Mass Spectrometry in Biomolecular Sciences

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CONTENTS

Preface ix

Contributing Authors xi

Participants xv

Part I: Methods in Mass Spectrometry

1. Ion Formation by Fast Atom Bombardment Mass Spectrometry 3
   G. Sindona

2. Matrix-Assisted Laser Desorption-Ionization (MALDI) Mass Spectrometry of Biological Molecules 33
   M. Karas, U. Bahr

3. Matrix-Assisted Laser Desorption Mass Spectrometry on a Magnetic Sector Instrument Fitted with an Array Detector 51
   R. S. Bordoli, K. Howes, R.G. Vickers, R.H. Bateman, and D.J. Harvey

4. Electrospray Ionization Mass Spectrometry: Protein Structure 61
   T. B. Farmer and R. M. Caprioli

5. Applications of Quantum Chemistry in Mass Spectrometry 89
   K. Vékey

6. Proton Affinities and Intrinsic Basicities of Alanine and Glycine Studied by Means of AM1 and PM3 Methods 103
   T. Marino, N. Russo, and M. Toscano

Part II: Instrumentation for Mass Analysis and Detection

7. Energy-Isochronous Time-of-Flight Mass Spectrometers 111
   H. Wollnik

8. The Detection of High Mass-to-Charge Biological Ions by Fourier Transform Mass Spectrometry: Issues and Routes for Instrument Improvement 147
   C.L. Holliman, D. L. Rempel and M. L. Gross

9. Quadrupole Mass Filters, Quadrupole Ion Traps and Fourier Transform Ion Cyclotron Resonance Spectrometers 177
   L. Olimpieri and P. Traldi

10. Energy Shifts in Collisional Activation 201
    H.J. Cooper and P. J. Derrick

11. Hybrid Instruments of Unusual Geometry.....261
D. Fravetto and P. Traldi

Part III: Application to Biomolecules

12. Continuous-Flow Fast Atom Bombardment Mass Spectrometry: Applications to Dynamic Systems.....273
R.M. Caprioli

13. Hybrid Tandem Mass Spectrometry of Peptides.....299
S.J. Gaskell

14. Mass Spectrometry in the Study of Advanced Glycation End Products.....317
A. Lapolla, D. Fedele, S. Catinella, P. Traldi

14. Nucleic Acids: Overview and Analytical Strategies.....351
P.F. Crain

15. Monitoring of Human Exposure to Xenobiotics; Identification and Quantification of Cancer Initiators in Vivo.....381
M. Törnqvist

16. The Role of Mass Spectrometry in Biomonitoring Exposure to Carcinogens.....397
N.Sannolo, V. Carbone, P. Ferranti, I. Fiume, D. Santoro and A. Malorni

17. Characterization of Ceramide Mixtures by Fast Atom Bombardment and Tandem Mass Spectrometry.....417
F.M. Rubino, S. Sonnino

18. Bioorganic Studies of a New Photoreceptor Structure.....429
M. Orlando and ***M. L. Gross***

Part IV: Coupling of Chromatography to Mass Spectrometry

19. Gas Chromatography and Mass Spectrometry Coupling.....437
J. Abián and E. Gelpi

20. Recent Developments in Combined Supercritical Fluid Chromatography/Mass Spectrometry (SFC/MS).....461
P. Arpino, F. Sadoun, H. Virelizier

21. GC-MS Analysis of Volatile Compounds of Mesir.....475
Y. Hisil, N. Bagdatlioglu, S. Ötles

22. The Application of Mass Spectrometry to Food and Nutrition Research.....483
R. Self, F.A. Mellon, B.A. McGaw, A.G. Calder, G.E. Lobley and E. Milne

Index.....517

PREFACE

The important role of mass spectrometry as an analytical tool in the life sciences is now well recognized. The remarkable development of both instrumentation and methodology allows the structural characterization of biological molecules of all classes; peptides and proteins, carbohydrates, nucleic acids, lipids, drugs and their metabolites, and other xenobiotics. The present capabilities of mass spectrometry are truly impressive, encompassing the analysis of biopolymers of molecular weights of hundreds of thousands and measurements of minute quantities of compound at the attomole level. It is clear that mass spectrometry has had a big impact on many different areas of biological research and quality control in bioprocesses.

The goal of the NATO ASI dedicated to "Mass Spectrometry in the Biomolecular Sciences" is to provide young scientists with an intensive short course on the latest instrumental advancements, developments in appropriate analytical methodology and the opportunity to discuss these topics with experts in the field who are themselves leaders in some of these developments. This NATO ASI was launched in 1988 and the first institute, held in southern Italy (Cetraro) in 1990, was enthusiastically greeted by both junior and senior scientists. In many academic institution, the participation of students in international schools, such as this NATO ASI, is considered an important part of the training of Ph.D. students and young scientists because it aids in the development of their ability to communicate and exchange information. For this reason, senior scientists involved in the first meeting have agreed that an advanced course in mass spectrometric applications in biological sciences should be organized on a regular basis, each two or three years. The impressive advances in the science of mass spectrometry in the three years following the first ASI formed the backdrop for the second meeting on this subject held at the Hotel Augusto in Lacco Ameno, on the island of Ischia in Southern Italy, June 23-to July 5, 1993. In a congenial and casual atmosphere, 103 scientists discussed the developments of the methodology with reference to important applications in biology, bio-medicine, environmental sciences and food chemistry.

This book provides an account on the recent developments of both the technology and applications related to the topics presented at the ASI in 1993. It is divided into four sections. Section I, "Methods in Mass Spectrometry", introduces and reviews some of the newer ionization methods widely employed in the analysis of biological molecules, such as fast atom bombardment, electrospray, and matrix-assisted laser desorption ionization. Further, an introduction to the application of quantum chemistry in mass spectrometry is provided. Section II, "Instrumentation for Mass Analysis and Detection", describes the major instrumentation involved in mass analysis including magnetic, time-of-flight, quadrupole, ion trap and fourier transform mass spectrometers. A discussion of MS/MS applications to large molecules and the principles of low and high energy collisions for structure characterization are also presented. Section III, "Applications to Biomolecules", presents the scope of the technology in biology, medicine, and environmental areas, with specific examples for a selected number of topics. These topics include the use of continuous flow interfaces for the *in vivo* detection of analytes, evaluation of the risks of human exposure to carcinogens, and the analysis of peptides and proteins, lipids and nucleic acids derived from biological sources. Section IV, "Coupling of Chromatography to Mass Spectrometry", presents recent achievements in the on-line combination of separation techniques such as gas chromatography, liquid chromatography, and supercritical fluid chromatography. In addition, applications in the environmental sciences, and in human nutrition, are presented.

The editors acknowledge the special efforts of the other fourteen senior plenary lectures, P. Arpino (France), A. Burlingame (USA), P. Crain (USA), P. Derrick (UK), S. Facchetti (Italy), S.

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