

Methods in Enzymology, Volume 193: Mass Spectrometry,

Edited by James A. McCloskey,

Academic Press, Inc., 465 S. Lincoln Drive, Troy, MO 63379, 1990, \$107.

The *Methods in Enzymology* series has a well-established reputation for producing carefully edited, authoritative, practical summaries of current research by experts in various specialty fields. J. A. McCloskey has continued that high standard in his selection of 70 scientists who have written 47 chapters. This single volume of 960 pages has been organized into four sections of related subjects plus appendixes and indices. Volume 193 could have been titled "mass spectrometry applied to structural biology," and thus occupies a niche not filled previously by any single publication in the field.

The first section is devoted to general techniques, and serves the function of an introductory text in mass spectrometry as well as covering specialty topics in sample introduction, ionization, and mass analysis. The first three chapters on ionization by A. G. Harrison and R. J. Cotter, mass analyzers by K. R. Jennings and G. G. Dolginowski, and detectors by S. Evans summarize general principles of instrumentation, setting the stage for the following 14 chapters on topics ranging from tandem mass analysis, liquid chromatography-mass spectrometry, and collision-induced dissociation, to chapters on the utility of exact mass measurements, chemical derivatization, and the selection and use of mass reference standards. Many of these topics are suitable for books dedicated to the chapter topic, and in fact, some of the chapters have been written by authors or editors of such volumes. The challenge of distilling 30-page chapters from larger texts has been well handled by the contributing authors, who remained tightly focused upon their assignments but included important material and key references.

The next three sections are devoted to applications of mass spectrometry in structural biology—peptides and proteins, glycoconjugates, and nucleic acid constituents. Each of these sections begins with a short chapter on overview and strategy by a noted authority in the area—K. Biemann on peptides and proteins, R. A. Laine on glycoconjugates, and J. A. McCloskey on nucleic acids. Their perspectives are valuable guides to the contents of the following specific chapters as well as providing the kind of background that one might obtain from personal consultation with an expert. The overview chapters try to answer why one procedure or technique has evolved, what ancillary techniques should be utilized, and how to prioritize steps toward problem resolution.

The section on peptides and proteins contains ten chapters covering enzymatic and chemical digestion procedures, chromatographic separation and sample preparation for various types of mass analysis, and characteristic results from peptide and protein analysis

using the ionization and mass analyses described in the preceding section (fast-atom bombardment) (FAB), electrospray, and plasma desorption). It is unclear why two protein-specific chapters (plasma desorption by R. D. Macfarlane and matrix-assisted laser desorption by F. Hillenkamp and M. Karas) are included with the general techniques, but the reader is guided to them by extensive crossreferencing. The emphasis of each chapter is on very practical problem solving, so that discussions are clearly presented for determining post-translational modifications (glycosylations, phosphorylation, and sulfation), disulfide bond location, approaching "unknown" structures, characterizing recombinant proteins, and verifying DNA derived protein sequences.

The section on glycoconjugates contains 11 chapters covering the topics of linkage analysis (four alternative strategies and methods), tandem mass analysis applied to structural analysis with or without chemical degradation, analysis of mixtures of glycosphingolipids, and derivatization to optimize separation (liquid or gas phase) and mass analysis of oligosaccharides. These chapters present work that has been extensively pursued in several international centers of carbohydrate research, and is now receiving greater attention because of the success of biochemists in isolating and purifying biologically active glycoconjugates.

The section on nucleic acid constituents is shorter than the sections on proteins or glycoconjugates, reflecting the limited applications of mass spectrometry to DNA and RNA polymers. Mass spectrometry has been of critical importance in determining the structures of posttranscriptionally modified nucleosides, but has only played a minor role in DNA sequence analyses (detection of frame shifts from protein analyses). Consequently, the six chapters on nucleic acids are directed toward the specifics of analyses of hydrolysates of the biopolymers—the hydrolysis process itself, preparation and characterization of silyl derivatives for gas phase analyses, characteristics of liquid chromatographic-thermospray derived spectra, and a sensitive quantitative analysis of one base.

There are six very useful appendices to help guarantee that this volume will find a permanent home close to the operator of a mass spectrometer (elemental mass and abundance data, ions in 11 defined reference materials for different types of ionization, characteristic spectra of seven FAB matrices, calculation of isotopic abundance distributions, nomenclature for peptide fragment ions, and residue masses for peptides). In summary, this book is an extremely valuable resource for the practicing mass spectroscopist. Due to the inclusion of general introductory material, it would be an excellent text for a course in biological mass spectrometry directed toward graduate students in chemistry or biochemistry.

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Methods and Mechanisms for Producing Ions from Large Molecules

Edited by K. G. Standing and Werner Ens

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(20% higher outside US and Canada)

This book contains a collection of chapters by participants in the NATO Advanced Research Workshop on Methods and Mechanisms for Producing Ions from Large Molecules, Minaki Lodge, Minaki, Ontario, Canada, June 24-28, 1990. Sixty-four participants, many well-recognized pioneers in the field of high mass spectrometry, were invited and contributed 48 presentations; 38 are the basis of the volume.

The book is appropriately organized in eight sections: (1) MeV Particle Bombardment, (2) MeV Bombardment: Theory, (3) keV Particle Bombardment, (4) keV Bombardment: Theory, (5) Spray Ionization Methods, (6) Laser Desorption, (7) Laser Desorption: Theory, and (8) Post-Ionization of Desorbed Neutrals.

The book begins with a charming chapter on the founding fathers of mass spectrometry by H. E. Duckworth. Short, personal descriptions of Aston, Dempster, Mattauch, Bainbridge, and Nier are given.

Of the remaining 37 chapters, most are short research or review papers. In fact, most are so short as to be of little value except to give the reader an impression of the scope of the subject and a list of the practitioners. The average length of a chapter is 7 ± 3 pages. Those that are written as short research papers

contain, on average, 1.7 pages of actual text (excluding figures) for the Results and Discussion sections. How much descriptive material can be presented in 1.7 pages of single column book format (approximately 50 lines per page)?

A small fraction of the chapters are discussions of basic principles and of concepts that unify or distinguish the various methods of desorption ionization. Notable examples are chapters on "Heavy-Ion and Laser Pulse Induced Ejection of Large Organic Molecules" by Sundqvist and co-workers, "Experimental Observations of Particle Emission from Liquid Organic Matrices..." by Barofsky and co-workers and "Molecular Dynamics Simulation of Bulk Desorption" by Shiea and Sunner. In the area of spray ionization, "On the mechanisms Involved in Spray Ionization" by Vestal and "Electrospray, Mechanism and Performance" by Kebarle et al. are recommended. "Investigations of Matrix Isolated Laser Induced Polymer Sublimation..." by Beavis and Chait, "... Pulsed Laser Ablation of Frozen Aqueous Solutions" by Williams and Nelson, and "Laser Desorption of Large Molecules: Mechanisms and Models" by Vertes round out the volume by presenting some views on mechanisms of laser desorption.

The book has utility for those who wish to gain some appreciation of the status of desorption ionization of the large molecules circa 1990. Only a fraction of the chapters, however, provide perspective and insight.

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