At a meeting of the FACULTY OF ARTS AND SCIENCES on October 6, 2020, the following tribute to the life and service of the late John Torrence Tate, Jr., was spread upon the permanent records of the Faculty.

JOHN TORRENCE TATE, JR.

BORN: March 13, 1925
DIED: October 16, 2019

John Tate was born in Minneapolis, where his father was a professor of physics at the University of Minnesota and his mother was a high school English teacher. John came to Harvard as an undergraduate in mathematics and received his degree in 1945. He served in the Navy and studied meteorology at MIT. After the war he entered the graduate program in physics at Princeton University. A chance encounter with Emil Artin in Fine Hall led him to switch to mathematics. In the 1920s Artin had proved a general reciprocity law that extended John's favorite mathematical result—Gauss's law of quadratic reciprocity.

John's dissertation remains one of the most influential Ph.D. theses ever written in mathematics. Known simply as *Tate's Thesis*, it circulated widely in manuscript form for nearly 20 years before being published. John found a new proof of the analytic continuation and functional equation of Hecke's L-functions, using abstract Fourier analysis on the group of adeles of a number field. Along the way, he introduced a new interpretation of the local factors that occurred in these infinite products. His elegant treatment completely changed the subject. As John wrote, with characteristic modesty, "Artin suggested this wonderful exercise . . . the topic was in the air at the time."

His intellectual generosity remains a model for our mathematical community, as does the perfection he demanded of his own writings. His notes and letters were often freely circulated—sometimes for decades—while John continued to improve them, and while they served as the inspiration for fundamental directions of research. The 1,500 pages of his letters with Jean-Pierre Serre, published in two volumes, offer a vivid record of the day-by-day emergence *throughout the last half-century* of key ideas of Tate and Serre—many of them forming the shape of modern number theory. The letters are electric with new discoveries, with emotional intensity, and with exuberance (e.g., we see the joy he felt as he was fashioning the now-famous conjectures that bear his name; but also the joy he experienced with any engagement with mathematics). In one of those letters, John writes, "I went on a vacation to the surface V whose equation is $x_0^n + x_1^n + x_2^n + x_3^n = 0$ following the guide book of Weil. Quel beau lieu!"

After receiving his Ph.D. in 1950, John spent three years as an instructor at Princeton. He ran a seminar with Artin that reformulated the general reciprocity law, and indeed all of Class Field Theory, using new ideas from group cohomology. By the time that John arrived at Harvard as an assistant professor in 1954, he was already one of the world leaders in number theory. He was awarded the Cole Prize in Number Theory in 1956 for his work on the higher cohomology groups of class field theory and became a full professor at Harvard in 1959 and the Perkins Professor of Mathematics in 1971.

The work that John did at Harvard set the course of research in modern number theory. It is impossible to convey these fundamental advances to a general audience, but here are a few of the concepts that bear his name: Tate cohomology, the Tate module of an abelian variety, Lubin-Tate formal groups, the Tate-Shafarevich group, Tate twist, Tate duality, the Tate elliptic curve, the Néron-Tate height, the Mumford-Tate group, the Hodge-Tate decomposition, the Sato-Tate distribution, and the famous Tate conjectures on cycles, which remain unproven today. His contributions were recognized with the Steele Prize for Lifetime Achievement, the Wolf Prize, and the Abel Prize—the highest international award in mathematics. In 1990, he left Harvard and moved to the University of Texas, where he held the Sid W. Richardson Chair in Mathematics for almost twenty years. When he retired from Austin, he returned to Harvard as *emeritus* professor.

John supervised 41 graduate students between 1958 and 1998 and currently has over 650 mathematical descendants. He encouraged his students to find their own problems but was always available to hear about their work. The initial meeting might end with John complaining that he did not know enough to help. A few days later, he would pass this student in the hall and say that he had been thinking a bit more about it and perhaps understood what they had been telling him. This would be followed by a complete explanation, in John's characteristically lucid style. He would also encourage his students to communicate with each other and to work together. This extended to the sport that John loved: basketball. In 1977, an entire basketball team consisting of John's Ph.D. students graduated together and signed a basketball as a gift to John.

John was also fully committed to undergraduate teaching. He was a tutor at Adams House and for a short time at Quincy House, and he substituted as House Master at Dunster House when Professor Raoul Bott was on leave. He also started an honors mathematics course for undergraduates arriving at Harvard without the experience of studying calculus.

John wrote that he enjoyed the support of his family in spite of his obsession with mathematics. He married Karin Artin, the daughter of his mentor, with whom he had three daughters: Jennifer Tate, Valerie Clausen, and Amanda Tine; he had six grandchildren (including the mathematician Dustin Clausen) and one great-grandson. After his divorce, John married Carol MacPherson. He died at their home in Lexington, Massachusetts.

Respectfully submitted,

Barry Mazur
David Mumford
Benedict Gross, Chair

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