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Foreword

IJMS special issue John R. Eyler – Guest editors' foreword

This special issue is dedicated to John R. Eyler's contributions in mass spectrometry. The main focus of John's research has always been on irradiation of ions trapped in Fourier transform ion cyclotron resonance (FTICR) mass spectrometers with tunable lasers. Over the past 38 years, the fate of many ions has been to be trapped and *zapped* in John's intricate pieces of instrumentation. Unfortunately for many ions, but fortunately for the field of mass spectrometry, the field of ion spectroscopy has grown considerably, notably over the past decade. This special issue is a testament to this development, with 20 of the 26 manuscripts involving applications of lasers with ion traps, both for fundamental and applied research. This also reflects John's career, which has always been grounded by fundamental physical chemistry experiments, while being influenced by analytical applications. In this foreword, we aim to give a brief account of John's career to celebrate his achievements.

1. Formative years and early career

John Robert Eyler was born in 1945 in Wilmington, Delaware, where his father was a Ph.D. research chemist for the Hercules Powder Company. In 1948, his father was transferred to Hopewell, Virginia, where John attended elementary school (Fig. 1). In 1958, the family moved again, this time to Cumberland, Maryland, where John attended Allegany High School, graduating in 1963. John went on to do a B.S. in Chemistry at the California Institute of Technology. During this time, he began a long distance courtship with Fonda Page Davis, who lived down the street from his parents in Hopewell, and attended Mary Washington College in Fredericksburg, Virginia. They were married after their respective college graduations in 1967. In a sign for future things to come, they spent their honeymoon in Florida (Fig. 2), where (apparently) they had an excellent time.

John and Fonda headed west for their graduate studies in California. John did his Ph.D. in Chemical Physics in John Baldeschwieler's group at Stanford University. His main research interest at the time was in ion-molecule reactions using ion cyclotron resonance (ICR) to confirm the gas-phase basicity and acidity of molecules, co-authoring papers with Jack Beauchamp, Bob McIver, John Braumann and Melvin Comisarow, among others. It should be noted that a large number of Ph.D.s and postdocs from that time later went on to academic positions: Robert Dunbar (Case Western Reserve University), Jack Beauchamp (Caltech), Alan Marshall and Melvin Comisarow (University of British Columbia), Robert McIver (University of California Irvine), as well as John Eyler (University of Florida). John not only grew in stature as a scientist, but also became a proud father. His daughter, Lisa, was born in 1970 at the Stanford University Hospital.

John went on to do a postdoc at the National Bureau of Standards (NBS) (now NIST) (see Fig. 3), working with Pierre Ausloos, Sharon Lias, and Wayne Sieck. Here, he first experimented with irradiating trapped ions with lasers. He employed UV-Vis lasers pumped by a flashlamp or Nd:YAG garnet to induce photodissociation of cations, as well as electron detachment from anions. In terms of photodissociation of ions, Penning traps present a number of advantages, including high vacuum operation (for minimization of collision cooling) and long storage times (to increase the photodissociation yield). Nonetheless, the main challenge in these experiments lies in producing a sufficiently high photon flux. One approach to overcome this problem relies on bringing the ions into the laser cavity. A seminal paper of John's from this time involves intracavity photodissociation of ions trapped in an ICR cell [1]. Similar approaches are now being used in the Free Electron Laser Intra-Cavity Experiments (FELICE) at the FOM institute 'Rijnhuizen' in the Netherlands. Meanwhile, the Eyler family had another addition; his son Jason was born at home in 1974 in Kensington, Maryland.

2. University of Florida

In 1974, John started his independent research career at the University of Florida (UF) as an Assistant Professor in Physical Chemistry. He rose through the ranks to full Professor, and served as Head of Department (1994–2000) (see Fig. 4) and Head of the Physical Chemistry division (2004–2007). During his 35 years at UF, John graduated thirty-three Ph.D. and four Masters students (Table S1, Supplementary Materials), and mentored thirteen undergraduate students and post-doctoral associates (Table S2, Supplementary Materials). Fig. 5 shows the Eyler group in 2004.

A constant theme in John's career has been the implementation of tunable infrared lasers (mainly pulsed and cw CO_2 gas discharge lasers) to study infrared multiple photon dissociation (IRMPD) processes. Of particular note were the two-laser experiments to enhance aspects of the laser desorption and photodissociation processes [2], and the construction of multi-pass cells to enhance laser fluence [3]. In terms of applications, the differentiation of isomeric complexes has featured prominently in John's work for quite some time, starting in the mid-1980s [4] to nowadays [5]. Isomers present an inherently difficult challenge for mass spectrometry, requiring methods that can yield further structural information.

Other interesting research adventures along the way included the study of the structures and reactivities of small hydrocarbon

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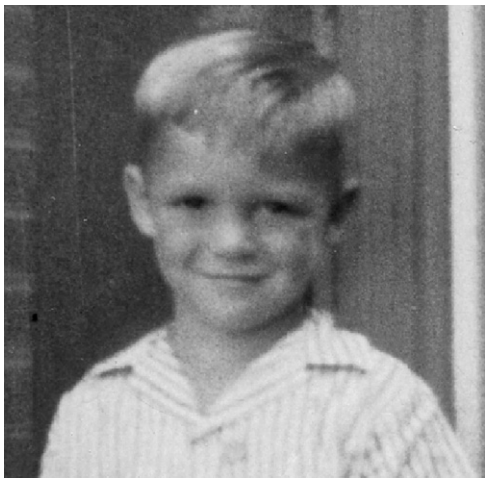

Fig. 1. John at age 5.

ions potentially relevant in soot formation. Later, the focus was on the properties and reactivities of metal, inorganic and organic cluster ions. Bracketing experiments by ion-molecule charge transfer reactions allowed an early determination of the ionization potential (IP) of C_{60} [6], which were later confirmed by photoelectron spectroscopy measurements on neutral C_{60}. In ion source development, John's group was first in coupling glow discharge and inductively coupled plasma (ICP) sources with high-resolution FTICR mass spectrometry [7]. These developments allowed discrimination of isobaric masses in elemental analysis.

In addition to developing mass spectrometry tools, John has been one of the most active faculty members in Chemistry at UF to instigate research collaborations for applying these techniques. These include collaborations both with his UF colleagues (see Table 1), as well as with researchers at other institutions. In a collaboration with Alan Katritzky, they investigated the gas phase reaction and dissociation chemistry of a series of organic

Fig. 2. John and Fonda Eyler at their honeymoon trip in Florida (1967). It appears that John and Fonda already had inkling where their academic careers might take them. This is also the last known picture of John without facial hair.

Fig. 3. John as a postdoctoral associate at NBS in front of self-built ICR instrument (1973).

Fig. 4. Photograph of the three most recent department chairs of Chemistry at the University of Florida, showing David E. Richardson, John R. Eyler, and Daniel R. Talham (present chair) (2003).

Fig. 5. Eyler group in 2004 in between Leigh Hall and the Chemistry Laboratory Building.

Table 1
Faculty collaborators.

Bob Hanrahan
Merle Battiste
Sam Colgate
Willis Person
Kirk Schanze
Alan Katritzky
Jack Sabin
David Richardson
Martin Vala
Dave Powell
Kitty Williams
Rick Yost
Phil Brucat
Nick Polfer
Mike Zerner
Jim Winefordner
Steve Benner
Anna Toth
So Hirata
Nigel Richards

Fig. 6. Original FELIX FTICR 'team' (from left to right): Jos Oomens, David T. Moore, John R. Eyler, Jan Pluygers and Jose Valle (2005).

cations. John delved into astrochemistry research in collaboration with Martin Vala, focusing on photodissociation of polyaromatic hydrocarbons (PAHs). John engaged in a fruitful and long-term collaboration with David Richardson (Fig. 4) on the properties and reactivities of organometallic complex ions. More than twenty publications have so far ensued from this work, making this one of the most extensive reactivity studies done to date using mass spectrometry to directly compare solution and gas-phase reactivity of organometallic species.

John has been instrumental in promoting mass spectrometry user facilities. When the National High Magnetic Field Laboratory moved from M.I.T. to Florida in 1990, John helped organize a workshop and multiple visits to federal grant agencies, culminating in the formation of an Ion Cyclotron Resonance Program at Florida State University, supported by the NSF Chemistry Division. One of the most important recent contributions that John has made for the mass spectrometry community has been his spearheading of the FTICR mass spectrometer at the FELIX free electron laser in the Netherlands (Fig. 6) [8]. This led to the establishment of a user facility, where researchers can apply for beamtime to record infrared spectra of mass-selected ions. Since 2004, more than 120 publications have been published using this instrument, benefiting many areas of science. In parallel, the emergence of other free electron laser (FEL) facilities, such as CLIO in France and FEL-SUT in Japan, have led to a true renaissance of IR spectroscopy of ions over the past decade.

Among the projects that John was involved with at the FELIX facility, the work on carbohydrate differentiation, in collaboration with Brad Bendiak (University of Colorado), stands out as the most timely and comprehensive. The additional structural information from wavelength-dependent photodissociation allows structural distinction between isomers, which remains one of the most pertinent challenges for mass spectrometry techniques. Moreover, these measurements provided unambiguous evidence that the ring structures of oligosaccharide fragments can open up in the gas phase, which presents a challenge to the structural characterization of glycosidic bond anomericity. A study of proton-bound dimers showed that the large-amplitude motions of the proton couple with many other vibrational modes, making these intriguing reference experiments for understanding the IRMPD process. John was also involved in a large range of other collaborative projects, ranging from metal–ligand complexes and clusters, astrophysically related molecules, and proteins.

In latter years, John's group has developed IRMPD spectroscopy of trapped ions using benchtop, tunable optical parametric oscillator (OPO) set-ups coupled to FTICR instrumentation. Such experiments reveal information on the hydrogen stretching modes of gas-phase molecules. Due to the local-oscillator nature of OH stretches, bands can be resolved more readily than in the mid-IR range, thus offering a particularly useful region for isomeric differentiation. In addition, the wider implementation of IRMPD spectroscopy for isomeric characterization hinges on the development of affordable benchtop light sources.

Over his career, John is one of the few academicians not to have lost his ability (and interest) for hands-on expertise in the laboratory. He still regularly sits at the console or troubleshoots electronic problems (see Fig. 7). Most remarkably, he has hardly aged during this time, lending credence to the claims that exposure to electric and magnetic fields can inhibit aging [9]. He has always taken great

Fig. 7. Left: John with Nicolet FTMS-1000 in 1982. Right: John with undergraduate student Jon Collins in front of FTICR instrument console in 2004.

care of his instruments, treating them as his offspring. Moreover, he has mentored many of his graduate students and postdocs in the art of instrument development. A few of them went on to work for instrument companies, such Cliff Watson, Goekhan Baykhut and Bob Weller, who now work for Bruker Daltonics.

John is currently Professor Emeritus at UF, which in his own words allows him to "engage in research without having to deal with many of the other distractions in academia, such as teaching, writing research proposals, and doing administrative tasks." Of course, he has other distractions now. After years of John and Fonda sharing the joys and challenges of their academic careers, Fonda just recently joined him in retirement from her position as Professor in Pediatrics. In June they will celebrate their 45th wedding anniversary and, in addition to adventures of their own, they will continue to travel frequently to visit Lisa and Jason and their families, the main attraction being their five grandchildren. Nonetheless, John has much more to give in terms of his experience and ideas, and we hope that he will remain active in research for some time to come.

3. Service to the community

John has served as treasurer for the American Society for Mass Spectrometry (2000–2002). He has participated in many educational and outreach activities over the years, such as playing the element cesium in a "Cinderella of the Elements" play at the Florida ACS meeting.

Outside of his work responsibilities, John has always taken social responsibilities very seriously. He is an active member of the United Church of Gainesville, where he served as Church Moderator. He sings tenor in the choir and plays clarinet with the All-Church Band. John has also been active in social justice issues and is a dedicated campaigner and fundraiser. He participates in social justice issues at church, including helping with the Interfaith Hospitality Network and construction of a Habitat for Humanity house. More recently, John has become involved in Rebuilding Together North Central Florida and, in particular, is one of the home auditors for the Community Weatherization Coalition.

John sets a very high standard both as a scientist and as a human being. He has inspired many scientists, many of whom wish to take this particular opportunity to wish John the best in his continuing endeavors within and alongside the scientific pursuits that have made his career so noteworthy. We hope that you, the reader, will enjoy this special issue in his honor with the theme "*Probing the Structures of Ionic Complexes by Photons, Electrons, Collisions, Reactions and Mass*"!

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ijms.2011.09.009.

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Nicolas C. Polfer*
Department of Chemistry, University of Florida, Gainesville, FL 32611, United States

James E. Bruce
Department of Genome Sciences, University of Washington, Seattle, WA 98195, United States

* Corresponding author.
E-mail address: polfer@chem.ufl.edu (N.C. Polfer)

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