

MICRO TOTAL ANALYSIS SYSTEMS '98

Micro Total Analysis Systems '98

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Dedicated to the late H. Michael Widmer.

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Preface

The Micro-Total Analysis Systems (μ -TAS) Conference Program, which was first and foremost the responsibility of the contributing authors, was screened and structured by the Program Committee. There were well over 130 manuscripts submitted for about 36 oral presentations and 68 poster presentations, and 18 well recognized researchers accepted invitations to speak. This tremendous response is an indication of the significant growth in the field of miniaturized and integrated analytical systems since μ -TAS '96. The space and time limitations associated with a predominantly single session, workshop style meeting imposed a limitation on the number of presentations. The Program Committee was able to create a strong program of oral and poster presentations from the large number of high quality submissions. All submitted abstracts were evaluated and discussed by the Program Committee before decisions were reached. The Committee hopes that the effort to maintain a limited number of presentations and an interactive, workshop style format will ensure an informative and enjoyable meeting for all attendees. Personally, I wish to thank the Program Committee members for their effort and their generous donation of time and resources to this process.

No Conference or Meeting can occur without the effort of a great many people contributing to its planning, organization and funding. The number of people I wish to thank for their contributions is large: first Allen Northrup for his assistance in fund raising for the meeting, next Amanda Rahn and Laura MacDougall for their assistance with planning, day to day organization and contact management over the past year, and Amanda for her handling of the Abstract submissions, mailings and Proceedings manuscripts, Gregor Ocvirk who contributed most of the art work needed for the brochures and for this volume, Loranelle Shultz-Lockyear for acting as a sounding board and organizer, all of my research group, who performed numerous tasks, the most onerous being assembly of the large volume mailings (including Said Attiya, Youssouf Badal, Abebaw Belay Jemere, Nicolas Bings, Siew Bang Cheng, Nghia Chiem, Guifeng Jiang, Mark Munroe, Charmaine Qiu, Cameron Skinner, Hossein Salimi-Moosavi, Thompson Tang, Can Wang), Patricia Conway for her organization of a special session on commercialization strategies, Albert van den Berg for his expert arrangement of the assembly and printing of this volume, and a number of others for helpful advice, suggestions and contributions. I also thank the Conference Steering Committee for agreeing to my bid to move the meeting to North America for 1998, holding it here in Banff under my Chairmanship.

I would like to dedicate this Proceedings volume to the memory of the late Professor Dr. Michael Widmer. Michael was the Chairman of μ -TAS '96. He was an important figure in the early development of the μ -TAS concept, developing the total analysis system concept for process control and providing guidance, assistance and shelter for the initial technology development within the research labs of Ciba-Geigy, Switzerland. Many of those currently working in the field have had the good fortune to work with him, benefit from interactions with him and his research group, or come into contact with him and his broad range of contributions to Analytical Chemistry. On behalf of all of those who have known Michael Widmer I would like to express our gratitude for his many and varied contributions.

The six years since μ -TAS '94 have seen remarkable developments and expansion of miniaturized instrumentation for chemical, biochemical and biological analysis and sample processing. In fact, the concept has grown to encompass analysis and synthesis for applications ranging from chemistry through to biology, with a high degree of parallelism for high sample throughput. Applications of micro-systems in genetic analysis, clinical diagnostics, chemical synthesis, drug discovery, portable instrumentation and industrial process control provide the drivers for continued research and development. The large degree

of industrial participation in this very young field speaks to the apparent high value of microfluidics and microinstrumentation for practical applications. The number of companies with presentations at this meeting, or which supported the meeting financially, that did not even exist at the time of the first μ -TAS meeting in 1994 is striking.

Evaluating the trends seen in the work presented here at μ -TAS '98, two main schemes for miniaturized fluidic systems have become apparent. In one method, conveniently referred to as array based systems, sample or reagent is immobilized in large arrays on a plate or chip and fluids are flushed over the surface. In the other, microfluidic channels form complex manifolds for fluid manipulation and controlled delivery of samples and reagents; these are often referred to as microfluidic systems. These two approaches are both competitive and complementary, as demonstrated by their merger into a larger system for genetic analysis in papers presented in this volume. Inclusion of array based systems within the μ -TAS concept appears to be well established now.

Several other current themes become apparent when reflecting upon the presentations at μ -TAS '98. Applications, rather than fabrication methods, appear to be the primary interest of researchers in this field. This focus has engendered a much broader exploration of materials outside of those normally compatible with integrated circuit technologies than has been seen in the parent Micro-Electromechanical Systems (MEMS) community. In particular, μ -TAS '98 sees extensive developments in the field of plastic microfabrication, the subject of only one or two pioneering papers at μ -TAS '94 and '96, due to the demand for single use disposable products in diagnostic applications. The most dominant application at μ -TAS '98 is clearly genetic analysis, reflecting the value of parallel analysis in genetics and the ability of microfabrication methods to potentially meet this need. Various chemical and biochemical analyses remain the focus of significant effort, but applications in drug discovery, cell biology and in chemical synthesis represent exciting and powerful new trends that greatly extend the range of applicability of microfluidic systems. The dominance of electrokinetically pumped systems remains apparent, yet the application of sophisticated approaches to prepare better pumps and valves for microfluidic systems is evidently beginning to produce functionally useful components.

Two key issues of difficulty for μ -TAS have been the detection of the necessarily small amounts of sample, and interfacing the chip based fluidic device to the external environment for sample, reagent and solvent delivery. Progress is being made on these problems, as evidenced by the presentations on integrating micro-optics or electrochemical detection with microfluidic devices, and others on sample interfacing with quick-fit connectors, low dead volume connectors and continuous sampling elements. The interfacing of microfluidic systems with the mass spectrometer requires a good interfacial connection method, as indicated by several papers augers well for the future of this powerful combination of integrated sample processing and information rich analysis.

Many other exciting ideas, concepts and applications are identified by the authors in the following pages, and their lack of inclusion in this discussion is only due to limits of space and time. I invite the conference attendees to enjoy this meeting and extract all they can from the opportunity to interact personally with many of the leading researchers in this growing field. I trust that future readers of this Proceedings volume will find it to be a highly useful snapshot of the current state of the art and the future goals of a major fraction of the pioneers in microfluidics, arrays and μ -TAS.

D. Jed Harrison
 μ -TAS '98 Chairman
July 22, 1998

Contents

Day 1

Microsystems for genetic analysis

DNA Analysis with Capillary Array Electrophoresis Microplates..... 1
R.A. Mathies, P.C. Simpson, A.T. Woolley

Continuous Flow PCR on a Chip..... 7
M.U. Kopp, M.B. Luechinger, A. Manz

Advances in Integrated Genetic Analysis..... 11
R.C. Anderson, G.J. Bogdan, A. Puski, X. Su

Themes in μ -TAS today

Photo-Polymer Microchannel Technologies and Applications..... 17
P. Renaud, H. van Lintel, M. Heuschkel, L. Guérin

Interconnections and sample interfaces

Parallel Separations in Microfabricated Channels with Capillary Electrophoretic
Sample Introduction..... 23
A.G. Ewing

Novel Interconnection and Channel Technologies for Microfluidics..... 27
*N.J. Mourlas, D. Jaeggi, A.F. Flannery, B. L. Gray, B.P. van Drieënhuizen,
C.W. Storment, N.I. Maluf, G.T.A. Kovacs*

A μ -TAS Based on Microdialysis for On-line Monitoring of Clinically Relevant
Substances..... 31
S. Böhm, W. Olthuis, P. Bergveld

Microdevices for Electrospray Mass Spectrometry..... 35
F. Foret, H. Liu, B. Zhang, C. Felten, B.L. Karger

Fluid mobilization and control

Cell Sorting in Microfluidic Systems..... 39
P. Telleman, U.D. Larsen, J. Philip, G. Blankenstein, A. Wolff

Electrohydrodynamic Pumps for High-Density Microfluidic Arrays..... 45
S.E. McBride, R.M. Moroney, W. Chiang

Electrokinetic Generation of High Pressures using Porous Microstructures..... 49
P.H. Paul, D.W. Arnold, D. J. Rakestraw

Studies of Hydrostatic Pressure Effects in Electrokinetically Driven μ -TAS..... 53
G. Boer, A. Dodge, K. Fluri, B.H. van der Schoot, E. Verpoorte, N.F. de Rooij

Poster session I

An Electronic Nose Based on a Micromechanical Cantilever Array..... 57
*H.P. Lang, F.M. Battiston, M.K. Baller, R. Berger, J.-P. Ramseyer, P. Fornaro,
E. Meyer, H.-J. Güntherodt, C. Andreoli, J. Brugger, M. Despont, P. Vettiger,
J.-H. Fabian, T. Mezzacasa, L. Scandella, Ch. Gerber, J.K. Gimzewski*

Chemical Analysis Based on Environmentally Sensitive Hydrogels and Optical
Diffraction..... 61
J. Schumacher, M. Ranft, T. Wilhelm, R. Dahint, M. Grunze

Mass-Sensing Multianalyte Micro-Array Based Immunoassay by Direct NIR Fluorescence and Quantitative Image Analysis.....	65
<i>J.W. Silzel, C. Dodson, R.J. Obremski, T. Tsay</i>	
Biology Lab-on-a-Chip for Drug Screening.....	69
<i>H. Salimi-Moosavi, R. Szarka, P. Andersson, R. Smith, D.J. Harrison</i>	
Results Obtained Using a Prototype Microfluidics-Based Hematology Analyzer.....	73
<i>E. Altendorf, D. Zebert, M. Holl, A. Vannelli, C. Wu, T. Schulte</i>	
Rare Event Cell Sorting in a Microfluidic System for Application in Prenatal Diagnosis.....	77
<i>A. Wolff, U.D. Larsen, G. Blankenstein, J. Philip, P. Telleman</i>	
Simultaneous Self-Referencing Analyte Determination in Complex Sample Solutions using Microfabricated Flow Structures (T-Sensors TM).....	81
<i>B.H. Weigl, J. Kriebel, K. Mayes, P. Yager, C.C. Wu, M. Holl, M. Kenny, D. Zebert</i>	
Fabrication of Injection and Switching Micro Valve for Whole Blood Control.....	85
<i>K. Miura, S. Shoji</i>	
A Microfluidics-Based Microcytometer: Interfacing Microfluidics with Macrofluidics.....	89
<i>M. Tracey, I. Johnston, R. Greenaway, J. Davis, N. Sutton, G. Schulze, W. Doetzel</i>	
Microfabricated Biosensors for Measuring Neurotransmitters from Cultured Nerve Cells...	93
<i>O. Niwa, R. Kurita, T. Horiuchi, K. Torimitsu</i>	
Anti-Resonant Reflecting Optical Waveguides (ARROWS) as Optimal Optical Detectors for μ TAS Applications.....	97
<i>N.J. Goddard, K. Singh, F. Bounaira, R.J. Holmes, S.J. Baldock, L.W. Pickering, P.R. Fielden, R.D. Snook</i>	
Probe Beam Deflection of Isotachophoresis on Miniaturised Planar Glass Devices.....	101
<i>L.W. Pickering, S.J. Baldock, P.R. Fielden, N.J. Goddard, R.D. Snook, B.J. Treves Brown</i>	
Integration of Microelectrodes with Etched Microchannels for In-Stream Electrochemical Analysis.....	105
<i>R. B. Darling, P. Yager, B. Weigl, J. Kriebel, K. Mayes</i>	
On-line Detection of Electrophoretic Separations on a Microchip by Raman Spectroscopy.....	109
<i>K.A. Reshni, M.D. Morris, B.N. Johnson, M.A. Burns</i>	
Electrophoretic Separations in Ultrathin Channels Using Microelectrode Array Detection.....	113
<i>S. Suljak, L. Thompson, A. Ewing</i>	
Micromechanical Thermogravimetry on Single Zeolite Crystals.....	117
<i>J.-H. Fabian, R. Berger, H.P. Lang, Ch. Gerber, J. K. Gimzewski, J. Gobrecht, E. Meyer, L. Scandella</i>	
A One-Spot Electrochemical Transducer for use in μ TAS.....	121
<i>J. Hendrikse, G.F. Dirks, W. Olthuis, P. Bergveld</i>	
Various Current Regimes Applicable for Sensing in μ TAS.....	125
<i>W. Olthuis, S. Böhm, C. Neagu, P. Bergveld</i>	

Optimization of a Porous Silicon Carrier Matrices Applied in Chip Based Micro-Enzyme Reactors.....	129
<i>J. Drott, M. Bengtsson, L. Rosengren, T. Laurell</i>	
Electrochemical Fabrication of Multi Walled Micro Channels.....	133
<i>R. Tjerkstra, J.G.E. Gardeniers, M.C. Elwenspoek, A. van den Berg</i>	
Utilizing the {111} Plane Switch-Over Etching Process for Micro Fluid Control Applications.....	137
<i>R. E. Oosterbroek, J.W. Berenschot, S. Schlautmann, T.S.J. Lammerink, A. van den Berg, M.C. Elwenspoek</i>	
Coupling Electrospray Mass Spectrometry to Microfluidic Devices with Low Dead Volume Connections.....	141
<i>N.H. Bings, C.D. Skinner, C. Wang, C.L. Colyer, D.J. Harrison, J. Li, P. Thibault</i>	
Silicon-Micromachined Separation Columns Coated with Amino Acid Films for an Integrated On-chip Gas Chromatograph.....	145
<i>S. Hannoe, I. Sugimoto, T. Katoh</i>	
Computer Simulations for Microchip Electrophoresis.....	149
<i>S.V. Ermakov, S.C. Jacobson, J.M. Ramsey</i>	
Electrophoretic Separation of Antisense DNA using Polymer-solution filled Capillary by Cross-Injection.....	153
<i>S.-H. Chen, Y.-C. Lin, Y.-H. Chen, H.-S. Liao, C.-Y. Wu, S.-H. Wang</i>	
Integrated Serial Dilution on a Microchip for Immunoassay Sample Treatment and Flow Injection Analysis.....	157
<i>S.B. Cheng, C.D. Skinner, D.J. Harrison</i>	
Minimizing Dispersion Introduced by Turns on Microchips.....	161
<i>C. T. Culbertson, S.C. Jacobson, J.M. Ramsey</i>	
Use of Surfactant Additives for Modification of Electroosmotic Flow and Wall Chemistry.....	165
<i>C.A. Lucy, K.K.-C. Yeung</i>	
Sample Matrix Effects on Injection and Sample Loading in Integrated Capillary Electrophoresis Devices.....	169
<i>L. Shultz-Lockyear, C. Colyer, K. Roy, D.J. Harrison</i>	
Development of a Microfabricated Biochemical Workbench - Improving the Mixing Efficiency.....	173
<i>T. Fujii, K. Hosokawa, S. Shoji, A. Yotsumoto, T. Nojima, I. Endo</i>	
Micro Mixer Incorporated with Piezoelectrically Driven Valveless Micropump.....	177
<i>Z. Yang, H. Goto, M. Matsumoto, T. Yada</i>	
Liquid Mixing Studies with an Integrated Mixer/Valve.....	181
<i>J. Voldman, M.L. Gray, M.A. Schmidt</i>	
Fabrication of an Integrated Mixing/Reaction Micro Flow Cell for μ -TAS.....	185
<i>A. Yotsumoto, R. Nakamura, S. Shoji, T. Wada</i>	
Micro-fluidic Diffusion Coefficient Measurement.....	189
<i>P. Galambos, F.K. Forster</i>	

Day 2**Cells on chips**

- Sizing, Fractionation and Mixing of Biological Objects via Microfabricated Devices..... 193
O. Bakajin, R. Carlson, C.F. Chou, S.S. Chan, C. Gabel, J. Knight, T. Cox, R.H. Austin
- Individual Embryo Transport and Retention on a Chip..... 199
I.K. Glasgow, H.C. Zeringue, D.J. Beebe, S.-J. Choi, J.T. Lyman, M.B. Wheeler
- Single Cell Enzymatic Analysis on a Microchip: Lysing of Single Cells
 and Identification of their β -Galactosidase Activity..... 203
*G. Ocvirk, H. Salimi-Moosavi, R.J. Szarka, E. Arriaga, P.E. Andersson,
 R. Smith, N. J. Dovichi, D.J. Harrison*
- Applying Microfluidic Chemical Analytical Systems to Imperfect Samples..... 207
Paul Yager, D. Bell, J.P. Brody, D. Qin, C. Cabrera, A. Kamholz, B. Weigl

Array based technologies

- Building Highly Diverse Arrayed Substance Libraries by Micro Offset Printing..... 213
*E. Ermantraut, T. Schulz, J. Tuchscheerer, S. Wöfl, H.-P. Saluz, E. Thallner,
 J. M. Köhler*
- Fluorescence Array Biosensor - Biochemistry and Application..... 217
F.S. Ligler, C.A. Rowe, S. Balderson, M. Feldstein, J.P. Golden
- An Integrated Microelectronic Hybridization System for Genomic Research
 and Diagnostic Applications..... 221
*M.J. Heller, A. Holmsen, D. Ackley, G. Tu, R. Sosnowski, B. Butler, P. Dillion,
 M. Nerenberg, D. Raymond, E. Sheldon, J. Cheng, R. Rooney, B. Mather, J. O'Connell*

Microfluidic systems for assays

- Development of a Generic Microfluidic System for Electrochemical
 Immunoassay-Based Remote Bio/Chemical Sensors..... 225
C.H. Ahn, T. Henderson, W. Heineman, B. Halsall
- Integrated Microsystem for Sample Introduction, Mixing, Reaction, Separation and
 Self Calibration of Immunoassays..... 231
S. Attiya, X. C. Qiu, G. Ocvirk, N. Chiem, W.E. Lee, D.J. Harrison
- Continuous-flow vs. Batch Process - a Few Examples..... 235
A. Manz, F. Bessoth, M.U. Kopp

Microfabrication in plastic

- Micro-TAS on Polymer Substrates Micromachined by Laser Photoablation..... 241
A. Schwarz, J.S. Rossier, F. Bianchi, F. Reymond, R. Ferrigno, H.H. Girault
- Key Elements of a Transparent Teflon® Microfluidic System..... 245
L.P. Lee, S.A. Berger, L. Pruitt, D. Liepmann
- An Inexpensive Plastic Technology for Microfabricated Capillary Electrophoresis Chips 249
J. R. Webster, M.A. Burns, D.T. Burke, C.H. Mastrangelo
- Microfluidic Manifolds by Polymer Hot Embossing for μ -TAS Applications..... 253
H. Becker, W. Dietz, P. Dannberg
- Multiplexed, Disposable, Plastic Microfluidic Systems for High-Throughput Applications 257
T.D. Boone, H.H. Hooper

Day 3

DNA analysis on microchips

Micro-Genetic Analysis Systems..... 261
T.B. Taylor, P.M. St. John, M. Albin

A Microfabricated Fluidic Reaction and Separation System
 for Integrated DNA Analysis..... 267
*S.N. Brahmamandra, B.N. Johnson, J.R. Webster, K. Handique, D.T. Burke,
 C.H. Mastrangelo, M. A. Burns*

High Performance DNA Separations in Microchip Electrophoresis Systems..... 271
L. Bousse, B. Dubrow, K. Ulfelder

Nucleic Acid Concentration and PCR for Diagnostic Applications..... 277
L.A. Christel, K. Petersen, W. McMillan, M.A. Northrup

Micro optics and detection

Microoptical Fluorescence Detection for Chip-Based Multiplexed Analysis Systems..... 281
A.E. Bruno, E. Baer, R. Völkel, C.S. Effenhauser

Micro-Optical Systems for Fluorescence Detection in μ -TAS Applications..... 287
*J.-C. Roulet, K. Fluri, E. Verpoorte, R. Völkel, H.-P. Herzig, N.F. de Rooij,
 R. Dändliker*

Integrated Bio/Chemical Microsystems Employing Optical Detection: A Cytometer..... 291
O. Leistiko, P. F. Jensen

Photothermal Ultrasensitive Detection and Microchemistry
 in the Integrated Chemistry Lab..... 295
T. Kitamori, M. Fujinami, T. Odake, M. Tokeshi, T. Sawada

Fluid control concepts

Impedances for Design of Microfluidic Systems..... 299
R.L. Bardell, F.K. Forster

Miniaturized Electrocaloric Flow Controller for Analyte Multiplexing
 and Cell/Particle Sorting..... 303
T. Schulz, S. Poser, E. Ermantraut, J. McCaskill, H. Mathis, J. M. Köhler

Hydrophobic Microcapillary Vent for Pneumatic Manipulation of Liquid in μ -TAS..... 307
K. Hosokawa, T. Fujii, I. Endo

Microfabricated Chips for Capillary Electrophoresis on Quartz Glass Substrates
 Using a Bonding with Hydrofluoric Acid..... 311
T. Nishimoto, H. Nakanishi, H. Abe, A. Arai, R. Nakamura, A. Yotsumoto, S. Shoji

Micro chip based electrophoresis

Rapid Electrophoretic and Chromatographic Analysis on Microchips 315
S.C. Jacobson, J.P. Kutter, C.T. Culbertson, J. M. Ramsey

Free Flow Electrophoresis Module Fabricated with Pyrex Glass..... 319
E. Shinohara, N. Tajima, H. Suzuki, K. Kano

A Miniaturized Planar Isotachopheresis Separation Device for Transition Metals with Integrated Conductivity Detection.....	323
<i>P.R. Fielden, S.J. Baldock, N.J. Goddard, L.W. Pickering, J.E. Prest, R.D. Snook, B.J. Treves Brown, D.I. Vaireanu</i>	
Characterization of Silicon-Based Insulated Channels for Capillary Electrophoresis.....	327
<i>Y. Fintschenko, P. Fowler, V. Spiering, G.-J. Burger, A. van den Berg</i>	
Novel Microfabricated Capillary Array Electrophoresis Chip Fabricated by Synchrotron Radiation & Direct Observation of Dynamics of DNA Molecules Migrating in Microchannels.....	331
<i>Y. Baba, O. Tabata</i>	
Poster session II	
Continuous Flow versus Stopped Flow in a Micro Flow Injection System	335
<i>E.B. van Akker, M. Bos, A. van den Berg, W.E. van der Linden</i>	
Microfabricated Channels and Fluid Control Systems for Integrated Flow Injection Analysis.....	339
<i>M. Fujinami, M Tokeshi, T. Odake, T. Kitamori, K. Sato, T. Sawada, K. Matsumoto, M. Nakao, T. Ooi, Y. Hatamura</i>	
Microfabricated Dual-Microdialysis and Capillary Isoelectric focusing Devices for Cleanup and Separations/ Mass Spectrometric Anyalysis of Biomolecules.....	343
<i>Y. Lin, N. Xu, J. Wen, D. Matson, R.D. Smith</i>	
Chip-based Heterogeneous Immunoassay for Clinical Diagnostic Applications.....	347
<i>K. Fluri, G.-L. Lettieri, B.H. van der Schoot, E. Verpoorte, N.F. de Rooij</i>	
Micro-Analytical (μ FIA) Reactor for the Determination of Phosphate as Orthophosphate.....	351
<i>G.N. Doku, S.J. Haswell</i>	
Investigation of Chemiluminescent MicroAnalytical Systems.....	355
<i>L.J. Nelstrop, G.M. Greenway, S.N. Port</i>	
Isotachopheresis on Planar Polymeric Substrates.....	359
<i>S.J. Baldock, N. Bektas, P.R. Fielden, N. J. Goddard, L.W. Pickering, J.E. Prest, R.D. Snook, B.J. Treves Brown, D.I. Vaireanu</i>	
Application of Thin Cross-Linked Gelatin Layers in Micro Systems Technology.....	363
<i>K. Wohlfart, E. Ermantraut, J.M. Köhler</i>	
Plastic Microfluid Devices for Clinical Measurements.....	367
<i>L.E. Locascio, M. Gaitan, J. Hong, M. Eldefrawi</i>	
Fabrication Processes for Polymer-based Microfluidic Analytical Devices.....	371
<i>D.W. Matson, P.M. Martin, W.D. Bennett, D.E. Kurath, Y. Lin, D. Hammerstrom</i>	
μ -Structured Polymers as Components of Chemical Microreactors.....	375
<i>H.-G. Braun, E. Meyer, T. Kratzmüller</i>	
Development of Microfabricated Valves for μ TAS.....	379
<i>H. Hartshorne, Y. Ning, W.E. Lee, C. Backhouse</i>	
A Silicon Micropump with a High Bubble Tolerance and Self-Priming Capability.....	383
<i>P. Woias, R. Linnemann, M. Richter, A. Leistner, B. Hillerich</i>	

Flow-through Microdispensing; Design and Applications.....	387
<i>J. Nilsson, L. Wallman, P. Önnnerfford, G. Marco-Varga, T. Laurell</i>	
Manufacturing of Self-Priming Plastic Micropumps.....	391
<i>S. Böhm, M. Dierselhuis, W. Olthuis, P. Bergveld</i>	
Micromachined Bi-directional Liquid Pump with Thermally Controlled Dynamic Valves.....	395
<i>S. Matsumoto, A. Klein, R. Maeda</i>	
Micro Ball Valve for Fluidic Micropumps and Gases.....	399
<i>O. Krusemark, A. Feustel, J. Müller</i>	
Nanomanipulation Techniques Inside the SEM - First Attempts to Integrate Microfabrication into a SEM.....	403
<i>E. Meyer, H.-G. Braun</i>	
Fluidics for a Multi-analyte Detector Based on Intermolecular Binding Forces.....	407
<i>C.R. Tamanaha, D.R. Baselt, P.E. Sheehan, R.J. Colton</i>	
Reagent Handling by Manipulation of Magnetic Particles: A New Approach to the Automation and Miniaturization of Analytical Chemistry.....	411
<i>S. Ostergaard, G. Blankenstein, H. Dirac, O. Leistiko</i>	
Novel DNA Manipulation Based on Local Temperature Control: Transportation and Scission.....	415
<i>K. Hirano, R. Ishii, S. Matsuura, S. Katsura, A. Mizuno</i>	
Numerical Simulation of Magnetic Separation of Particles in a Rectangular Microchannel.....	419
<i>S. Lomholt, J.-P. Lynov, P. Telleman</i>	
Automated Microchip Platform for Biochemical Analysis.....	423
<i>W.E. Lee, D.E. Bader, D.J. Harrison, T. Tang, N. H. Chiem, X. C. Qui, S. Attiya, C.D. Skinner, H. Mottl, M. Paulson, G. Burchett, G. McKinnon, Y. Ning, F. Bekkaoui, D. Mah</i>	
Automatic Sensor System for Water Analysis.....	427
<i>A. Ehlert, S. Büttgenbach</i>	
Fluorescence Array Biosensor - Part 1: Optics and Fluidics.....	431
<i>M.J. Feldstein, J.P. Golden, F.S. Ligler</i>	
Microseparations and Microfluidic Studies.....	435
<i>D.W. Arnold, C.G. Bailey, M.G. Garguilo, C.M. Matzke, J. R. Wendt, W.C. Sweatt, S.H. Kravitz, M.E. Warren, D.J. Rakestraw</i>	
μ TAS for Volumetric or Coulometric Titrations of Nanomole Amounts of Analytes in Microliter Samples.....	439
<i>O.T. Guenat, W. E. Morf, E. Verpoorte, B.H. van der Schoot, N.F. de Rooij</i>	
System Requirements for a Portable Cell Based Sensor.....	443
<i>B.D. Debusschere, D.A. Borkholder, G.T.A. Kovacs</i>	
Laboratory on Chip for Clinical Applications.....	447
<i>I. Moser, G. Jobst, G. Urban</i>	

Future themes in micro-TAS I

Microfabricated Liquid Chromatography Columns Based on Collocated Monolith Support Structures.....	451
<i>B. He, F. Regnier</i>	

Towards a Modular Microfluidic System for Proteome Analysis by Mass Spectrometry...	457
<i>D. Figeys</i>	

Future themes in micro-TAS II

Integrated Gas Phase Microreactors.....	463
<i>Klavs F. Jensen, S.L. Firebaugh, A.J. Franz, D. Quiram, R. Srinivasan, M.A. Schmidt</i>	

In Situ Detection of Cells and Biochemical Reactions by Optical Diffraction.....	469
<i>F. Morhard, R. Dahint, M. Grunze</i>	

Micromachined Flame Analysers (Atomic Emission Flame Spectrometer (AES) Flame Ionization Detector (FID)).....	473
<i>S. Zimmermann, B. Ripenhusen, J. Müller</i>	

Integrated Chemical Analysis Systems for Gas Phase CW Agent Detection.....	477
<i>G. C. Frye-Mason, R.J. Kottenstette, E.J. Heller, C. M. Matzke, S.A. Casalnuovo, P.R. Lewis, R.P. Manginell, W. K. Schubert, V.M. Hietala, R.J. Shul</i>	

Authors index	483
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Subject index	489
----------------------------	-----