

Society Becomes More than the Annual Conference

For most of the previous years, the primary business of ASMS was to arrange the Annual Conference and publish the proceedings. While this was no small task, particularly when the Society relied solely on the volunteer labor efforts of its Board, leadership in the Society sought to expand business beyond this limited role, particularly after securing the services of Professional Association Management in 1981. Freeing Board members from the detailed business of maintaining membership roles, collecting dues, and dealing with a myriad of minute details during the week of the conference, allowed the Board to explore new ways to serve its members.

As noted in the previous decade, the arrival on the scene of FAB was the impetus to hold the first small topical meeting away from the Annual Conference; the "Fall Workshop on FAB". Several years passed before the next Fall Workshop was held in 1984 on "High Mass Ion Analysis". Finally, in 1989, the Fall Workshop became an annual feature of the Society. In 1988 Mark Ross, Kenneth Busch and Robert Cotter organized an ASMS-sponsored meeting on Sanibel Island in Florida as an East Coast counterpart to the Asilomar Conferences. This January gathering was also a focused topic conference, featuring a list of speakers who had established credentials in the area of study and a small interested audience who wanted to know more about the topic in greater detail than they could get attending papers at the Annual Conference. These small topical meetings provide a venue whose ambiance is more in keeping with that of the very early Annual Conferences.



The Board decided in 1989 to publish a journal devoted exclusively to mass spectrometry. There were several venues available at the time, but the Board felt strongly that the field could use another journal. They secured the services of Michael Gross, previously the Editor of Mass Spectrometry Reviews, as Editor for the new journal and in 1990, the Journal of the American Society for Mass Spectrometry (JASMS) made its debut. Published in six issues for the first several years, in 1992 it expanded to 12 issues. A subscription to JASMS is included in the membership fees for the Society. The journal has been a leader in E-publishing, accepting manuscripts via E-mail attachments and providing ASMS members access to complete journal articles via the web. Most recently, fully citable papers are pre-published on the journal web-site prior to print copies arriving at members homes and offices.

It was in the previous decade, that the Society saw the need to play a greater role in mass spectrometry education. Harry Hertz initiated a series of lectures on the basics of mass spectrometry interpretation and quantitation, based on short courses that had been offered by the Greater Washington Baltimore Area Mass Spectrometry Discussion Group. The ASMS short courses were held the weekend prior to the meeting and were taught by ASMS members recruited by the Board for their expertise, knowledge and communication skill. This popular feature of the meeting has grown since its inception and the Annual Conference at Orlando offers a wide variety of courses covering both basics and the latest techniques in mass spectrometry.

The LC/MS Problem Solved

The development of electrospray (ESI) as a means of ionizing biological compounds and coupling those two incompatible instruments, the liquid chromatograph and the mass spectrometer, is a case study of the random-walk nature of progress in science. In the late '60s, a group at Northwestern University headed by Malcolm Dole, interested in characterizing synthetic polymers, explored a nozzle-skimmer arrangement to spray a dilute solution of polystyrene in a process called 'electrospraying.' They observed the formation of negative 'macroions' and were able to deduce information regarding the charge and mass of these ions by ion mobility studies. A second group at Yale working under John Fenn had been pursuing fundamental studies of molecular beams formed during free-jet expansion under conditions of supersonic flow since the early '70s. Focused on studies of nucleation phenomena, they employed mass spectrometry to characterize the nature of the nuclei formed during the spray process. In the early '80s, Marvin Vestal and co-workers at the University of Houston pursued spray techniques as a means of interfacing liquid chromatography with mass spectrometry. They developed the 'thermospray' LC/MS interface and discovered that ions could be formed from compounds even when the filament, which was supposed to provide an ionizing current, was off.

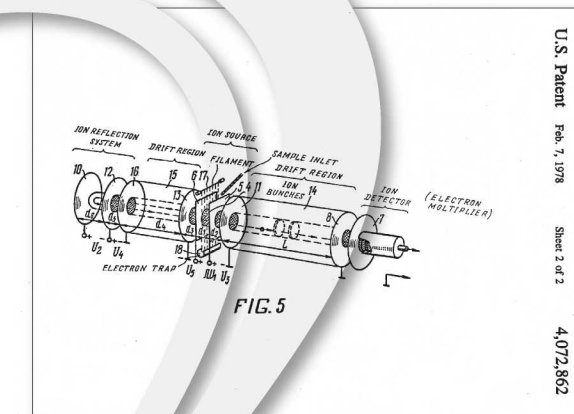
Encouraged by their results and also by mass spectrometrists familiar with the work, the Yale group turned their attention to spraying small biopolymers in 1984. The publication in 1988 of spectra showing a series of multiply-charged ions formed when proteins were introduced with the spray technique was another defining moment in mass spectrometry. Like FAB, electrospray extended even farther the range of biomolecules that could be studied. Today electrospray is employed in an ever widening array of applications in every area of the biological sciences. Not only is electrospray an ideal way to interface the liquid chromatograph to the mass spectrometer, it is also an optimal ionization technique for compounds that, heretofore, could not be studied by mass spectrometry.

The Phoenix Rises from the Ashes

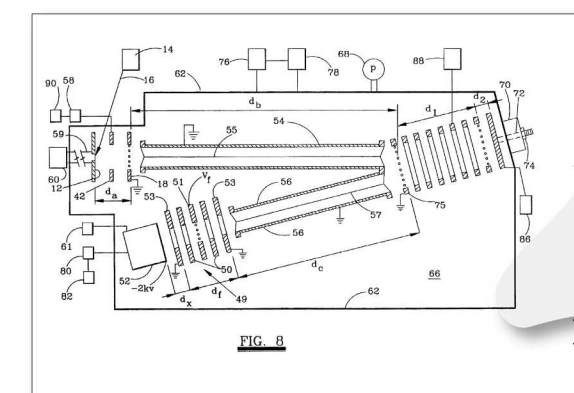
Time-of-flight (TOF) mass spectrometry slowly disappeared from the scene in the 70s as the quadrupole mass filter became the instrument of choice for combined GC/MS. Forgotten by many and assumed to be incapable of providing significant resolving power by those familiar with the old Bendix TOFs, mass spectrometer development focused on extending the mass range and resolving power of both magnetic sector and quadrupole instruments. However, a handful of people continued to be intrigued by the concept that the TOF had, in principle, an unlimited mass range; something that would be necessary as larger biomolecules were succumbing to ionization.

Boris Mamyrin in the '70s in Russia was pursuing a new concept in time-of-flight design, based on reflection of the ions to a detector located behind the ion source. It had been established that part of the cause of poor resolving power in the linear time-of-flight came about because the detector was in line of sight of the ion path and any metastable ion formation that occurred during ion transit was recorded at the detector along with the stable ions. The reflectron design discarded these ions and only stable ions reached the detector. The added flight length also helped in increasing the resolving power.

Later in the '70s, Ron Macfarlane used californium 252 plasma desorption ionization to obtain time-of-flight spectra of some very large biomolecules using a linear instrument. Since ion formation was asynchronous, coincidence counting was used to synchronize ion formation with the time of arrival of the ion at the detector.



Drawing from Boris Mamyrin's 1978 patent of the reflectron time-of-flight mass spectrometer. Note that the source is shown in the center of the flight tube.



Drawing from Marvin Vestal's 1992 patent of a different version of the reflectron time-of-flight mass spectrometer.

Despite these pioneering experiments, interest in the time-of-flight mass analyzers didn't pick up until the mid '80s when matrix assisted laser desorption ionization (MALDI) as a means of ionization was developed by Franz Hillenkamp and Michael Karas in Germany. The TOF mass analyzer was a natural for this ionization technique since a pulsed laser was used to ionize the sample and matrix. By 1992, instrument companies were investing more effort in the development of the TOF mass analyzer. In the coming decade, electrospray sources would be fitted to the TOF and subsequently it would be incorporated into hybrid MS/MS designs. The step child mass analyzer of the '60s was on its way to become the Cinderella mass analyzer of the new millennium.

MASS SPECTROMETRY

1983

The theory of charge remote fragmentation is proposed at the University of Nebraska.

The first modern multicollector instrument for continuous-flow isotope ratio mass spectrometry is introduced.

1984

The thermospray interface for liquid chromatography mass spectrometry is announced.

The first commercial inductively coupled plasma mass spectrometer is introduced for elemental analysis.

1984

The Asilomar Conference on Mass Spectrometry affiliates with the ASMS. The first commercial ion trap analyzer is introduced.

Yale University researchers use electrospray ionization mass spectrometry to analyze small biomolecules.

1985

Liquid chromatography is interfaced to mass spectrometry with pneumatically assisted electrospray.

A particle beam interface for liquid chromatography mass spectrometry is developed at the Georgia Institute of Technology.

1985

"Absorbing" compounds are used to assist laser ionization of "nonabsorbing" compounds.

A. Q. Nier publishes his design of a miniature, field-portable Mattauch-Herzog geometry mass spectrometer.

Researchers at Rice University discover stable C60 clusters using time-of-flight mass spectrometry.

1986

Liquid chromatography is interfaced to mass spectrometry with pneumatically assisted electrospray.

Corazon Aquino is elected president of the Philippines after dictator Ferdinand Marcos is forced to flee the country.

1987

Capillary electrophoresis mass spectrometry that uses electrospray ionization is introduced.

Nazi war criminal Klaus Barbie is sentenced by a French court to life in prison.

1988

Electrospray ionization of proteins with molecular weights in the range of 5,000 to 40,000 daltons is demonstrated.

The United States and the U.S.S.R. agree to arms reduction in the Intermediate-Range Nuclear Forces Treaty.

1989

The first ASMS Sanibel Conference takes place.

Wolfgang Paul shares the Nobel Prize in physics for his work on the development of the ion trap.

1990

The ASMS launches the Journal of the American Society for Mass Spectrometry.

The first ASMS Award for a Distinguished Contribution to Mass Spectrometry is given.

1991

Oligonucleotides are sequenced using electrospray ionization mass spectrometry.

Cornell researchers investigate non-covalent receptor ligand complexes using mass spectrometry.

The Soviet Union dissolves after a failed coup by hard-line Communists trying to reverse the reforms of Mikhail Gorbachev.

1992

Researchers report the use of highly enriched ¹³C-labeled fatty acids to improve the detection limits of high-precision isotope ratio mass spectrometry analysis.

Structural information about compounds is obtained using Reflectron time-of-flight mass spectrometry (MALDI post-source decay).

Rudolph Marcus receives the Nobel Prize in chemistry for his theory of electron transfer reactions in chemical systems.

HISTORY

1983

U.S. forces invade Grenada.
British scientist Joe Farman first observes the Antarctic ozone hole.
Carl Sagan and others warn of the threat of "nuclear winter."

1984

Ethiopia is devastated by a famine triggered by civil war.
Alec Jeffreys develops genetic fingerprinting.

1985

Mikhail Gorbachev becomes leader of the Soviet Union.
Mexico City is hit by a major earthquake that kills tens of thousands.

1986

The Iran-Contra scandal is revealed.
A nuclear reactor in Chernobyl in the U.S.S.R. melts down and explodes in the worst nuclear power accident in history.

1987

Nazi war criminal Klaus Barbie is sentenced by a French court to life in prison.

1988

Soviet forces begin to withdraw from Afghanistan.
Pan Am flight 103 is destroyed by Libyan terrorists over Lockerbie, Scotland.

1989

Pro-democracy demonstrations in Tiananmen Square are violently quelled by the Chinese military.
The Communist party is voted out of power in Poland's first free elections since before World War II.
The oil tanker Exxon Valdez runs aground in Alaska, causing massive damage to coastal ecosystems.
The Berlin Wall is torn down.

1990

Namibia gains independence from South Africa.
Iraq invades Kuwait.
Gene therapy is first used to treat human patients.

1991

The Persian Gulf War is fought between Iraq and the United States.

1992

Civil chaos in Somalia prompts a failed U.S. intervention.
Alberto Fujimori becomes dictator of Peru.