IN MEMORIAM

HARRY SCHULTZ VANDIVER

1882 - 1973

The career of Harry Schultz Vandiver was remarkable in many ways. He was born in Philadelphia, Pennsylvania on October 21, 1882, and he attended Central High School in that city, but he did not graduate or receive a diploma. He did not take an undergraduate program in any college or university, but from 1904 to 1906 he attended some graduate courses at the University of Pennsylvania. He received no degree until that university conferred an honorary Doctor of Science Degree upon him in 1946 (in his sixty-fourth year).

From 1905 to 1917 he worked as a customs house broker and freight agent for a family firm. But as early as 1900 he began studying the problems presented in the AMERICAN MATHEMATICAL MONTHLY and submitting solutions. In later life he prepared a list of his publications and he included as item #1 a list of about a dozen solutions to problems which had appeared in the problems section of the MONTHLY and which solutions embodied original material. Had he continued in this vein he would, no doubt, have become what Julian Lowell Coolidge of Harvard University called a "gifted amateur" and some of his mathematics might have found its way into Coolidge's book, THE MATHEMATICS OF GIFTED AMATEURS.

A number of papers were written by Vandiver in the period 1902-1919. About half of them dealt with the celebrated Fermat's Last Theorem, and the others with various topics in algebra. In 1904 he and Professor George David Birkhoff collaborated on a paper, "On the Integral Divisors of a^n - b^n", which was published in the ANNALS OF MATHEMATICS. This paper is still being referenced today, two-thirds of a century later, and not always as a historical source.

But World War I marked a turning point. Vandiver served as yeoman, 1st class, in the U. S. Naval Reserve from 1917 to 1919, and upon his release from active duty he left the family firm for an instructor in
mathematics at Cornell, where he stayed until 1924. In some ways his life parallels that of Arthur Cayley who had entered the family legal firm in Great Britain. Cayley published many mathematical articles and finally left the law firm for an academic post, and then turned out a great number of original papers and articles on algebraic subjects.

The years at Cornell were fruitful. Vandiver received a visiting summer appointment with professorial rank at the University of Chicago in 1922; and while he was at his academic home at Cornell he received grants from the Heckscher Research Foundation for the years 1920-1923.

In 1923 he married Maude Polmsbee. They had one son, Frank Vandiver. In many ways this son is following in his father's footsteps. Frank was privately tutored for his secondary school education and for his undergraduate college program. But he did receive two M.A.'s and an earned doctorate in history. He is on the faculty of Rice University in Houston, and he has served an interim term as Acting President of Rice, and is currently Provost.

In 1924 Professor Milton Brockett Porter was engaged in building up the mathematics staff of The University of Texas at Austin. Porter knew that the mere possession of a doctoral degree (or any other degree) was small indication of ability. He was more apt to have been influenced by Vandiver's growing list of papers and reviews (about 20 by 1924). At any rate Vandiver came to the University of Texas in 1924 as an Associate Professor.

In the meantime Vandiver had edited Chapter 26 in Volume II of Leonard Eugene Dickson's HISTORY OF THE THEORY OF NUMBERS published by the Carnegie Institute of Washington, D.C. Perhaps Dickson of the University of Chicago (but who was a graduate of The University of Texas) had recommended Vandiver to his friend Porter. Also, in 1923, Dickson, Mitchell, Wahlin and Vandiver had prepared a "Report on the Theory of Algebraic Numbers" for the National Research Council which was published
in the BULLETIN OF THE NATIONAL RESEARCH COUNCIL for 1923.

All through his mathematical career Professor Vandiver was interested in the publication of authoritative expository, historical, and survey articles. When he felt himself running out of new mathematical ideas (and despite his enormous output, this did sometimes happen), Vandiver would concentrate on writing an expository paper. So keen was his judgement and his timing that these papers were readily accepted by the journal editors and published for the benefit of all mathematicians.

So Vandiver came to The University of Texas in 1924. There are those who bemoan the fact that he didn't "stay" here. He was always receiving grants and senior fellowships, and therefore moving about in an age when most people tended to stay put. He received a Guggenheim Fellowship in 1927-28, was a lecturer at Princeton in 1934, and a lecturer at the Universities of Indiana and Notre Dame in 1947. He received numerous research grants from The University of Texas, the American Philosophical Society, and the National Science Foundation. These grants from the National Science Foundation from 1955 to 1961 extended up to Vandiver's seventy-ninth year. This is surely a ripe age at which to be receiving research grants, but this represents only one remarkable facet in Vandiver's career.

One of the coveted prizes offered by the American Mathematical Society is the Frank Nelson Cole prize in the Theory of Numbers. Vandiver was awarded this prize in 1931. Also he was elected a member of the National Academy of Sciences, and thus was entitled to put the initials M.N.A.S. after his name in the faculty directories. As already noted, it was 1946 before he could put the initials D.Sc. after his name. But, of course, he didn't care whether or not the initials were there.

In the thirties, The University of Texas had a DISTINGUISHED PROFESSORSHIP, with a new distinguished professor named each year. The holder was relieved of half of his teaching duties, and was expected to give a series of lectures each spring. The first distinguished professor was Milton Brockett Porter (who had brought Vandiver to Texas when he had begun
building up the department in 1924). Vandiver was the DISTINGUISHED PROFESSOR in 1933, and his series of lectures was on the so-called Fermat's Last Theorem (or conjecture). This theorem is very easy to state, but it remains unproved. It asserts that for positive counting numbers (one, two, three, four, etc.) \( p, q, r, \) and \( n \) in the relation 
\[ p^n + q^n = r^n \]
holds only for \( n = 2 \) and, trivially, for \( n = 1 \). For \( n = 2 \) this suggests the familiar Pythagorean Theorem for certain right triangles with the side lengths being whole numbers. Many examples such as 
\[ p = 3, \; q = 4, \; r = 5, \; \text{or} \; 3^2 + 4^2 = 5^2 \]
and 
\[ p = 5, \; q = 12, \; r = 13 \; \text{or} \; 5^2 + 12^2 = 13^2 \]
are known for \( n = 2 \).

Fermat wrote on the margin of one of his books that he had discovered a truly remarkable proof of this theorem (i.e., that there are no solutions for \( n \) greater than 2), but that the margin of the page was too small to accommodate the proof. The note was found in the book after his death, but no proof was ever found in Fermat's papers. This marginal note was written about 1637 (although not discovered by his son and mathematical executor until some years later). Mathematicians have been trying ever since to either prove or disprove Fermat's Last Theorem, as this conjecture is known.

There are two schools of thought. One school says that it wishes that Fermat had had a larger sheet of paper handy and could have given us a full proof. (This assumes that Fermat's proof would have been correct.) Another school says that so much new mathematics has been invented in trying to prove Fermat's Last Theorem (which presumably would not have been invented if there had been no theorem to prove) and these new additions to mathematics have been so fruitful in other areas and problems that it is just as well that Fermat had a small margin.

At any rate Harry Vandiver devoted himself to working on Fermat's Last Theorem. He proved the theorem for certain special cases, and in 1946 wrote a twenty page survey article for the AMERICAN MATHEMATICAL MONTHLY summarizing the known results. In 1953 this was followed by a
four page note on new special cases. At the end of World War II it had become possible to approach some of the outstanding mathematical problems via the digital computing machines. While it would be inexact to portray the then seventy year old Vandiver as a computer programmer, he and his younger students enlisted the aid of computer programmers and many hypotheses were tested and Vandiver himself pored over pages of computer print-out material looking for the unusual. In 1955, J. L. Selfridge, C. A. Nicol and Vandiver showed that if Fermat's Last Theorem were to prove to be false, then the exponent \( n \) would have to be greater than 4,002. (Just a year earlier this bound was 2002.)

While essentially a research professor, Vandiver was not indifferent to the needs of graduate students. He served on many committees which approved theses and dissertations, and he developed students of his own. These include the following who completed M.A.'s:

- Miriam Elizabeth BADGER 1929
- Marshall McSwain ABERNATHY 1930
- Ferdinand Charles BIESELE 1933
- Raphael SANCHEZ-DIAZ 1933
- Morris Edward TITTLE 1935
- Erna Herzog PEARSON 1946
- Milo Wesley WEAVER 1950
- Charles Albert NICOL 1952

and the following who completed Ph.D.'s:

- Ferdinand Charles BIESELE 1941
- Olin B. FAIRCLOTH 1951
- Charles Albert NICOL 1954
- Milo Wesley WEAVER 1956
- Richard Paul KELISKY 1957.

Although Vandiver had no personal experiences as a carefree sophomore, he chose to live a part of his later life as if he were a happy sophomore when he followed the fortunes of the Longhorn Varsity baseball team. On a spring afternoon one could find him in a box seat at Clark Field
thoroughly enjoying a close and well-played baseball game. A game which
ended with a one-sided score was not to his taste.

The Vandivers never owned a home in Austin. To compensate in part
for this (as they moved from an apartment to the home of a faculty member
on leave and then on leave themselves for a semester and then back to an
apartment in Austin), for many years Professor and Mrs. Vandiver had a
"permanent" room at the Alamo Hotel on West 6th Street. Here they kept
a large supply of classical recordings and a record player. Thence
Vandiver would sometimes retreat; he would set a stack of records on the
player and perhaps turn over in his mind, while listening to music,
conjectures, lines of attack, and maybe mathematical proofs. Once, after
a mathematical lecture in Georgia, it developed that those still crowd-
ing around the lecturer wanted to hear about a musical personality which
Vandiver had mentioned briefly. He obliged them by giving a twenty
minute lecture on the theory of musical compositions and the pleasures
of musical listening.

In the middle nineteen fifties, Vandiver's intense and single-minded
concentration on his mathematical research brought him to the brink of
physical collapse. He would forget to eat, and he would work far into
the night. Eventually he found it necessary to withdraw temporarily from
this schedule. By following a regular and less-demanding schedule, his
health returned. In a few years he was working away on his research with
renewed vigor and enthusiasm. He gave up going to baseball games, he
quit accepting reviewing and refereeing assignments from journal editors,
and he planned his days so as to spread his energy where he thought it
would do the most good - on his research.

Vandiver thought so much of his research that in Christmas vacation
seasons when he was in Austin he would come up to his office for work.
The University was then on a forced economy drive (in the early and
middle nineteen fifties) and no building heat was being supplied to
certain office buildings. So Vandiver brought along a small portable
electric heater and kept himself warm as he turned out more mathematics.
In 1961, when he was in his 79th year, Vandiver was honored by the Texas Section of the Mathematical Association of American by being invited to deliver the principal address at the annual meeting of the Section on the campus of Stephen F. Austin State University at Nacogdoches. This was his last public professional appearance, and some two hundred of his colleagues, friends and ex-students attended. His lecture "On Developments in an Arithmetical Theory of Bernoulli Numbers" included recent advances and simplifications which Vandiver had made. (Work in Bernoulli numbers was second only to Fermat's Last Theorem in Vandiver's studies, and indeed certain properties of Bernoulli numbers were used to establish some of Vandiver's results on Fermat's Last Theorem.)

In 1965, when Vandiver was 83, the editors of the JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS decided to dedicate one issue of the 1966 volume to him. A number of papers contributed by former students and by friends from over the globe appeared in this volume -- but the most striking feature was the front-piece photograph of Vandiver taken a few years earlier by Walter Barnes (who was one of Vandiver's pupils in the late twenties and early thirties) of Austin. This portrait was given a special award as "best portrait of a man" by the Texas Professional Photographers at one of their meetings.

Vandiver was mentally active until late in life. Professor Alfred Brauer of the University of North Carolina wrote to Vandiver, saying "In my opinion there does not exist another mathematician in the history of mathematics who has done research so successfully as you after attaining the age of 70."

Finally, at age 84, he resigned his Modified Service appointment and became Professor Emeritus. Although he lived on for six and a half more years, his poor health made rest home care desirable for him. He died on January 4, 1973.
This Memorial Resolution was prepared by a Special Committee consisting of R. E. Greenwood (chairman), Anne Barnes, Roger Osborn, and Milo Weaver