

Contents

Preface	xi
List of Contributors	xiii
1. Quality Assurance, Quality Control and Method Validation in Chromatographic Applications	1
<i>Michele L. Merves and Bruce A. Goldberger</i>	
1.1 Introduction	1
1.2 History	1
1.3 Definition of Quality Assurance and Quality Control	3
1.4 Professional Organizations	4
1.5 Internal Quality Assurance and Control	5
1.5.1 Standard operating procedure manual	5
1.5.2 Method development	5
1.5.3 Method validation	6
1.5.4 Accuracy	7
1.5.5 Precision	7
1.5.6 Recovery	7
1.5.7 Lower limits of detection (sensitivity) and quantitation	8
1.5.8 Range of linearity	8
1.5.9 Specificity	9
1.5.10 Stability	9
1.5.11 Carryover	9
1.5.12 Ruggedness	9
1.5.13 Selection of a reference standard	10
1.5.14 Selection of an internal standard and standard addition	10
1.5.15 Selection of derivatization agent	10
1.5.16 Selection of ions for selected-ion monitoring or full-scan analysis	11
1.5.17 Chromatographic performance	11
1.5.18 Statistical evaluation of quality control	11
1.6 External Quality Assurance	13
References	13

2. Liquid Chromatographic-Mass Spectrometric Measurement of Anabolic Steroids	15
<i>Don H. Catlin, Yu-Chen Chang, Borislav Starcevic and Caroline K. Hatton</i>	
2.1 Introduction	15
2.2 LC-MS Analysis of Synthetic Steroids or Animal Samples	16
2.3 LC-MS Analysis of Natural Androgens in Human Samples	19
2.4 Conclusion	29
References	29
3. High-performance Liquid Chromatography in the Analysis of Active Ingredients in Herbal Nutritional Supplements	33
<i>Amitava Dasgupta</i>	
3.1 Introduction	33
3.2 St John's Wort	35
3.2.1 Drug interactions with St John's wort	35
3.2.2 Measurement of active ingredients of St John's wort using HPLC	36
3.2.3 Analysis of St John's wort extract with other analytical techniques	38
3.2.4 Measurement of hypericin and hyperforin in human plasma using HPLC	38
3.3 Herbal Supplements with Digoxin-like Immunoreactivity	39
3.3.1 Use of HPLC for the determination of chan su, danshen and ginsengs	40
3.4 Herbal Remedies and Abnormal Liver Function Tests	41
3.4.1 Use of GC-MS and HPLC for the measurement of active components	43
3.5 Ginkgo Biloba	43
3.5.1 Analysis of components of ginkgo biloba by HPLC	44
3.6 Echinacea	45
3.6.1 Analysis of active components of echinacea by HPLC	45
3.7 Valerian	46
3.7.1 Analysis of components of valerian by HPLC	46
3.8 Feverfew	46
3.8.1 Analysis of parthenolide by HPLC	47
3.9 Garlic	47
3.9.1 Measurement of components of garlic by HPLC	48
3.10 Ephedra (Ma Huang) and Related Drugs	48
3.10.1 Analysis of active components of ephedra-containing products	49
3.11 Conclusions	50
References	50
4. Measurement of Plasma L-DOPA and L-Tyrosine by High-Performance Liquid Chromatography as a Tumor Marker in Melanoma	56
<i>Thierry Le Bricon, Sabine Letellier, Konstantin Stoitchkov and Jean-Pierre Garnier</i>	
4.1 Introduction	56
4.2 Melanogenesis	57

4.2.1	Overview of the pathway	57
4.2.2	Potential tumor markers	58
4.3	L-DOPA Alone	59
4.3.1	Urine analysis	59
4.3.2	Blood (plasma or serum) analysis	59
4.4	L-DOPA/L-Tyrosine Ratio	60
4.4.1	Technical aspects	60
4.4.2	Clinical results	61
4.4.3	Future directions	63
4.5	Conclusion	64
	References	65
5.	Hypersensitive Measurement of Proteins by Capillary Isoelectric Focusing and Liquid Chromatography-Mass Spectrometry	67
	<i>Feng Zhou and Murray Johnston</i>	
5.1	Introduction	67
5.2	A Robust CIEF-RPLC Interface	69
5.3	First-Generation CIEF-RPLC-MS System for Proteins	71
5.4	Second-Generation CIEF-RPLC-MS System	76
5.5	Future Improvements	83
	Acknowledgment	83
	References	83
6.	Chromatographic Measurement of Transferrin Glycoforms for Detecting Alcohol Abuse and Congenital Disorders of Glycosylation	87
	<i>Anders Helander</i>	
6.1	Introduction	87
6.2	Transferrin Microheterogeneity	88
6.3	Carbohydrate-deficient Transferrin (CDT)	89
6.4	Congenital Disorders of Glycosylation (CDG)	89
6.5	Analytical Methods for Transferrin Microheterogeneity	90
6.6	Chromatographic Methods for CDT	91
6.6.1	HPLC conditions and potential interferences	91
6.6.2	Chromatographic separation of transferrin glycoforms	92
6.6.3	Genetic transferrin variants and glycoform types	94
6.6.4	Sensitivity and reproducibility	94
6.7	Chromatographic Methods for CDG	94
6.7.1	HPLC testing for CDG	95
6.7.2	LC-MS testing for CDG	95
6.8	Summary and Conclusions	96
	References	97
7.	Chromatographic Measurements of Catecholamines and Metanephhrines	101
	<i>Eric C. Y. Chan and Paul C. L. Ho</i>	
7.1	Background	101
7.1.1	Total or individual assays	104

7.2	Analytical Measurements of Catecholamines and Metanephines	105
7.3	Early Methods	105
7.3.1	Catecholamines	105
7.3.2	Metanephines	106
7.4	Current Chromatographic Methods	106
7.4.1	Chemistry of catecholamines	106
7.4.2	Specimen preparation	107
7.4.3	Fluorescence detection	109
7.4.4	Electrochemical detection	110
7.4.5	Chemiluminescence detection	112
7.4.6	Mass spectrometry	115
7.5	Practical Considerations for the Stability of Urinary Catecholamines and Metanephines During Storage	117
7.6	Future Developments	118
	Dedication	119
	References	119
8.	Chromatographic Measurement of Volatile Organic Compounds (VOCs)	127
	<i>Larry A. Broussard</i>	
8.1	Introduction	127
8.2	General Considerations	127
8.3	Intended Use	128
8.4	Volatility of Compounds	128
8.5	Sample Collection, Handling and Storage	129
8.6	Headspace Gas Chromatographic Methods	129
8.7	Columns and Detectors	130
8.8	Identification, Quantitation and Confirmation	130
8.9	Ethanol and Other Volatile Alcohols	131
8.10	Inhalants and Screening for Multiple VOCs	132
8.11	Interpretation	134
8.12	Conclusion	136
	References	136
9.	Chromatographic Techniques for Measuring Organophosphorus Pesticides	139
	<i>H. Wollersen and F. Musshoff</i>	
9.1	Introduction	139
9.2	Organophosphorus Pesticides (OPs)	141
9.2.1	Mechanism of action	141
9.2.2	Intoxication	141
9.2.3	Progression of intoxication and longer term risks	145
9.2.4	Therapy	146
9.2.5	Analytical procedures	146
9.3	Conclusion	163
	References	164

10. Chromatographic Analysis of Nerve Agents	170
<i>Jeri D. Ropero-Miller</i>	
10.1 Introduction	170
10.2 Neuromuscular Blockers	170
10.2.1 Background and uses	170
10.2.2 Classification, mechanism and duration of action	171
10.2.3 Effects and toxicity	173
10.2.4 Analysis	173
10.3 Paralytic Shellfish Poisoning: Saxitoxin	185
10.3.1 Background	185
10.3.2 Toxicity	187
10.3.3 Analysis	188
10.4 Summary	191
References	195
11. History and Pharmacology of γ-Hydroxybutyric Acid	197
<i>Laureen Marinetti</i>	
11.1 Introduction	197
11.2 History of Illicit Use of GHB	198
11.3 Clinical Use of GHB in Humans	200
11.4 History of Illicit Use of GBL and 1,4BD	200
11.5 Distribution and Pharmacokinetics of GHB, GBL and 1,4BD	202
11.6 GHB Interpretation Issues and Post-mortem Production	204
11.7 Analysis for GHB, GBL and 1,4BD	208
References	213
12. Liquid Chromatography with Inductively Coupled Plasma Mass Spectrometric Detection for Element Speciation: Clinical and Toxicological Applications	217
<i>Katarzyna Wrobel, Kazimierz Wrobel and Joseph A. Caruso</i>	
12.1 Introduction	217
12.2 Liquid Chromatography with Inductively Coupled Plasma Mass Spectrometric Detection	218
12.3 Analytical Applications of Clinical and Toxicological Relevance	219
12.3.1 Arsenic	219
12.3.2 Iodine	234
12.3.3 Mercury	234
12.3.4 Platinum	240
12.3.5 Selenium	245
12.4 Conclusions and Future Trends	260
12.5 Abbreviations	260
References	262

13. Applications of Gas Chromatography-Mass Spectrometry to the Determination of Toxic Metals	274
<i>Suresh K. Aggarwal, Robert L. Fitzgerald and David A. Herold</i>	
13.1 Introduction	274
13.2 Instrumentation	275
13.3 Experimental Procedure	276
13.3.1 Preparation of internal standard solutions	276
13.3.2 Digestion of biological sample	276
13.3.3 Preparation of metal chelate	277
13.4 GC-MS Studies	278
13.4.1 Memory effect evaluation	278
13.4.2 Precision and accuracy in measuring isotope ratios	281
13.4.3 Results of concentration determination of toxic metals in biological samples	283
13.5 Conclusions	284
References	284
Index	287