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Foreword: Raymond E. March and John F. J. Todd, Trappers

Raymond E. March and John F. J. Todd are among the small band who guarded the flame of ion trap mass spectrometry during the dark ages of this subject, the 1960s and 1970s. Ion traps, electrical containment devices for gaseous charged particles, were invented by Wolfgang Paul in the early 1950s and their potential as mass spectrometers was immediately recognized [W. Paul and H. Steinwedel, Z. Naturforsch, 8a (1953) 448]. Before the decade was out, Paul's student Fischer had employed nondestructive detection methods to detect ions in resonance with an auxiliary ac field applied across the endcap electrodes of the ion trap [E. Fischer, A. Phys. 156 (1959) 1]. The result of these and related experiments by Rettinghaus and others in the Bonn group was that the ion trap emerged rapidly as a sensitive but low-mass resolution, low mass range mass spectrometer. Unfortunately, the available detection methods, while mass-selective and nondestructive, were not well-suited to scanning a mass spectrum. Paul's simultaneous invention, the linear quadrupole mass filter, was well-suited to this purpose because ions drift through the device and a mass spectrum is scanned simply by continuously supplying ions while adjusting the voltages to achieve mass-selective stability for ions of different masses. This feature led, during the 1970s, to the rapid emergence of the quadrupole mass filter as an inexpensive, computer-controlled mass spectrometer and to its subsequent wide utilization in many areas of application of mass spectrometry [P. H. Dawson, Quadrupole Mass Spectrometry and its Applications, Elsevier, Amsterdam, 1976]. The success of the quadrupole mass filter tended to reinforce the relative lack of interest in the quadrupole ion trap.

March and Todd, working both separately and together, constituted one of the few research teams that utilized, developed, and characterized ion traps during the 60s and 70s. They were the leading such group concerned with chemical phenomena. They used traps for ion storage (quistor, quadrupole ion storage) and proceeded to examine the ion chemistry and reaction kinetics of the stored ions. The types of experiments done during these years included methodological and instrumental advances such as chemical ionization [R. F. Bonner, J. F. J. Todd, G. Lawson, R. E. March, Adv. Mass Spectrom. 6 (1974) 377], studies on the cylindrical ion trap [R. F. Bonner, J. E. Fulford, R. E. March, G. F. Hamilton, Int. J. Mass Spectrom. Ion Phys. 24 (1977) 255], simulation of the motion of trapped ions [M. C. Doran, J. E. Fulford, R. J. Hughes, Y. Morita, R. E. March, R. F. Bonner, Int. J. Mass Spectrom. Ion Phys. 33 (1980) 139], measurements of the kinetic energy of ejected ions, injection of ions into a trap from an external ion source, and multiphoton photodissociation of trapped ions [R. J. Hughes, R. E. March, A. B. Young, Int. J. Mass Spectrom. Ion Phys. 42 (1982) 255]. Mass analysis was awkward, however, and in one instrument, a separate quadrupole mass filter was used for this purpose [G. Lawson, R. F. Bonner, J. G. J. Todd, J. Phys. E 6 (1978) 357].

Ray March and John Todd were delighted when the mass-selective instability scan was introduced by George Stafford and co-workers of Finnigan Corporation in 1983. The March/Hughes book of 1989 (R. E. March and R. J. Hughes, Quadrupole Storage Mass Spectrometry, Wiley, New York, 1989) makes clear this delight in an important advance in their favorite instruments.

Stafford's invention meant that to the useful prop-

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erties of the ion storage device were added convenient scanning procedures of a powerful mass spectrometer. Tandem mass spectrometry, mass-selective chemical ionization, extended mass range, and enhanced resolution were soon added and these developments continue. Their pleasure at these further developments, many originating from the labs of friendly competitors, is a tribute to their qualities as outstanding scientists and people. Indeed, a strong interest in the work of others has characterized both Professor March and Professor Todd and made them favorites among graduate students of other groups.

With their stature as senior figures in a rapidly expanding subject, March and Todd have both been called on to do a great deal of refereeing and other service work. Both routinely provide reports that are characteristically detailed, thorough, and generous, but not uncritical. Ray's hallmarks are long reports that carefully correct the English (especially American English) and then give equal attention to clarity and mathematical precision. Instead of simply dropping this in front of the authors, a typical March report proceeds to carefully rewrite the troublesome sections. There are not a few papers on ion traps that contain highly crystalline little bits of writing supplied by March and Todd.

In this appreciation, it is impossible not to mention their monumental three volume book (Practical Aspects of Ion Trap Mass Spectrometry, R. E. March, J. F. J. Todd (Eds.), CRC, Boca Raton, FL, 1995), affectionately known as "the book." The size, scope, and quality of this multiauthor work is enduring testament to the efforts of John Todd and Ray March.

Neither March nor Todd is a one-dimensional person. John Todd is a committeeman and public servant who has performed extensive service in education, university administration, and local government. Ray is an aficionado (or the French equivalent) of all things Gallic and makes his second home in Provence. As both men enter formal retirement, we salute them and expect them to maintain their connections with "trappers, young and old." Thank you for keeping the torch aflame and for your pathbreaking research.

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