MICRO TOTAL ANALYSIS SYSTEMS '98

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edited by

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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

Day 2

Day 3

Day 4