Leonard Eugene Dickson was born in Independence, Iowa on January 22, 1874. He was a brilliant undergraduate at the University of Texas receiving his B.S. degree as valedictorian of his class in 1893. He was a chemist with the Texas Biological Survey from 1892–1893. He served as a teaching fellow at the University of Texas receiving the M.A. degree in 1894. He held a fellowship at the University of Chicago from 1894 to 1896 and was awarded its first Ph.D. in Mathematics in 1896. He spent the year 1896–1897 in Leipzig and Paris, was instructor in mathematics at the University of California 1897–1899, Associate Professor at Texas 1899–1900, Assistant Professor at Chicago 1900–1907, Associate Professor 1907–1910, and Professor in 1910. He was appointed to the Eliakim Hastings Moore Distinguished Professorship in 1928, and became Professor Emeritus in 1939. He served as Visiting Professor at the University of California in 1914, 1918, and 1922.

Professor Dickson was awarded the $1,000 A.A.A.S. Prize in 1924 for his work on the arithmetics of algebras. He was awarded the Cole Prize of the American Mathematical Society in 1928 for his book *Algebren und ihre Zahlentheorie*. He served as Editor of the Monthly 1902–1908, and the Transactions from 1911 to 1916, and he was President of the American Mathematical Society from 1916–1918. He was elected to membership in the National Academy of Sciences in 1913 and was a member of the American Philosophical Society, the American Academy of Arts and Sciences, and the London Mathematical Society. He was also a foreign member of the Academy of the Institute of France, and an honorary member of the Czechoslovakian Union of Mathematics and Physics. He was awarded the honorary Sc.D. degree by Harvard in 1936 and Princeton in 1941.

Professor Dickson died in Texas on January 17, 1954.

Dickson was one of our most prolific mathematicians. His bibliography (prepared by Mr. Richard Block, a student at the University of Chicago) contains 285 titles. Of these 18 are books, one a joint book with Miller and Blichfeldt. One of the books is his major three-volume *History of the theory of numbers* which would be a life's work by itself for a more ordinary man.

Dickson was an inspiring teacher. He supervised the doctorate dissertation of at least 55 Chicago Ph.D's. He helped his students
to get started in research after the Ph.D. and his books had a world-
wide influence in stimulating research.

Attention should be called to the attached bibliography. It in­
cludes Dickson’s books with titles listed in capitals. It does not in­
clude Dickson’s portion of the report of the Committee on Algebraic
Number Theory, nor does it include Dickson’s monograph on ruler
and compass constructions which appeared in Monographs on
Modern Mathematics.

We now pass on to a brief discussion of Dickson’s research.

1. Linear groups. Dickson’s first major research effort was a study
of finite linear groups. All but seven of his first forty-three papers
were on that subject and this portion of his work led to his famous
first book, [44]. The linear groups which had been investigated by
Galois, Jordan, and Serret were all groups over the field of \( p \) elements.
Dickson generalized their results to linear groups over an arbitrary
finite field. He obtained many new systems of simple groups, and he
closed his book with a still valuable summary of the known systems
of simple groups.

Dickson’s work on linear groups continued until 1908 and he wrote
about 44 additional papers on the subject. In these later papers he
studied the isomorphism of certain simple groups and questions about
the existence of certain types of subgroups. He also derived a number
of theorems on infinite linear groups.

2. Finite fields and Chevalley’s Theorem. In [44] Dickson gave the
first extensive exposition of the theory of finite fields. He applied
his deep knowledge of that subject not only to linear groups but to
other problems which we shall discuss later. He studied irreducibility
questions over a finite field in [113], the Galois theory in [114], and
forms whose values are squares in [139]. His knowledge of the role of the
non-null form was shown in [155]. In [142] Dickson made the
following statement: “For a finite field it seems to be true that every
form of degree \( m \) in \( m+1 \) variables vanishes for values not all zero
in the field.” This result was first proved by C. Chevalley in his paper
_Démonstration d’une hypothèse de M. Artin_, Hamb. Abh. vol. 11
(1935) pp. 73–75. At least the conjecture should have been attributed
to Dickson who actually proved the theorem for \( m = 2, 3 \).

3. Invariants. Several of Dickson’s early papers were concerned
with the problems of the algebraic geometry of his time. For example,
see [4], [48], [54]. This work led naturally to his study of algebraic
invariants and his interest in finite fields to modular invariants. He
wrote a basic paper on the latter subject in [141], and many other
papers on the subject. In these papers he devoted a great deal of
space to the details of a number of special cases. His book, [172], on
the classical theory of algebraic invariants, was published in 1914,
the year after the appearance of his colloquium lectures. His amazing
productivity is attested to by the fact that he also published his book,
[173], on linear algebras in 1914.

4. Algebras. Dickson played a major role in research on linear
algebras. He began with a study of finite division algebras in [105],
[115], [116], and [117]. In these papers he determined all three and
four-dimensional finite (non-associative) division algebras over a field
of characteristic not two, a set of algebras of dimension six, and a
method for constructing algebras of dimension $mk$ with a subfield of
dimension $m$. In [126] he related the theory of ternary cubic forms
to the theory of three-dimensional division algebras. His last paper
on non-associative algebras, [268], appeared in 1937 and contained
basic results on algebras of degree two.

Reference has already been made to Dickson's first book on linear
algebras. In that text he gave a proof of his result that a real Cayley
division algebra is actually a division algebra. He presented the
Cartan theory of linear associative algebras rather than the Wedder-
burn theory but stated the results of the latter theory in his closing
chapter without proofs. The present value of this book is enhanced
by numerous bibliographical references.

Dickson defined cyclic algebras in a Bulletin abstract of vol. 12
(1905–1906). His paper, [160], on the subject did not appear until
1912 where he presented a study of algebras of dimension 16.

Dickson's work on the arithmetics of algebras first appeared in
[204]. His major work on the subject of arithmetics was presented in
[213] where he also gave an exposition of the Wedderburn theory.
See also [237] and [238].

The text [231] is a German version of [213]. However, the new
version also contains the results on crossed product algebras which
had been published in [223], and contains many other items of
importance.

5. Theory of numbers. Dickson always said that mathematics is the
queen of the sciences, and that the theory of numbers is the queen
of mathematics. He also stated that he had always wished to work in
the theory of numbers and that he wrote his monumental three-
volume History of the theory of numbers so that he could know all of
the work which had been done in the subject. His first paper, [28],
contained a generalization of the elementary Fermat theorem which
arose in connection with finite field theory. He was interested in the
existence of perfect numbers and wrote [166], and [167] on the re-
lated topic of abundant numbers. His interest in Fermat’s last theorem appears in [190], [136], [137], [138], and [144]. During 1926–1930 he spent most of his energy on research in the arithmetic theory of quadratic forms, in particular on universal forms.

Dickson’s interest in additive number theory began in 1927 with [229]. He wrote many papers on the subject during the remainder of his life. The analytic results of Vinogradov gave Dickson the hope of proving the so-called ideal Waring theorem. This he did in a long series of papers. His final result is an almost complete verification of the conjecture made by J. A. Euler in 1772. That conjecture stated that every positive integer is a sum of \( J \) \( n \)th powers where we write
\[
3^n = 2^n q + r, \quad 2^n > r > 0, \quad \text{and} \quad J = 2^n + q - 2.
\]
Dickson showed that if \( n > 6 \) this value is correct unless \( q + r + 3 > 2^n \). It is still not known whether or not this last inequality is possible but if it does occur the number \( g(n) \) of such \( n \)th powers required to represent all integers is \( J + f \), or \( J + f - 1 \), according as \( f q + f + q = 2^n \), or \( f q + f + q > 2^n \), where \( f \) is the greatest integer in \((4/3)^n\).

6. Miscellaneous. We close by mentioning Dickson’s interest in the theory of matrices which is best illustrated by his text, *Modern algebraic theories*. His geometric work in [179], [181], [182], [183], [184], [185], and [186] must also be mentioned, as well as his interesting monograph [219] on differential equations from the Lie group standpoint.

**BIBLIOGRAPHY**

15. Concerning a linear homogeneous group in $C_{m,q}$ variables isomorphic to the general linear homogeneous group in $m$ variables, Bull. Amer. Math. Soc. vol. 5 (1898) pp. 120–135.
22. The group of linear homogeneous substitutions on $mq$ variables which is defined by the invariant $\Phi = \sum_{i=1}^m \xi_1 \xi_2 \cdots \xi_q$, Proc. London Math. Soc. vol. 30 (1899) pp. 200–208.
23. Determination of the structure of all linear homogeneous groups in a Galois field which are defined by a quadratic invariant, Amer. J. Math. vol. 21 (1899) pp. 193–256.
32. The structure of the linear homogeneous groups defined by the invariant $\lambda_1 \xi_1 + \lambda_2 \xi_2 + \cdots + \lambda_m \xi_m$, Math. Ann. vol. 52 (1899) pp. 561–581.
33. Definition of the Abelian, the two hypoabelian, and related linear groups as quotient groups of the groups of isomorphisms of certain elementary groups, Trans. Amer. Math. Soc. vol. 1 (1900) pp. 30–38.
37. Proof of the existence of the Galois field of order \( p^r \) for every integer \( r \) and prime number \( p \), Bull. Amer. Math. Soc. vol. 6 (1900) pp. 203–204.
38. Concerning the cyclic subgroups of the simple group \( G \) of all linear fractional substitutions of determinant unity in two non-homogeneous variables with coefficients in an arbitrary Galois field, Amer. J. Math. vol. 22 (1900) pp. 231–252.
41. Determination of an abstract simple group of order \( 2^7 \cdot 3^8 \cdot 5 \cdot 7 \) holoedrically isomorphic with a certain orthogonal group and with a certain hypoabelian group, Trans. Amer. Math. Soc. vol. 1 (1900) pp. 353–370.
42. Proof of the non-isomorphism of the simple Abelian group on \( 2m \) indices and the orthogonal group on \( 2m+1 \) indices for \( m > 2 \), Quarterly Journal of Pure and Applied Mathematics vol. 32 (1900) pp. 42–63.
44. LINEAR GROUPS WITH AN EXPOSITION OF THE GALOIS FIELD THEORY, Leipzig, Teubner, 1901, 10+312 pp.
48. The configurations of the 27 lines on a cubic surface and the 28 bitangents to a quartic curve, Bull. Amer. Math. Soc. vol. 8 (1901) pp. 63–70.
69. Ternary orthogonal group in a general field, University of Chicago Press, 1903, 8 pp.
70. Groups defined for a general field by the rotation groups, University of Chicago Press, 1903, 17 pp.
75. Three sets of generational relations defining the abstract simple group of order 504, Bull. Amer. Math. Soc. vol. 9 (1903) pp. 194–204.
77. The abstract group G simply isomorphic with the alternating group on six letters, Bull. Amer. Math. Soc. vol. 9 (1903) pp. 303–306.
84. 1. Ternary orthogonal groups in a general field. 2. The groups defined for a general field by the rotation group, University of Chicago Press, 1904, 26 pp.
85. The subgroups of order a power of 2 of the simple quinary orthogonal group in the Galois field of order $p^n = 8l \pm 3$, Trans. Amer. Math. Soc. vol. 5 (1904) pp. 1–38.
93. Application of groups to a complex problem in arrangements, Ann. of Math. vol. 6 (1904) pp. 31–34.
95. A property of the group $G_{2n}$ all of whose operators except identity are of period 2, Amer. Math. Monthly vol. 11 (1904) pp. 203–206.
97. The minimum degree $r$ of resolvents for the $p$-section of the periods of hyperelliptic functions of four periods, Trans. Amer. Math. Soc. vol. 6 (1905) pp. 48–57.
102. Definitions of a group and a field by independent postulates, Trans. Amer. Math. Soc. vol. 6 (1905) pp. 198–204.


144. Lower limit for the number of sets of solutions of $x^n+y^n+z^n=0 \pmod{p}$, J. Reine Angew. Math. vol. 135 (1909) pp. 181–188.
158. On the negative discriminants for which there is a single class of positive binary quadratic forms, Bull. Amer. Math. Soc. vol. 17 (1911) pp. 534–547.
166. Finiteness of the odd perfect and primitive abundant numbers with $n$ distinct prime factors, Amer. J. Math. vol. 35 (1913) pp. 413–422.


206. Reducible cubic forms expressible rationally as determinants, Ann. of Math. vol. 23 (1921) pp. 70–74.

207. A fundamental system of covariants of the ternary cubic form, Ann. of Math. vol. 23 (1921) pp. 78–82.


209. PLANE TRIGONOMETRY WITH PRACTICAL APPLICATIONS, Chicago, Sanborn, 1922, 12+176+35 pp.


212. The rational linear algebras of maximum and minimum ranks, Proc. London
Math. Soc. (2) vol. 22 (1923) pp. 143-162.
213. ALGEBRAS AND THEIR ARITHMETICS, Chicago, University of
214. HISTORY OF THE THEORY OF NUMBERS, Vol. III. QUADRATIC
AND HIGHER FORMS (With a chapter on the class number by G. H. Cresse),
464–467.
(1924) pp. 1–16.
247–257.
219. Differential equations from the group standpoint, Ann. of Math. (2) vol. 25
220. Quadratic fields in which factorization is always unique, Bull. Amer. Math.
838.
222. Resolvent sextics of quintic equations, Bull. Amer. Math. Soc. vol. 31 (1925)
pp. 515–523.
224. MODERN ALGEBRAIC THEORIES, Chicago, New York, Boston; San-
225. All integral solutions of $ax^3 + bxy + cy^2 = w_1 w_2 \cdots w_n$, Bull. Amer. Math. Soc.
227. Quaternion quadratic forms representing all integers, Amer. J. Math. vol. 49
228. Integers represented by positive ternary quadratic forms, Bull. Amer. Math.
229. Extensions of Waring’s theorem on nine cubes, Amer. Math. Monthly vol. 34
231. ALGEBREN UND IHRE ZAHLENTHEORIE, Zurich, Orell Füssli, 1927,
8+308 pp. (translation of completely revised and extended manuscript).
233. Singular case of pairs of bilinear, quadratic, or Hermitian forms, Trans. Amer.
234. Generalization of Waring’s theorem on fourth, sixth, and eighth powers, Amer.
235. Ternary quadratic forms and congruences, Ann. of Math. (2) vol. 28 (1927)
236. All positive integers are sums of values of a quadratic function of $x$, Bull.
244. Quadratic functions or forms, sums of whose values give all positive integers, J. Math. Pures Appl. vol. 7 (1928) pp. 319–336.


283. All integers except 23 and 239 are sums of eight cubes, Bull. Amer. Math. Soc. vol. 45 (1939) pp. 588–591.


A. A. Albert