

PREFACE

This volume contains an archival record of the NATO Advanced Study Institute on *Microfluidics Based Microsystems – Fundamentals and Applications* held in Çeşme-Izmir, Turkey, August 23–September 4, 2009. ASIs are intended to be high-level teaching activity in scientific and technical areas of current concern. In this volume, the reader may find interesting chapters and various microsystems fundamentals and applications.

As the world becomes increasingly concerned with terrorism, early on-spot detection of terrorist's weapons, particularly bio-weapons agents such as bacteria and viruses are extremely important. NATO Public Diplomacy division, Science for Peace and Security section support research, Advanced Study Institutes and workshops related to security. Keeping this policy of NATO in mind, we made such a proposal on Microsystems for security. We are very happy that leading experts agreed to come and lecture in this important NATO ASI.

We will see many examples that will show us Microfluidics usefulness for rapid diagnostics following a bioterrorism attack. For the applications in national security and anti-terrorism, microfluidic system technology must meet the challenges. To develop **microsystems** for security and to provide a comprehensive state-of-the-art assessment of the existing research and applications by treating the subject in considerable depth through lectures from eminent professionals in the field, through discussions and panel sessions are very beneficial for young scientists in the field.

Microfluidics are great tools for security and anti-terrorism with many applications. New and better diagnostic technology must be developed in order to be prepared for an act of bio-terrorism. The subject will be treated through lectures by experts on biosensors, microsystems, bio micro-electro-mechanical devices, and nanofluidics. To establish the objectives of this Institute, important lectures by prominent expert on the field are presented and are included in this volume of the Institute.

Basics of Electrokinetic Microfluidics, Lab-on-a-Chip Devices for Biomedical Applications, Microfluidic Biological Application Specific Integrated Circuits, Integrated Optofluidics and Nanofluidics, Cell Culture Revolution via Dynamical Microfluidic Controls, Fundamentals of droplet flow in microfluidics, Implementation of fluidic functions in digital microfluidics, Chip architecture and applications for digital microfluidics, Mixing in microfluidic systems are presented and discussed in detail. In addition more presentations such as Optofluidics – Fusing Nanofluidics and Nanophotonics, Programmable Matter – Micro and milliscale fluid dynamics of reconfigurable assembly for control of living systems, An Overview on Microfluidic

Platforms for Lab-on-a-Chip Applications, Centrifugal Microfluidics for Lab-on-a-Chip Applications are also given.

Transport of droplets and bubbles in microfluidic systems – from flow through a simple pipe to logic gates and automated chips for chemical processing, Analytical, Synthesis and Bio-Medical Applications of Microchip Technology, Hydrophoretic separation method for blood sample analysis, Magnetophoretic multiplexed immunoassays in a microchannel, programmable particle manipulation using lab-on-a-display are discussed in details with fundamentals and applications.

During the 10 working days of the Institute, the invited lecturers covered fundamentals and applications of Microsystems in various fields including the security.

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