WILLIAM ELWOOD BYERLY—IN MEMORIAM

William Elwood Byerly was born in Philadelphia, December 13, 1849. At the St. Louis Exposition in 1904 he met his contemporary Professor Felix Klein. Klein remarked that this was an excellent birth year for a mathematician as it was the only year in the nineteenth century which was a perfect square. Had Byerly lived two weeks longer, he would have died in the only year of the twentieth century that has the same peculiarity.

His parents early moved to Orange, New Jersey, where he was brought up and prepared for college by private tutors. He entered Harvard in September, 1867, graduating with distinction in 1871, a classmate of Charles Jerome Bonaparte, Henry Cabot Lodge, and William Lawrence, long Bishop of Massachusetts. As an undergraduate he was interested in gymnastics and all his life he was essentially an out-of-doors man devoted to horseback riding, camping, and especially golf. He played his last few holes at the age of eighty-five.

Returning to the graduate school he studied two years and in 1873 received, contemporaneously with another student, one of the first two degrees of doctor of philosophy ever granted by the University. His thesis, which was never published, dealt with the heat of the sun. It was based on the changes of energy induced by the sun's substance coming in from infinity. It is interesting to note that this first doctor's thesis consisted of twenty-five pages longhand. On leaving Harvard he was appointed assistant professor of mathematics at Cornell, where he stayed for three years. He returned to Cambridge as assistant professor in 1876. He was promoted to a full professorship in 1881 and made Perkins Professor at the death of J. M. Peirce in 1905.

In 1913 Professor Byerly resigned his position at Harvard. He was told by his oculist that if he continued working he would become blind within two years, whereas he might enjoy many years of health if he severed his academic ties. This prediction proved absolutely accurate, for, although he tried a certain amount of writing after giving up his professorship, it turned out to be too exacting for his eyesight, but he enjoyed reasonable health for the next twenty-two years. Perhaps it was a bitter time to hand in his resignation. On the one hand, he was in excellent general health; on the other hand, he was distinctly critical of the new policies inaugurated by the Lowell administration and he was far from seeing eye to eye with some of his younger colleagues. But he retained no bitterness and remained a loyal Harvard man till the day of his death from cerebral hemorrhage, December 20, 1935.

Byerly's professional life is largely explained by the influence of two unusual men. The first and greater of these was Benjamin Peirce, who towered above his mathematical contemporaries as a mountain peak in a level plain. He was Byerly's teacher both in college and in the graduate school and undoubtedly settled his pupil's career. Byerly summed up his attitude towards Peirce by saying, "Although we rarely could follow him, we sat up and took notice." We may credit Peirce with deciding Byerly to give his life to mathematical teaching, although the special branches which interested the pupil were not those favored by the teacher. The other man who influenced him similarly was

his predecessor in the Cornell professorship, Evan W. Evans. He introduced Byerly to the modern technique in analytic geometry. Very soon after the latter's appointment at Harvard he initiated a course in this subject which he taught regularly until his resignation. The course has continued uninterruptedly since, and in spite of all modifications, the traces of the original inspiration persist.

Byerly's influence as a teacher was spread through his publications, all of which were primarily didactic in aim. Three years after he began his work at Harvard appeared his *Elements of the Differential Calculus*. He had learned the subject from Peirce, whose methods were strange and wonderful. After leaving Harvard he became acquainted with the best French writers and his eyes were opened to a new day. The spirit of his *Calculus* was taken from the work of Duhamel and Bertrand. He followed Duhamel in continually stressing the idea of limits; he was less happily inspired in his "rather elaborate treatment of infinitesimals in pure geometry." His early introduction of integration was an excellent feature. He followed the happy inspiration of the best English texts by providing numerous and pertinent problems. His *Integral Calculus*, a natural continuation of the *Differential*, appeared in 1881, a second edition in 1888. In 1893 came *An Elementary Treatise on Fourier Series*. This dealt with a variety of mathematical processes applicable to the partial differential equations used in studying such topics as the flow of heat, of electricity, the vibration of strings and membranes. It was the outcome of his work in Mathematics 10, a course which he shared for many years with Professor B. O. Peirce, part of whose work was in the department of physics. At B. O. Peirce's instigation he published, after his resignation, two small books which he hoped would be of value to the physicists, *An Introduction to Generalized Coordinates* in 1916, and *An Introduction to the Calculus of Variations* in 1917. These were not perhaps his happiest ventures. He was not primarily a physicist and his work at Harvard had not kept him in close touch with the more modern mathematical technique used in studying physical problems. Yet the books proved of real service to working physicists, and it was for such that they were written.

Professor Byerly's contributions to education were not confined to his work at Harvard. In 1892 the National Education Association appointed a Committee of Ten, headed by President Eliot, to look into the teaching in American secondary schools. There was a sub-committee on mathematics which met at Harvard under the chairmanship of Simon Newcomb of the Naval Observatory; Byerly was Vice-Chairman and took a vital part in preparing their report. The total report of the Committee was long held as an educational document of high significance.

An important part of Byerly's life work was his service in promoting the higher education of women. When, in 1879, members of the Harvard faculty were asked by a committee of women whether they would offer private instruction of collegiate grade for women students, the first affirmative reply received came from him. Perhaps his Quaker affiliations influenced him in this matter. Perhaps his teaching experience at Cornell, where he had as pupils M. Carey Thomas, afterward the president of Bryn Mawr College, and Christine Ladd, who became a distinguished mathematician, inclined him to a favorable opinion of the intellectual capacity of women.

Whatever the cause of his interest in this movement, which led ultimately to the establishment of Radcliffe College, this interest was, like all of his attachments, deep and abiding. He was active in this enterprise as a teacher of young women for ten critical years, 1879 to 1889, and the always masterly character of his teaching must from the start have given something of strength and dignity to the curriculum offered. But teaching was not his most important service to Radcliffe.

When, in 1882, the Cambridge Society for the Collegiate Instruction of Women was formally incorporated, Byerly was one of the incorporators. He remained a member of the corporation, and of its executive board, called the Council, for forty-two years, till 1924. Thus he had a part, doubtless a weighty part, in shaping and carrying out the policies of Radcliffe during its formative and also its more mature years.

It is probable, however, that he did most for that institution in his capacity as Chairman of its Academic Board. This board consisted of certain members of the Harvard Faculty of Arts and Sciences and, *ex officiis*, the President and the Dean of Radcliffe. The Harvard members were appointed by the President of Harvard to exercise such authority and supervision regarding instruction at Radcliffe as would justify the Harvard Corporation in declaring the various academic degrees of Radcliffe equivalent to the corresponding degrees of Harvard.

Byerly as Chairman of this Academic Board was in fact, as regards the instruction given at Radcliffe and the degrees to which this instruction led, the most authoritative official of the College. He was also the official spokesman of Radcliffe in the not invariably friendly forum of the Harvard faculty.

It is evident enough that the duties of his office, in either of its aspects, were difficult. To fulfill them completely, as Byerly did for so many years, the Chairman had to be what Byerly was, a wise, gentle, forceful man.

When he retired from this office in 1913 the Radcliffe Bulletin quoted President Emeritus Eliot as follows: "I have known about Professor Byerly's work from the beginning and I still know about it. I can only say that he has been the most indispensable person connected with the growth and development of Radcliffe College."

In fitting recognition of his service the newly completed Physics and Chemistry Laboratory Building of Radcliffe was in 1933, on the suggestion of President Emeritus Briggs, named the William Elwood Byerly Hall.

There can be no doubt that Byerly's finest work in life was as a classroom teacher. At a dinner given by his former students on his retirement, he expressed regret that so much of his time and strength had been given to administration at the expense of teaching, "for," said he, "I love to teach but I hate to administer." The key-note of his success was in the words "I love to teach." Dean Briggs once said of him, "Others taught the subject; he taught the class." The quality suggested by these words can be a dangerous one, but it was not so in his case, for the basis of his teaching was love. He loved his subject and he loved his pupils, and the kernel of all his endeavor was the wish to make his pupils see the beauty and significance of the subject which was close to his heart. He would stand before the class, rolling a piece of chalk between his palms, expounding his theme with a perfect comprehension of what was most

interesting to his audience and where they would find their difficulties in mastery. He represented an earlier mathematical generation than a body of teachers whose inspiration came from Germany and who insisted on accuracy to the last detail. Neither in his textbooks nor his classroom did he carry rigor of proof to the furthest possible stage. He felt that a meticulous exactness which killed the pupil's interest was bought at too high a price. From Peirce he had received inspiration. Through his teaching and writing he passed on inspiration in ample measure to a large number of grateful pupils who paid him in return with love and reverence.

J. L. COOLIDGE

HARVARD UNIVERSITY

DAVID CLINTON GILLESPIE—IN MEMORIAM

David Clinton Gillespie, professor of mathematics at Cornell University, died at Ithaca, N.Y., on October 31, 1935, after but one day's illness.

Gillespie was born at Knob, Tazewell County, Virginia, on December 13, 1877. His undergraduate training at the University of Virginia, centering about the sciences and the classics, was completed in 1900. After one year of study in mathematics at the Johns Hopkins University, he went to Göttingen; there he received the degree of Ph.D. in 1906, with a thesis entitled *Anwendungen des Unabhängigkeitssatzes auf die Lösung der Differentialgleichungen der Variationsrechnung*. He then came to Cornell University, at which he spent his whole teaching career; he was appointed instructor in 1906, assistant professor in 1911, and professor in 1924.

Gillespie's special field in mathematics was always analysis, though he had also a lively interest in applied mathematics. His initial training was predominantly formal; but questions of rigor and logic soon aroused his interest, and at an early period of his activity he began to emphasize the insistence on accuracy which he maintained throughout his life. Fundamental questions particularly concerned him; he preferred to make deeper inquiry into the beginnings of analysis rather than to extend its superstructure; typical of this interest are his papers on the equivalence of the Cauchy and Riemann definitions of the integral, and on the inversion of the order of repeated integration. However, he was easily led to a live participation in the study of more sophisticated problems. It was he who furnished the essential ideas which made possible his joint paper with the present writer on the uniform summability of a bounded sequence of continuous functions converging to a continuous function. He left behind him a considerable bulk of manuscript on the solution of an infinite set of linear equations in an infinite set of variables, containing some novel and interesting developments which it is hoped may contain sufficiently definitive results to be prepared for publication.

Closely allied to his interest in fundamentals was his attitude toward the process of demonstration. He preferred to think less in symbols than in ideas themselves. Preliminary lists of postulates or axioms were for him only to be used in a final verification, not to be remembered as consciously formalized separate steps in establishing a theorem. He was never satisfied with a proof