fulbright Senior Fellow in Italy. Her specialty is Italian history, and she is Emmy Noether's niece.)

On May 3, 1935, there appeared a letter from Albert Einstein in The New York Times, which read in part as follows:

> Within the past few days a distinguished mathematician, Professor Emmy Noether, formerly connected with the University of Göttingen and for the past two years at Bryn Mawr College, died in her fifty-third year. In the judgement of the most competent living mathematicians, Fräulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began.[1]

Born in 1882, Emmy Noether was the daughter of the mathematician Max Noether, professor at the University of Erlangen. The Noethers belonged to the intellectual middle class in Wilhelminian Germany, marked by orderly customs and great stability. The family occupied the same second floor apartment for forty-five years, or until the death of Max Noether in 1921. It respected education for its own sake and was interested in intellectual pursuits. The home life must have been warm and companionable. Emmy was the first-born to Max and his wife, Ida

Amalia Kaufman who came from a rather wealthy family. Three brothers followed, two of whom died rather young, leaving Emmy and the remaining brother Fritz to follow their father's dedication to mathematics.

As a child, however, Emmy gave no signs of precociousness or extraordinary ability in mathematics. She was undistinguishable from all the other young girls in Erlangen, except for her extreme near-sightedness and lack of outward attractiveness. As Hermann Weyl, her close friend and co-worker at the University of Göttingen, who spoke so movingly in commemoration of her death at Bryn Mawr on April 26, 1935, said, "no one could contend that the Graces had stood by her cradle."[2] From 1889 to 1897 she attended the State Girls' School in Erlangen. There, with other daughters of the bourgeoisie, she learned the elements of language and arithmetic. She also seems to have studied the piano, and to have learned French and English. As she grew to young womanhood she developed a great love of dancing and spent many evenings at family parties. Her schoolmates and friends of this period remember her as a clever, friendly, and rather endearing child. In 1900 she took the Bavarian state examinations to become certified as a teacher of English and French. The examinations lasted four days, were rather demanding and strenuous, and she did well in them. It would seem that now her education was complete. She had gone through the required schooling deemed necessary for a young woman of her class and breeding. Moreover, she had acquired a certificate which would enable her to earn her livelihood, should the need ever arise.

It is at this point that the story of Emmy Noether becomes interesting. For it was shortly after 1900 that she decided that she would like to attend the University. What is intriguing about this decision, the reasons for which will probably never be known, for none of Emmy Noether's personal papers have survived her exile from Germany, death, and dispersal of her possessions, is why at this point in her life--after having given no outward sign until then of being anything but a conformist to the path outlined for her by her family and social class--did she suddenly decide that she did not want to continue as a dutiful "fille de famille" or become a teacher of French and English to other well brought up young ladies? Was it the example of her younger brother Fritz, now beginning his university studies, and undoubtedly brimming with enthusiasm over his mathematical studies which he probably discussed at dinner with his father Max? Was it the cumulative effect of years of having been exposed to discussions by the Erlangen mathematicians who frequented the Noether home? Was it a sudden rebellion to be herself, a desire to follow her own inclinations, though Weyl stressed that she had never been a rebel in her life, but who knows the inner thoughts of Emmy in the early 1900s? Was it a desire for a room of her own, as Virginia Woolf expressed it so poignantly for all women?[3] We shall probably never know, but can only surmise. What matters for the history of mathematics is that she did take the step, she did persist, despite all the odds against women, and did go on to become one of the most distinguished algebraists of the twentieth century.

In the early years of this century, it was not easy for a woman in Germany to do what Emmy Noether set out to accomplish. Women could enroll as auditors in courses at the university, but only with the professor's permission, and they were not allowed to take examinations, except again by special permission of the instructor. Only in 1908 did the German Ministry of Education permit coeducation at the universities. One of the difficulties facing any woman who wished to qualify for admission to a German university was that she was barred from attending the Gymnasium which provided the rigorous education required for university admission. The various girls' schools were little better than finishing schools for the daughters of the bourgeosie and trade schools for those of workers. There was, however, an escape clause to the limitations placed upon women. They could take matriculation examinations to demonstrate their mastery of the course of study prescribed in the Gymnasium.

After attending the University of Erlangen from 1900 to 1902 as an auditor, Emmy Noether, on July 14, 1903, took and passed the matriculation examination for admittance to the university at the Royal Gymnasium in Nürnberg. In the following school year, 1903-4, we find her enrolled for the first semester at the University of Göttingen, more liberal, perhaps, than other German universities at this time towards women, for in 1906 Vera Lebedoff-Myller was to get her degree, working under the mathematician David Hilbert, who later was to invite Emmy Noether to join his group at Göttingen. The following year Emmy returned to continue her studies at the University of Erlangen, and on October 24, 1904, she was duly inscribed as student number 486 in this University. She was the only woman enrolled in the faculty of mathematics with forty-six male fellow-students. On December 13, 1907, she successfully defended her thesis, receiving a summa cum laude, and on July 2, 1908, was awarded her degree.

Undoubtedly, the first two influences on her development as a mathematician were her father and her mentor, Paul Gordan, under whom she wrote her dissertation. She remained devoted to him, even after his death in 1912, and his picture hung in her study in Göttingen for all the years that she was there. Max Noether was "a very intelligent, warm-hearted, harmonious man of many-sided interests and sterling education."[4] Paul Gordan was a very different sort of person. Weyl described him as "a queer fellow, impulsive and one-sided. A great walker and talker....either with friends, and then accompanying his discussions with violent gesticulations...or alone, and then murmuring to himself and pondering over mathematical problems; or...carrying out long numerical calculations" in his head.[5]

Having received her degree, in 1907-8 Emmy worked without any formal appointment or pay at the Mathematical Institute in Erlangen, partly helping her father and partly on her own research. Slowly, recognition began to come her way. In 1908 she was elected to membership in the Circolo matematico of Palermo, Italy. In the following year she was invited to join the German Mathematical Union and began to lecture publicly. Her first lecture was at the Salzburg section of the Union in 1909; in 1913 she was invited to read a paper at the Vienna branch. These lectures were interrupted by the war in 1914, but resumed during the Weimar period when she spoke in such diverse cities as Bad Nauhiem (1920), Jena (1921), Leipzig (1922), Marburg an der Lahn (1923), Innsbruck (1924), Danzig (1925), and Prague (1929). In 1908 she attended her first International Mathematical Congress in Rome, Italy, with her father. Then, an unknown young mathematician, she must have played an inconspicuous role during the proceedings, listening to her elders, and probably touring the Roman ruins, Baedecker in hand, before returning home to Erlangen.

In 1913, while continuing her research and publishing its results, she began to substitute for her father at the University of Erlangen. Max Noether, who had suffered polio as a child, was feeling the effects of age. Two years later, David Hilbert and Felix Klein seem to have invited her to go to Gottingen. By then Emmy had published some half-dozen papers and had an impressive knowledge of certain aspects of mathematics which Hilbert and Klein felt would complement their own work on relativity theory. Emmy accepted the invitation and moved to Göttingen, where she remained until forced out by the Nazis in 1933. But, while in 1915 Göttingen had a more liberal policty towards women students, it was not ready to admit women to the faculty. The mathematicians wanted some sort of appointment for Emmy Noether to regularize her position at the University. At the very least they wanted the Habilitation for her, but the entire "Philosophical Faculty," which included philosophers, philologists and historians as well as natural scientists and mathematicians, had to vote on the acceptance of the habilitation thesis. Particular opposition came from the non-mathematical members of the Faculty.

"They argued formally: 'How can it be allowed that a woman become a Privatdozent? Having become a Privatdozent, she can then become a professor and a member of the University Senate. Is it permitted that a woman enter the Senate?' They argued informally: 'What will our soldiers think when they return to the University and find that they are expected to learn at the feet of a woman?!'. . . Hilbert answered their formal argurment...with... directness: 'Gentlemen, I do not see that the sex of the candidate is an argument against her admission as a Privatdozent. After all, the Senate is not a bathhouse.'

"When, in spite of this rejoinder, he still could not obtain her habilitation, he solved the problem of keeping her at Göttingen in his own way. Lectures would be announced under the name of Professor Hilbert, but delivered by Fräulein Noether."[6]

November 1918 saw the end of both the war and the monarchy in Germany. While the war had been lost, hope in the future of a more democratic Germany paralleled the disorders and revolutions that marked the immediate post-war years. On January 19, 1919, in the elections for the National Assembly of the new Germany, citizens of both sexes over the age of twenty were entitled to vote, and this provision was written into the Weimar Constitution which was adopted on August 11, 1919. While there is no record indicating that Emmy participated actively in the political changes that were altering the physiognomy of Germany, she was intensely interested in the political and social issues of the day. A woman in her late thirties by now, whose scholarly reputation was growing, she still had no secure position in the academic world. Politically, she had great hopes for the future of the new German republic and she was a convinced pacifist.

The changes in the political structure of Germany represented by the Weimar Republic did

not really change the conservative outlook of the "Mandarins" of academia.[7] But they were forced to make some few concessions, and Emmy Noether was finally allowed to take her Habilitation on June 4, 1919. Now she could lecture openly under her own name. However, it should be pointed out, that the title Privatdozent, which she was able to use after her Habilitation, was a purely honorific one, carrying no pay with it. Three years later, she was appointed "ausserordentlicher Professor", again a largely honorific title without renumeration, since she was not, as we would say in the United States, on the tenure track. The early twenties were years of extraordinary inflation for Germany. Whatever private means Emmy may have possessed which had enabled her to sustain herself were decimated by the inflation, so in the spring of 1923, she was given a Lehrauftrag, or Lectureship, for algebra, to which was attached a stipend. Finally, she could teach officially, give examinations, direct dissertations, and be paid, even if very little. The first student to complete a doctorate under her direction was a woman, Grete Hermann, who finished in February, 1925.

Many of her younger colleagues, including Hermann Weyl, who became a permanent member of the Gottingen faculty in 1930, recognized Emmy's outstanding abilities and tried to get a better position from the Ministry for her, without success. Weyl also failed to get her elected to membership in the Göttingen Society of Science. Traditional hostility and prejudice towards women overbalanced her scientific contributions and growing reputation.[8] But Emmy Noether, so long as she could continue her work and disseminate her ideas among willing students, did not seem embittered by the shabby treatment officaldom gave her. She was, according to Weyl and other mathematicians, the strongest center of mathematical activity in Göttingen from 1930 to 1933, both because of her research and because of her influence upon a wide circle of students

Among them were two mathematicians who came to Göttingen not as aspiring Ph.D. candidates, but as already recognized young scholars. One was the Dutch mathematician van der Waerden and the other was the Russian Alexandroff, who had been professor at the University of Moscow since 1924 and came to Göttingen as a guest professor. Both became members of the group known as the "Noether boys"who joined Emmy in long walks during which the only topic of conversation was mathematics. Many years later, after the ravages of Nazism and the Second World War had passed over Germany, van der Waerden singled out the years from 1920 to 1934 as the period during which Emmy Noether, Emil Artin, and Alexander Ostrowski had given algebra a new turn.

Emmy's friendship with the Russian mathematician Alexandroff endured during these years. Her work became known and gained recognition in Russia, and during the academic year 1928-29, she was invited to Moscow where she gave a course in abstract algebra at the University and conducted a seminar in algebraic geometry at the Communist Academy.

International recognition came also to Emmy. At the International Mathematical Congress, held at Bologna, Italy, in 1928, she delivered a major paper at one of the section meetings. In 1932, at the International Mathematical Congress in Zurich, she addressed a plenary session.

The rise of Nazism to power in January 1933 shattered the life and work of many German scholars in universities throughout Germany. Göttingen was no exception. National Socialism had been gaining support among students. The predominantly conservative faculty members, though having reservations about some of the extreme aspects of National Socialism, were not averse to its coming to power. By and large, academia had only tolerated the Weimar Republic; many of its members thought of themselves as apolitical intellectuals and felt that they could accept the changes that Nazism seemed to offer for the benefit of the fatherland.

By a series of anti-Semetic laws enacted shortly after they came to power, the Nazis sought to purge the civil service of Jews and persons of partially Jewish ancestry.[9] The impact of these laws was immediately felt in the Mathematical Institute of Göttingen, by then the foremost center for mathematical studies in Germany. The Director of the Institute, Richard Courant, Emmy Noether, and Max Born, the theoretical physicist and later Nobel prize laureate, were dismissed.

Forbidden to lecture at the University, Emmy Noether continuted to receive some of her students, eager to continue their work under her, in her home; one of them repeatedly turned up in a Nazi uniform. The summer of 1933 was a difficult and troubled one, but she seemed never to lose her serenity. Weyl recalled that "her courage, her frankness, her unconcern about her own fate, her conciliatory spirit, were, in the midst of all the hatred and meanesss, despair and sorrow...a moral solace."[10]

Alexandroff initiated talks with the People's Commissariat for Education in Russia about appointing her to a chair at the University of Moscow. But, as he reported after her death,

it was slow in making a decision. Emmy, deprived of her modest stipend, unable to participate officially in the academic life of Gottingen, could not wait for the Russian People's Commissariat for Education to make up its mind and she accepted the offer of a one year's guest professorship from Bryn Mawr.[11]

At the end of October 1933 Emmy Noether left Germany for her year at this unknown American girls' college, in a strange country, whose customs were unfamiliar to her. But with her usual buoyancy she adjusted to her new surroundings. She was pleased to learn that Byrn Mawr had offered a graduate fellowship in her name for the academic year 1933-4 to a qualified student. Her seminar drew few students, but in February 1934 she started to give weekly lectures at the Institute for Advanced Study at Princeton. At Bryn Mawr she slowly began to form a group around her, this time they were the "Noether girls" rather than the "Noether boys " of Gottingen. Unwilling to give up her love of walking and talking mathematics, she would take her American students for hikes on Saturday afternonns. Often she would become so absorbed in her discussion of some fine mathematical point that she would forget about traffic. One of her American colleagues at Bryn Mawr, Grace Shover Quinn, remembered her as "sincere, straightforward, kindly, thoughtful, and considerate."[12]

In the summer of 1934 she returned to Germany to see her brother Fritz and his family. He too had lost his position at the Technische Hochschule in Breslau and had accepted a professorship at the University of Tomsk in Siberia to where he was moving with wife and two sons. This was the last time that Fritz and his family were to see Emmy. She also returned to her beloved Göttingen, visited other friends in Germany, and then went back to Bryn Mawr. During her second year there she acquired a few more graduate students and her first Ph.D. candidate, Ruth Hauffer, finished her dissertation under Emmy's direction. In the spring of 1935 she entered Bryn Mawr hospital to be operated on for the removal of a tumor; she seemed to be recovering well, when she died suddenly on April 14 at the age of fifty-three. Thus ended the life and career of this remarable woman, whose death was mourned by her friends and colleagues not only as a loss to the work of mathematics, but also on a deep, personal level.

Her qualities as a human being left a lasting impression on those who had known her. Weyl said that she was "warm like a loaf of bread. There irradiated from her a broad, comforting, vital warmth."[13] While she did not have any of the outward attributes usually associated with femininity, for she has been variously described as having "a loud disagreeable voice," as looking like "an energetic and very nearsighted washerwoman," in "baggy clothes."[14] Alexandroff remembered that "she loved people, science, life, with all the warmth, all the cheerfulness, all the unselfishness, and all the tenderness of which a deeply sensitive -- and feminine -- soul is capable."[15]

FOOTNOTES

1. Letter to the Editor by Albert Einstein, The New York Times, May 4, 1935, p. 12.
2. Hermann Weyl, "Emmy Noether," Gessamelten Abhandlungen (Heidelberg-Berlin: Springer-Verlag,), III, 53-72.
3. Virginia Woolf, A Room of One's Own (New York: Harcourt, Brace and Co., 1929).
4. Weyl, op. cit, p. 55.
5. Ibid.
6. Constance Reid, Hilbert (New York-Heidelberg-Berlin: Springer-Verlag, 1970), p. 143.
7. For an analysis of German academia see: Fritz K. Ringer, The Decline of the German Mandarins: The German Academic Community, 1890-1933 (Cambridge, Mass.: Harvard University Press, 1969), especially pp. 213-52, 435-49.
8. Weyl, op.cit., p. 60.

9. Karl Dietrich Bracher, Die Auflösung der Weimarer Republik (2nd Aust., Stuttgart, 1957), p. 148, quoted in From the Middle Ages to Nazi Rule, Year Book XVIII, Publications of the Leo Baeck Institute (London: Secker and Warburg, 1973), p. 130.

10. Weyl, op. cit., pp. 62-3.

11. Alexandroff, Address to the Moscow Mathematical Society, 1935, quoted in C. H. Kimberley, "Emmy Noether," The American Mathematical Monthly, 79, no. 2 (February 1972), p. 147.

12. Ibid., p. 148.

13. Weyl, op. cit., p. 57.

14. Reid, op. cit., p. 143.

15. Quoted in Kimberley, op. cit., p. 147.

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Emmy Noether's Contributions to Mathematics

by Martha K. Smith

(Martha K. Smith teaches at the University of Texas, Austin. Her graduate work was at the University of Chicago, and she is a well-known ring theorist.)

Emmy Noether proved many deep and beautiful theroems in ring theory, some of which will be described later. However, even a complete description of all Noether's published work would not accurately portray her contribution to mathematics, for her influence on other mathematicians was great. First, she is recognized as beginning a new style of thinking in algebra. Alexandroff in his memorial address on the occasion of Emmy Noether's death described it in this manner:

> "She taught us to think in simple, and thus general, terms...homomorphic image, the group or ring with operators, the ideal...and not in complicated algebraic calculations; and she therefore opened a path to the discovery of algebraic regularities where before these regularities had been obscured by complicated specific conditions."

In addition, Emmy Noether was quick to offer ideas, often very fruitful ones, to her colleagues. Her influence has been acknowledged in, for example, Van der Waerden's Modern Algebra, Deuring's Algebren, Hasse's papers on the relation between class field theory and algebras, Pontriagin's work on topological groups, Kolmogoroff's work in combinatorial topology, Hopf's generalization of the Euler-Poincaré formula, Weyl's book on group theory and quantum mechanics, Alexandroff's theory of the continuous decomposition of topological spaces, and Kurosch's work on groups. Noether first proposed the modern definition of homology (or Betti) groups as the group of cycles modulo cocycles. Her pupils, the "Noether boys," including Drull, Loether, Deuring, (as already mentioned), Fitting, Witt and Levitzki, of course came under her influence.

Emmy Noether's thesis and early work were quite different from the later work for which she is most well known. Her thesis was in the formal style of her advisor, Paul Gordon. It contains large quantities of formidable calculations, including one tabulation of 331 forms for a certain ternary quartic.

After Gordon's retirement, Noether came under the influence of another Erlangen mathematician, Ernst Fischer. His interests were invariant theory and elimination theory, in the style of Hilbert. During this period Noether showed in (1) the existence of a finite rational basis for fields of rational functions; that is, if K is a field of rational functions in a finite number of indeterminates over the field F, then there exists a finite subset S of K such that every element of K is a rational function (over F) in the elements of S. In a subsequent paper (2), she applied the same methods to study the question of the existence of polynomials with given galois group. If the group G is embedded in a symmetric group of degree n, then G acts on the field $L = F(x_1,....,x_n)$, where $x_1,...,x_n$ are indeterminates, by permuting

the x_i's. Let $K=L^G$, the field of L under this action. Noether used Hilbert's Irreducibility Theorem to show that if K is purely transcendental over F, then G can be realized as a galois group over F. Whether or not K satisfies this condition for arbitrary G remained open until 1969, when Swan (Invariant Rational Functions and a Problem of Steenrod, Invent. Math., 7 (1969), 148-158) provided a counterexample of order 47, 113, 233.

When Emmy Noether went to Göttingen in 1916, her knowledge of invariant theory was welcomed by Hilbert and Klein, who were at that time interested in general relativity theory. The result was two papers on differential invariants (3,4). In the first, she reduced the question of finding differential invariants for an expression $f(x_1,\ldots x_n,dx_1,\ldots dx_n)$ (i.e., of finding all analytic functions in f, $x_1,\ldots x_n$ and their derivatives which are invariant under transformations of a certain type) to a question of algebraic invariants. In the second, Noether gave necessary and sufficient conditions for certain integrals to be invariant under the action of a Lie group. These papers are still widely quoted today.

The conceptual, axiomatic style for which Noether is best known first appeared in 1920, in a joint paper with W. Schneidler (5). In it, questions concerning differential operators are dealt with by examining the ring of differential operators, rather than by manipulating formal expressions.

In 1921, Emmy Noether published "Idealtheorie in Ringbereichen," which Irving Kaplansky describes in his book Commutative Rings as a "revolutionary paper." The "revolution" involved not only the development of a general theory of ideals, but also the recognition of the importance of chain conditions in algebra. It is because of this paper that rings with the ascending chain condition on ideals are now called Noetherian rings. Chain conditions had appeared previously in the literature, in particular in works of Dedekind and of Lasker, but Noether used them to give an axiomatic ideal theory unifying and strengthening the results for specific rings obtained by these and other authors. Her results generalized the fundamental theorem of arithmetic to the class of commutative rings with ascending chain condition by showing that in such a ring, every ideal may be expressed as the intersection (with appropriate uniqueness properties) of ideals of a particularly nice (e.g. irreducible or primary) type. This paper was followed by a number of papers (7,8,9) answering related questions in ideal theory.

In the late '20's, Noether began extending her technique to non-commutative rings. In "Hypercomplexe Grossen und Derstellungstheorie" (10), she again introduced a now classical point of view. In this paper, Noether emphasized the equivalence of modules and representations. She thereby tied together existing results on finite-dimensional algebras and their representations and added to them to form a unified, conceptual theory of rings with minimum conditions. The ideas introduced here can now be found in almost any graduate student textbook.

During the thirties, Noether was very interested in number theory. In (11), she studied the connection between the existence of a normal basis and ramification of a field extension. If K/k is a Galois extension of algebraic number fields, let O_K and O_k denote the rings of integers of K and k respectively. A normal basis for K/k is a basis for O_K over O_k consisting of elements conjugate under the action of the Galois group of K/k. K/k is tamely ramified if for each prima $\mathfrak{p}$ of O_k, $\mathfrak{p}O_K = \varphi_1^e,\ldots\varphi_g^e$, where $\varphi_1,\ldots\varphi_g$ are primes in O_K and e is not ramified, then for each ramification prima $\mathfrak{p}$ (i.e. such that $e>1$), the field extension obtained by taking $\mathfrak{p}$-adic completions has a normal basis. This implies the existence of a certain decomposition of the discriminant of the extension. Only recently (A. Frolich, Module Conductors and Module Resolvents, Proc. Lond. Mathe. Soc, 32(1976), 279-321) have these results been improved upon.

Much of Noether's interest in number theory centered on its interaction with the theory of non-commutative algebras. For example, number theory was an important joint paper with Brauer and Hasse (12). Its main theorem, commonly known as the Brauer-Hasse-Noether Theorem, states that every simple algebra A which is finite-dimensional over its center k, where k is an algebraic number field, is cyclic. This means that there exists a non-zero element $u \in A$ such that some power $u^n \in k$, and a maximal subfield K of A which is invariant under the inner automorphism induced by u, such that $1, u,\ldots u^{n-1}$ form a K-basis for A. This theorem is important in studying the structure of finite-dimensional algebras and the representation theory of finite groups. For example, it implies that every absolutely irreducible representation of a finite group (i.e., one that remains irreducible on extending to a larger field) in characteristic zero is realizable in some cyclotomic field.

Noether also felt that non-commutative methods were an important tool in studying commutative problems, particularly those of algebraic number theory. In her address to the 1932 International Congress of Mathematicians in Zurich (13), she outlined a program for further study in field theory. Several important results in field theory, such as the Hasse Norm Principal, Hilbert's Theorem 90, and the Principal Genus Theorem, are theorems about cyclic field extensions. Noether claimed that these theorems could in fact be seen to be special cases of theorems about arbitrary Galois extensions, and that these more general theorems had their proper setting in a non-commutative context, namely the theory of crossed products. If K/k is a finite Galois extension with group G, then a crossed product of G and K is an algebra A over k containing K with a K-basis $\{u_\sigma : \sigma \in G\}$ in one-to-one correspondence with G, such that $u_\sigma u_\tau = a_{\sigma,\tau} u_{\sigma\tau}$ for some non-zero elements $a_{\sigma,\tau} \in K$ must form a factor set (i.e., a 2-cycle) in order that A be associative. Crossed products are simple algebras with center k. The cyclic algebras mentioned earlier are crossed products where K/k is cyclic.

Noether's program was to prove that the known results on cyclic extensions were equivalent to statements about crossed products, then to prove these statments without the restriction of cyclicity. As an example of the feasibility of this program, she gave the Hasse Norm Principal. If K/k is a Galois extension, let $N(\alpha)$ denote the norms from K to k of $\alpha \in K$, i.e., the product of the conjugates of α under the action of G. The Hasse Norm Principal states that if K/k is a cyclic extension of algebraic number fields, then an element $\beta \in k$ is a norm of some element in K if and only if for every prime $\mathfrak{p}$ of k, β is a norm of some element in the $\mathfrak{p}$-adic completion $K_\mathfrak{p}$ of K. If A is a cyclic algebra corresponding to the cyclic extension K/k with Galois group (σ) of order n and u_σ is the element of A corresponding to u_σ, then $u_\sigma^n \in k$. Furthermore, A is split (i.e., isomorphic to a full ring of matices over k) if and only if u^n is a norm of some element of K. Thus the Hasse norm principal is equivalent to the statement that a cyclic algebra splits if and only if it splits on passing to every $\mathfrak{p}$-adic completion. The general form of the Norm Principal would then be obtained by replacing the words "cyclic algebra" by "crossed product" in this statement. This general form is indeed true for algebraic number fields, since by the Brauer-Hasse-Noether Theroem, every crossed product may also be represented as a cyclic algebra.

Noether followed this program to give a general form of the Principal Genus Theorem (15). For a cyclic extension K/k of algebraic number fields with group (σ), this theorem asserts that every element of a certain subgroup (the "principal genus"; its definition in this case is rather involved) of the ideal class group C of K (fractional ideals modulo principal ideals; a fractional ideal is just an O-submodule of K, whoere O is the ring of integers in K) is of the form $c(c^\sigma)^{-1}$ for some $c \in C$. (The resemblance to Hilbert's Theorem 90 is not coincidence; Noether's generalization encompasses this also.) Gauss' original Principal Genus Theorem dealt with the case of degree two over the rationals. There, ideal classes correspond to equivalence classes of binary quadratic forms under integral equivalence classes under rational equivalence. Similar interpretations in terms of n-ary forms of degree n exist in the case of a cyclic extension of degree n. Noether's reformulation and generalization essentially replace the ideal class group by what is today known as the first cohomology group $H^1(G,C)$, where G is the Galois grou of the Galois extension K/k and C is the ideal class group of K (still assumed to be an algebraic number field). Now the principal genus is more easily described. If $(\bar{c}_\sigma)$ is a 1-cocycle (crossed homomorphism), then its boundary $\bar{c}_\sigma \bar{c}_\tau^\sigma \bar{c}_{\sigma\tau}^{-1}$ must be trivial, i.e., $c_\sigma c_\tau^\sigma c_{\sigma\tau}^{-1}$ must be a principal ideal, say $(a_{\sigma,\tau})$. The principal genus consists of all 1-cocycles $\{\bar{c}_\sigma\}$ such that the $a_{\sigma,\tau}$'s may be chosen to be a factor set such that the corresponding crossed product of G and K splits at every ramified prime. The generalized Principal Genus Theorem then states that every 1-cocycle $\{\bar{c}_\sigma\}$ in the principal genus is a 1-coboundary; i.e., there exists $\bar{b} \in C$ such that $c_\sigma = b(\bar{b}^\sigma)^{-1}$ for every $\sigma \in G$.

One of her last papers, "Nichtkommutative Algebra" (14), probably illustrates the scope and style of Emmy Noether's work more than any other single publication. It consists of four parts. The first studies central simple algebras. In it Noether advocates, as she so often did, a new point of view. And, as usual, her point of view has become the standard one. Previously, central simple algebras were mainly studied by splitting them, i.e., by embedding them in the algebra of matrices over a field. Noether emphasized that a more natural representation is as the full ring of matrices over a division algebra. (For example, it is well

known that the division algebra H of quarterions is isomorphic to a subalgebra of the complex numbers C. This implies that the simple algebra H_2 of all 2 x 2 matrices over H is isomorphic to a subalgebra of the algebra of 4 x 4 matrices over C. This second representation is appealing, but the original formulation as H_2 is in fact more natural and useful.) She also introduced and exploited the concepts of double (or bi-) module and reciprocal (or opposite) representation in the deveopment of the structure theory of simple and semi-simple algebras. The second portion of the paper begins a development of a Galois theory of simple algebras. The third section deals with splitting fields of a division ring D, that is, fields K containing the center k of D such that for some n, $D \otimes_k K \approx K_n$, the ring of all n x n matrices over K. Noether gives here a succinct characterization of splitting fields and a new, non-computational proof of a theorem of Köthe stating that a finite dimensional division algebra always has a separable splitting field. In the final section of the paper, she applies the techniques of representations and tensor products used in the earlier portion of the paper to the commutative theory in order to develop the Galois theory of fields in a suitable fashion to apply to simple algebras. This approach also has the advantage of being independent of the characteristic of the field.

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JOB REGISTER

The Job Register exists again this year. You send in self-addressed, stamped envelopes and we send you lists of jobs as we receive them. If you send too few envelopes, we'll put a note in your last envelope reminding you of the fact.

The fee for this service is $3, which may be applied towards your membership fee. If you wish to be in the Job Register, send a note and a bunch of self-addressed stamped envelopes to our Wellesley Office.

Nov.-Dec 1976 AWM Newsletter

THIRD ANNUAL REPORT OF EMPLOYMENT OF WOMEN IN MATHEMATICS DEPARTMENTS
by Judy Green, AWM Employment Officer

In the October 1976 Notices of the American Mathematical Society the first report of the 1976 AMS survey of faculty salaries appears. In this report the numbers of faculty at various ranks and types of institutions are given for the years 1975-1976 and 1976-1977. Since the number of women in each category is also given it is possible to compute the percentages of women in these categories. The results of these calculations appear below. They are not encouraging since, with the exception of doctorate granting statistics departments, they once again do not show any appreciable increase (cf. AWM Newsletter April 1975 and January 1976 for the first two reports).

Another discouraging statistic which can be found in the AMS Survey is that although the percentage of women among new Ph.D.'s in 1976 was up to 11.1 (it was 10.1% in 1975 and 9.1% in 1974) the percentage of women among unemployed new Ph.D.'s was 15 and the percentage of women among underemployed new Ph.D.'s was 37.5.

Also in the October 1976 Notices is an article by Mary Gray and Alice Schafer entitled "Has Affirmative Action Affected the Composition of Doctorate Granting Mathematics Department Faculties in the U.S.A.?" which analyzes the data obtained in the 1974 and 1975 Annual AMS Surveys. I am including below a display of data from this year's survey in their format.

For all these reports the doctorate granting institutions have been divided as follows:

- I — the 27 most prestigious mathematics department in the US
- II — the 38 next best mathematics departments in the US
- III — the rest of the mathematics departments in the US
- IV — statistics, biostatistics and biometric departments in the US
- V — departments in the mathematical sciences in the US not included above
- VI — Canadian departments in the mathematical sciences.

AWM NL
Nov. 1976

		percentage of women on faculty		percentage of women on tenured faculty	
		1975-76	1976-77	1975-76	1976-77
Doctorate granting					
I	without doctorate	60.0	75.0	100.0	100.0
	with doctorate	4.2	3.8	2.6	2.7
	total	4.5	4.1	2.7	2.8
II	without doctorate	32.5	28.1	23.1	23.1
	with doctorate	4.2	3.8	3.1	3.1
	total	5.3	4.5	3.5	3.4
III	without doctorate	25.0	22.8	22.4	21.7
	with doctorate	5.3	5.4	4.1	3.9
	total	7.8	7.5	6.6	6.1
combine I, II, III					
	without doctorate	26.6	24.2	22.8	22.1
	with doctorate	4.7	4.5	3.4	3.3
	total	6.3	5.9	4.8	4.6
IV	without doctorate	25.0	27.3	28.6	33.3
	with doctorate	6.0	7.2	3.9	4.6
	total	7.3	8.1	4.5	5.4
V	without doctorate	16.1	10.7	5.9	6.3
	with doctorate	4.0	4.1	2.5	2.7
	total	4.7	4.4	2.7	2.9
VI	without doctorate	18.5	16.9	15.7	17.4
	with doctorate	2.4	2.2	1.6	1.5
	total	4.0	3.5	3.0	3.0
Masters granting					
	without doctorate	24.2	25.4	19.8	20.9
	with doctorate	8.3	8.3	7.6	7.7
	total	12.7	12.7	11.2	11.2
Bachelor granting					
	without doctorate	19.8	19.5	15.5	15.3
	with doctorate	9.3	9.6	9.6	8.5
	total	13.3	13.2	12.0	11.1
Four-year colleges and universities					
	without doctorate	22.6	22.5	18.4	18.8
	with doctorate	6.1	6.2	5.1	5.1
	total	9.2	9.7	7.6	7.5

* *

Update of Gray-Schafer article

TWENTIETH ANNUAL AMS SURVEY (October 1976 Notices)
DOCTORATE GRANTING MATHEMATICS DEPARTMENTS IN THE U.S.A.

	Number Departments	Number Responding	Percent Responding
Group I	27	19	70
Group II	38	30	79
Group III	91	72	79
	156	121	78

WOMEN ON DOCTORATE GRANTING MATHEMATICS DEPARTMENT FACULTIES

	1975-1976			1976-1977		
	Total Faculty	Women	Percent Women	Total Faculty	Women	Percent Women
Group I	943	42	4.5	945	39	4.1
Group II	1,123	59	5.3	1,126	51	4.5
Group III	1,956	153	7.7	1,967	147	7.5
	4,022	254	6.3	4,038	237	5.9

DOCTORATE HOLDING FACULTY

	1975-1976			1976-1977		
	Total Faculty	Women	Percent Women	Total Faculty	Women	Percent Women
Group I	938	39	4.2	941	36	3.8
Group II	1,083	46	4.2	1,094	42	3.8
Group III	1,708	91	5.3	1,730	93	5.4
	3,729	176	4.7	3,765	171	4.5

WOMEN AMONG DOCTORATE HOLDING ASSISTANT PROFESSORS IN GROUPS I, II, III

	1975-1976			1976-1977		
	Total Number Assistant Professors	Women	Percent Women	Total Number Assistant Professors	Women	Percent Women
Group I	170	16	9.4	166	17	10.2
Group II	253	19	7.5	240	14	5.8
Group III	477	39	8.2	432	39	9.0
	900	74	8.2	838	70	8.4

* *

REPORT OF COMMITTEE W, 1975-76

by Mary W. Gray

(The following report on AAUP's Committee W, written by its chairperson, is reprinted from the summer, 1976 AAUP Bulletin. The charts which follow it were taken from the "Report on the Economic Status of the Profession, 1975-76" from the same AAUP Bulletin issue, #62 pp. 195-284. The data in these tables was provided by institutions participating in the Annual Survey of Faculty Compensation of the American Association of University Professors. We thank Sarah

Womack of the AAUP for permission to reprint this material.)

During the years in which I have served as chairperson of Committee W (1974-76), academic women have made some notable strides in eliminating discriminatory policies and practices once prevalent in higher educational institutions. One of Committee W's greatest achievements can be viewed as the adoption and adaption by colleges and universities of policies developed and recommended by Committee W. For example, many institutions have formulated antinepotism regulations patterned after the Association's Statement on Faculty Appointments and Family Relationship or leave policies reflecting the Statement on Leaves of Absence for Child-bearing, Child-rearing, and Family Emergencies.

Of substantial distinction in the recent past have been the Committee's efforts to seek economic parity and financial equity for academic women. In this regard, several projects should be noted. For the last two years, Committee W has worked vigorously to implement the Association's policy favoring the payment of equal periodic retirement benefits to men and women. This issue is addressed in greater detail later. We have also been particularly pleased with the cooperation and support of Committee Z on the Economic Status of the Profession which now regularly collects salary data by sex for the Annual Salary Survey. A third project, the preparation of a salary evaluation kit, is also being compiled with the joint cooperation and sponsorship of Committee Z and Committee W and the financial support of the Exxon Education Foundation.

As well as focusing on policy issues, we have attempted, by cooperating with Committee A, to be of assistance in resolving individual academic discrimination cases. We have found this to be our most difficult area of work and the one in which I am able to report the least progress. Discrimination cases usually involve allegations that an individual has been denied tenure, or nonrenewed, or dismissed because of the individual's sex. While Committee A's work normally focuses on the violation of Association policies in regard to tenure, dismissals, or nonrenewals, the evidentiary standards applied in sex discrimination cases and in Committee A cases are not sufficiently similar to permit an easy crossapplication. For example, in a sex discrimination case an individual will frequently establish arbitrary or discriminatory treatment by comparing the qualifications of the individual complainant to members of the opposite sex who were successful in achieving tenure or reappointment. In addition to establishing disparate treatment among persons of similar qualifications, the individual will normally attempt to establish a pattern or practice of sex discrimination at an institution by compiling statistical evidence supporting a conclusion that women or men as a class have not been treated similarly to members of the opposite sex. Just as is true of academic freedom and tenure cases, academic discrimination cases require an expertise and sensibility developed through sustained involvement in the issues.

Committee W has strengthened and enlarged its overall impact and influence by working with other committees of the Association, through local chapters and state conferences, and through Congress, executive and regulatory agencies. We have been only partially successful in regularly reaching academic women on the campuses. however, and I should hope that the isolation women frequently feel can be alleviated in the future.

In 1976, I see academic women somewhat more likely to obtain a first appointment and less likely to be offered a clearly discriminatory salary. However, women remain clustered in the lower ranks and continue to endure discriminatory fringe benefits in many institutions. We are rarely given serious consideration for major administrative positions and our access to prestigious appointments, fellowships, and grants, while growing, is more limited, for a variety of reasons, than that of our male colleagues. We are pleased, however, to report success on one project on which Committee W has worked for several years: Rhodes scholarships are now open to women and men.

Nonetheless, we have achieved substantial recognition--recognition of our individual and collective merits and of our individual and collective problems. The greatest threat now comes from the general financial crises in higher education, which seems to be having a disproportionately heavy impact on female faculty members. It is a situation full of promise and challenge that I pass on to the attention of my successor.

I should like to review our progress in several areas of Committee W. activity during 1975-76.

EQUAL RETIREMENT BENEFITS

The year has been marked by a continuation of the series of court decisions in favor of equal benefits. Committee W has been in communication with attorneys in these cases and in lawsuits yet to come to trial which may eventually lead to a legal resolution of the equal benefits problem. We look forward to continued Association activity in this area.

An article on the issue of equal periodic benefits by Committee W member Barbara Bergmann and myself has appeared in the Civils Rights Digest, published by the U. S. Commission on Civil Rights. The AAUP Bulletin has published an exchange of correspondence between AAUP President Van Alstyne and TIAA-CREF Chairman Greenough debating the policy of unequal periodic benefits presently applicable to certain TIAA-CREF pension plans, and an article by Daniel Halperin exploring the issue.

TIAA-CREF has provided to several universities and to the AAUP suggested alternate plans for the provision of equal monthly benefits for male and female retirees. While those that Committee W has seen continue to present problems, AAUP representatives intend to meet further with TIAA-CREF to explore possible avenues for achieving a mutually satisfactory plan.

The Equal Employment Opportunity Coordinating Council, composed of representatives of EEOC, HEW, the Labor Department, the Justice Department, and the U. S. Civil Rights Commission has finally reported to President Ford on the issue of differing agency regulations on equal benefits. It is my understanding that the Council's report recommended legislation to require equal benefits. There is, then agreement that equal benefits should be required by federal law, but disagreement on the legislation which would most appropriately remedy the problem. The Association has communicated with the Coordinating Council and the President expressing our support for a uniform federal regulation requiring the payment of equal periodic benefits.

Throughout our involvement in this controversy it has become increasingly apparent to Committee W that the only solution which will be acceptable under Title VII is the use of sex-neutral mortality tables. the socalled "unisex" approach. The operating principle is the same as that currently applied with respect to race--if plan participants are not identified by sex, they cannot be treated differently according to their sex. Thus the social benefits from those who die early and the social costs from those who die late will be shared equally across the whole population.

I should like to commend President Van Alstyne and General Secretary Duffey for their untiring efforts on the equal benefits issue. They have provided critical leadership in carrying the mandate of the Council, "to take action to implement the principle of equal monthly retirement benefits for women and men faculty."

TITLE IX

Another major concern of Committee W has been the enforcement of Title IX of the 1972 Education Amendments which prohibits sex discrimination in education programs or activities receiving federal funds. Federal regulations to implement Title IX were approved and issued by HEW last July. They included provisions for grievance procedures and institutional self-evaluations, proposals which Committee W has supported in testimony before the House Subcommittee on Secondary Education and in comments on the proposed regulations.

We have had a continuing interest in determining whether institutions are complying with the Title IX grievance procedure and self-evaluation requirements. This past spring, Committee W conducted a mini-survey to discover whether or not self-evaluations were being prepared and whether faculty have been involved in their preparation.[1] The response to the survey indicates that institutions have not placed a high priority on preparation of the Title IX self-evaluations and their completion is being left until the July deadline. Faculty awareness of the Title IX institutional review, or indeed of the requirement for the self-evaluation, is minimal. Prompted by the receipt of our questionnaire, the inquiries of local Committee W's have stimulated action on some campuses. We urge other chapters and Committee W's to investigate the status of Title IX compliance on their campuses. Absent faculty interest, input, and pressure, the future of Title IX enforcement on individual campuses may be nonexistent.

AFFIRMATIVE ACTION

Last fall, Committee W prepared testimony on affirmative action to present at Labor Department hearings. The thrust of the presentation emphasized that the concept of affirmative action must be separated from the few abuses which have complicated and thwarted its implementation.

The abuses must be eliminated or corrected. We believe that a major step will be taken if affirmative action enforcement at the government and campus levels is administered by persons who are knowledgeable and committed to the ideals embodied in Executive Order 11246, as amended.

For the moment, all seems to be calm on the affirmative action front. Legislation has been introduced to remove the requirements of goals and timetables, but it appears to be going nowhere. A Labor Department task force on affirmative action has been established. Committee W will continue to meet with representative of various governmental agencies and the Congress to provide input for their deliberations and to monitor their activities.

Attention has now focused on the possible loss of affirmative action gains because of budgetary cutbacks for financial reasons. Professor Georgina Smith (former Committee W member, and newly elected Rutgers chapter president) has reported on the differential impact on men and women of recent retrenchment in New Jersey, finding that the appointments of women were being nonrenewed or terminated in numbers disproportionately high in relation to their participation in the academic work force.

At the urging of Committee W, Committee A and the Council have included in the revised Recommended Institutional Regulation 4 a provision permitting affirmative action considerations, as part of educational policy, to be taken into account in retrenchment.

JOINT PROJECTS

Committee W has continued to work with Committee A on how best to handle academic discrimination complaints. A subcommittee is being formed by Committee A to work out guidelines for processing of discrimination cases. We hope that investigations will move forward and we look forward to the publication of a report in this area. We note with approval that the Legal Defense Fund is providing financial support and an expert witness to a complainant in one academic discrimination case.

Less heartening is the news on the Equal Rights Amendment. Jointly with Committee R we have contacted conference presidents in those states which have not yet approved the Amendment and have asked for their assistance. We have also asked state and local Committee W's to be active in the ERA campaigns, for this is now essentially a state issue. However, four states are still needed for ratification so our efforts will continue. I should like to thank Associate Secretary Alfred Sumberg for his help in this and other Committee W legislative activities.

Committee W took the iniative in proposing to the Council Exectuve Committee the establishment of an editorial board for the AAUP Bulletin. It is my belief that the future board should include representatives of various Association committees. The Council will discuss this in the fall.

Representatives of Committees A, W, Z, and N have prepared a preliminary statement on policies for part-time faculty. Issues of tenure, participation in governance, and compensation are covered. Input from as many people as possible who are interested and knowledgeable on the subject will be appreciated. We have particularly been concerned about the impact of ill-defined and limited part-time policies on academic women.

The salary kit, developed jointly by Committees W and Z under a grant from the Exxon Foundation, is in a final draft form and will soon be ready for distribution. Committees W and Z sponsored a workshop at the Annual Meeting on the general subject of remedying salary inequities. Project Director Maryse Eymonerie is to be commended for her efforts in marshalling the project through the grant phase to the present final draft stage. We are grateful to Barbara Bergmann for her preliminary work and to Elizabeth Scott for her efforts in compiling the necessary data and translating it into a final, organized form. We are hopeful that the salary survey kit will provide an impetus for salary equity reviews which will particularly benefit those academic women and others who have suffered economic loss as a result of salary discrimination.

I want to conclude my report by thanking the other Committee W members for their help and support, particularly Professor Barbara Bergmann whose term on the Committee is ending. Barbara has put a great deal of productive effort and creative energy into the equal-benefit and salary-equity projects. I am very grateful to her for her contributions. My special thanks also go to Associate Secretary and Associate Counsel Carol Polowy.

As I review the years of my chairing Committee W, I can mark some substantial successes, some partial successes, and some areas where there is still much to be done. I am glad to have had the opportunity to serve AAUP and academic women but I also look forward to turning over the responsibility to someone who can bring a new approach and fresh energy to the tasks ahead.

1 Each Committee W state chairperson received a questionnaire, with the request that it be distributed to chapter Committee W chairpersons. The items were as follows, each having boxes for yes and no responses and explanation (if any):

1. The Title IX Institutional Self-Evaluation has been prepared on my campus.
2. The Title IX Self-Evaluation has actually been conducted.
3. Faculty participated in the preparation of the Title IX Self-Evaluation.
4. Faculty participated in the conduct of the Title IX Self-Evaluation.
5. The Title IX Self-Evaluation form is available and a copy is attached.
6. The results of the Title IX Self-Evaluation are available and a copy is attached.

* * * *

Below are the Categories used in the tables on the following pages:

Category I - includes institutions which offer the doctorate degree and which conferred in the most recent three years and annual average of fifteen or more earned doctorates covering a minimum of three nonrelated disciplines.
Category IIA - includes institutions awarding degrees above the baccalaureate but not included in Category I.
Category IIB - includes institutions awarding only the baccalaureate or equivalent degree.
Category III - includes two-year institutions with academic ranks.
Category IV - includes institutions without academic ranks. (With the exception of a few liberal arts colleges, this category includes mostly two-year institutions.

PERCENTAGE OF FACULTY MEMBERS WHO ARE WOMEN IN INSTITUTIONS PROVIDING DATA FOR BOTH MEN AND WOMEN, BY CATEGORY, TYPE OF AFFILIATION, AND ACADEMIC RANK, 1975-76 AND 1974-75

Academic Rank	All Combined		Public		Private Independent		Church-Related	
	1975-76	1974-75	1975-76	1974-75	1975-76	1974-75	1975-76	1974-75
CATEGORY I								
Professor	5.6%	6.1	5.8%	5.9%	4.6%	6.8%	6.9%	7.3%
Associate	12.3	12.7	12.2	12.6	12.2	13.2	15.5	14.3
Assistant	24.5	23.9	24.5	23.6	23.1	24.2	27.7	26.4
Instructor	48.3	46.8	49.4	48.2	40.8	36.2	46.7	48.9
Lecturer	39.6	36.1	40.5	37.2	20.1	32.8	50.0	40.0
All Ranks	16.4	16.8	16.6	16.8	14.2	15.6	19.7	19.3
CATEGORY IIA								
Professor	12.9	12.9	12.4	12.9	19.8	15.9	9.4	9.4
Associate	18.8	18.6	18.0	18.3	26.0	21.5	17.0	18.1
Assistant	29.2	28.3	29.5	28.3	30.8	30.1	26.6	26.6
Instructor	50.2	48.4	50.1	48.0	48.2	48.7	52.7	51.4
Lecturer	42.6	44.7	43.8	44.4	44.2	48.5	27.0	44.4
All Ranks	24.1	23.9	23.7	23.6	28.6	26.5	22.5	23.1
CATEGORY IIB								
Professor	13.4	14.1	14.1	15.0	14.2	15.1	12.6	13.3
Associate	19.8	20.0	17.8	16.3	18.8	20.7	21.2	21.5
Assistant	29.1	27.8	29.5	28.3	27.5	26.3	29.7	27.9
Instructor	47.9	47.0	48.5	47.0	43.8	43.9	49.3	48.3
Lecturer	49.4	47.8	46.2	50.6	31.0	38.3	67.2	52.2
All Ranks	25.6	25.6	27.1	26.6	23.3	24.4	26.1	25.7
CATEGORY III								
Professor	20.8	28.2	20.9	27.9	*	71.4	16.0	26.1
Associate	27.3	32.4	27.0	32.0	46.9	57.5	29.0	26.6
Assistant	36.8	42.0	36.9	42.0	36.4	47.8	28.7	38.5
Instructor	50.5	50.0	49.6	49.4	70.2	66.9	57.3	50.8
Lecturer	44.3	52.5	44.3	52.5	-	-	-	-
All Ranks	36.2	40.6	35.9	40.3	55.1	59.6	38.5	40.1
CATEGORY IV								
No Rank	33.3	32.1	33.1	31.9	30.3	30.5	49.6	49.0
ALL CATEGORIES COMBINED EXCEPT IV								
Professor	9.1	10.1	8.7	10.0	9.7	10.5	10.4	10.9
Associate	16.6	17.3	15.9	16.8	18.3	18.2	18.9	18.2
Assistant	27.9	27.9	28.0	28.1	26.7	28.7	28.4	27.4
Instructor	49.3	48.0	49.7	48.3	45.7	44.6	50.2	49.4
Lecturer	41.2	41.4	41.7	42.4	37.0	35.4	51.5	47.9
All Ranks	21.7	22.5	21.5	21.7	20.6	21.4	24.0	24.0

NOTE: The number of institutions providing data for both men and women was 1,351 in 1974-75 and 1,304 for the most recent academic year. For definition of categories see Table 2, footnote 2

* Sample too small to be meaningful.

PERCENTAGE DIFFERENCES BETWEEN AVERAGE COMPENSATION OF MEN AND WOMEN FACULTY MEMBERS, BY CATEGORY, TYPE OF AFFILIATION, AND ACADEMIC RANK, 1975-76 and 1974-75[1]

Academic Rank	All Combined		Public		Private Independent		Church-Related	
	1975-76	1974-75	1975-76	1974-75	1975-76	1974-75	1975-76	1974-75
CATEGORY I								
Professor	10.0%	10.5%	8.9%	9.5%	12.9%	12.7%	9.0%	9.0%
Associate	3.7	4.7	3.2	4.5	3.8	4.5	8.1	7.0
Assistant	4.6	5.4	4.5	5.3	3.9	4.5	7.1	5.6
Instructor	4.5	5.0	4.6	5.6	2.4	-1.8	7.0	6.3
All Ranks	22.2	22.4	21.2	21.9	26.1	24.5	20.0	19.4
Average Within-Rank Difference[2]	5.1	5.8	4.8	5.7	4.9	5.1	7.5	6.4
CATEGORY IIA								
Professor	3.9	3.1	3.0	2.6	7.1	6.7	12.4	11.0
Associate	3.2	1.9	2.3	0.9	4.5	4.3	8.8	9.7
Assistant	3.9	3.0	3.2	2.4	4.7	4.8	8.3	7.5
Instructor	5.2	4.6	5.1	4.3	4.7	5.8	4.9	5.0
All Ranks	14.5	13.0	13.7	12.3	15.8	15.4	19.0	18.4
Average Within-Rank Difference[2]	4.0	3.1	3.4	2.5	4.9	5.2	8.0	7.7
CATEGORY IIB								
Professor	6.4	7.1	9.2	6.6	2.0	2.8	9.6	10.2
Associate	6.7	6.8	6.2	4.5	3.5	3.7	7.5	7.9
Assistant	4.5	5.3	4.3	5.1	2.3	3.6	6.2	6.1
Instructor	5.0	5.1	6.0	4.1	4.4	4.8	4.4	5.6
All Ranks	14.8	14.3	14.4	12.9	12.0	13.1	15.9	15.4
Average Within-Rank Difference[2]	5.3	5.8	5.6	4.8	2.9	3.7	6.4	6.9
CATEGORY III								
Professor	*	3.5	*	2.7	*	*	*	*
Associate	3.5	1.2	2.9	0.1	9.3	7.4	5.3	6.2
Assistant	2.1	0.7	2.2	0.4	1.7	5.8	4.0	1.7
Instructor	7.7	4.4	7.2	3.5	-4.5	1.1	9.3	1.2
All Ranks	10.4	8.5	9.9	7.8	11.8	8.7	9.6	7.9
Average Within-Rank Difference[2]	4.2	2.2	3.9	2.7	-0.9	3.5	7.0	2.1
CATEGORY IV								
No Rank	10.2	9.1	9.9	8.8	9.3	7.6	6.7	4.5
ALL CATEGORIES COMBINED EXCEPT IV								
Professor	9.7	8.4	7.7	6.5	13.7	13.7	12.1	12.0
Associate	4.7	3.8	3.2	2.1	5.8	6.2	9.0	9.4
Assistant	4.2	3.7	2.3	3.1	4.2	4.9	6.9	6.7
Instructor	5.3	4.7	5.5	4.5	4.8	4.7	5.0	5.2
All Ranks	19.1	17.5	18.1	16.4	22.4	21.9	18.6	17.9
Average Within-Rank Difference[2]	5.2	4.5	3.9	3.6	6.0	6.5	7.4	7.5

* Sample too small to be meaningful.

1 Samples include 1,351 and 1,304 institutions submitting data broken down by sex for 1975-76 and 1974-75 respectively

2 Average of percent differences for the ranks, weighted by proportion of women in rank.

NOTE: For definition of categories see footnote 2 Table 2. A negative sign indicates that women are paid more than men.

ANNOUNCEMENTS

On Saturday, January 29, a group of former students of Professor Lee Lorch is sponsoring a luncheon in his honor. The luncheon will take place in Mr. Sam's Restaurant at the Chase-Park Plaza, beginning at noon. Tickets for the luncheon are $6.50 each, and will be available at the registration desk. The price includes tax and gratuity.

H. Hope Daly, Head
Meeting Arrangements
American Mathematical Society

A joint subcommittee of Committee A (Academic Freedom and Tenure), Committee W (Status of Women in the Profession), and Committee Z (Economic Status of the Profession) of AAUP is developing a statement on policies for part-time faculty. Issues such as tenure, compensation, and participation in governance are being addressed. Although the report is still in draft form, it is expected that AAUP support for tenure for at least some categories of part-time faculty will be recommended. There are many extremely complex issues involved, and the committee would appreciate hearing from those with interest and/or knowledge in the field. Requests for copies of the draft report should be addressed to AAUP, One Dupont Circle, Washington, D.C. 20036. Suggestions can be sent there or to me.

Mary Gray
Department of Mathematics
American University
Washington, D.C. 20016

OF POSSIBLE INTEREST

Bell Laboratories has a Graduate Research Program for Women which encourages women graduate students in mathematics and the sciences, by giving them money and summer employment at Bell Labs. Most applicants are college seniors. Application forms may be obtained from Dr. Samuel P. Morgan, Director, Computing Science Research Center, Bell Laboratories, 600 Mountain Avenue, Murray Hill, N.J. 07974.

The AAAS Mass Media Intern Program is in its third year. It is designed to get graduate students in the sciences working with the media. For information write to Gretchen Vermilye, American Association for the Advancement of Science, 1776 Massachusetts Avenue NW, Washington, D.C. 20036.

The Northridge campus of the California State University has an organization called Women in Science and Engineering, sponsored by the school of engineering and computer science there. They have put out a feisty booklet called Women in Science and Engineering with lots of charts and pictures. You can contact Bonita J. Campbell, School of Engineering and Computer Science, California State University at Northridge, 18111 Nordhoff Street, Northridge, Calif. 91324.

The Purdue University School of Electrical Engineering has an elaborate support system for its female students, as well as programs reaching into the high schools to encourage young women to become engineers. They've been doing this since 1968, and in that time the five-year retention rate for women has increased dramatically until it is now slightly better than the five-year retention rate for men. Contact Violet Haas, School of Electrical Engineering, Electrical Engineering Building, Purdue University, West Lafayette, Indiana 47907.

The International Biographical Centre is preparing the fourth edition of the World Who's Who of Women. If you think that you or a friend should be in it (they asked us for our membership list, but we never give it out) write to Melody Bradley, International Biographical Centre, Cambridge CB2 3QP, England.

Fundamentals of Management and Organizational Behavior for Women is a seminar run by Dr. Howard E. Mitchell and Dr. Diana C. Robertson of the Wharton School of Business. It will be in New York City on December 6-7, San Francisco on January 17-18, Chicago on February 7-8, and Houston on March 21-22. If you're interested, contact the Wharton Registrar, New York Management Center, 360 Lexington Avenue, New York, N.Y. 10017.

Feminist movies, among others, are available from Insight Exchange, P.O. Box 42584, San Francisco, Calif. 94101.

The Women's History Library is now dispersed. Its collection is on microfilm. You might suggest that your school library order pieces of the collection. For information, write to Tina Stableford, Research Publications, 12 Lunar Drive, Woodbridge, Connecticut 06525.

And lest we think the battle's won, the following is exactly what appeared in the announcements of the fall meeting of the Society for Industrial and Applied Mathematics:

"Ladies Program

While there is no "official" Ladies Program, attendees who plan to bring their wives should write or call Professor William F. Ames, Department of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332. If enough interest is shown, Prof. Ames has offered to organize some sightseeing and shopping trips. Telephone 404-894-2695 or 404-355-7487."

JR

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ENCOURAGING WOMEN TO BROADEN THEIR MATHEMATICAL BACKGROUNDS

An AWM panel discussion on the need for female students to broaden their mathematical backgrounds in high school was held on November 8, 1976 in Anaheim, Calif. as part of the annual meeting of the California Council of Teachers of Mathematics, Southern Section. The panel coordinator was Ruth Afflack, California State University, Long Beach.

The panel presented studies that show that the proportion of females in high school mathematics classes steadily declines from beginning algebra classes to senior level trigonometry and calculus classes. A recent check of a few local high schools put the composition at 50% female in 9th grade algebra, down to 33% female in 12th grade calculus. Since college entrance requirements are typically two years of algebra and geometry high school girls (and their parents, teachers, and counselors) may not be too concerned about these statistics, but a limited background in mathematics can be a serious handicap in college studies. As pointed out by a panel member "...two years of mathematics may be enough to get you into college but may not be enough to get you out with a degree in the major of your choice."

Today a number of career majors (e.g. business, psychology, geography) which to the high school student may seem to require little mathematics actually do require calculus and/or probability and statistics - courses for which a third and, possibly, fourth year of high school mathematics are very desirable. The alternative to more mathematics in high school is to take one or two semesters of remedial mathematics in college with the disadvantage of large classes covering material at a much faster rate than in high school and with the possibility of a delay in getting started in a chosen major.

To encourage girls to study more mathematics in high school we need to deal with a girl's feeling that she is "no good at math", to give her more opportunity to engage in problem solving activities and to deal with her weak perception of herself as a working adult which influences her attitude on the need for career-oriented subjects like mathematics. By communicating with the mathematics teachers about the importance of mathematics in the college curriculum the AWM panel hopes to reduce the number of students who come to college mathematically ill-prepared.

Diane L. Schwartz, Assistant Professor
University of Southern California

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