

**SPECIAL ISSUE**  
**MEMBRANE COMPUTING**  
**PREFACE**

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The present volume contains a selection of papers presented and further elaborated during the “Workshop on Cellular Computing (Complexity Aspects)”, held in Seville University, Spain, from January 31 to February 2, 2005, as an Exploratory Workshop of European Science Foundation (ESF), Standing Committee for Physical and Engineering Sciences (PESC), which was part of the “Third Brainstorming Week on Membrane Computing”, which continued in the same place, from February 2 to February 5, 2005. The meetings were organized by the Research Group on Natural Computing (RGNC) from the Department of Computer Science and Artificial Intelligence of Seville University.

Membrane computing is a young area of natural computing, dealing with computability models inspired in the structure and functioning of living cells. Very shortly, the obtained models (called P systems) can be described as compartmentalized (distributed) devices, with multisets processed in parallel, especially by rewriting-like and communication rules. Most classes of P systems are computationally universal and, when additional possibilities are provided for producing working space (e.g., by membrane division), they are able to solve hard problems (typically, **NP**-complete problems) in a feasible time (polynomial, or even linear). There are many classes of P systems, making use of the large variety of features inspired in biology or mathematically motivated. A series of applications were recently reported, especially in biology and medicine, but also in computer graphics, cryptography, linguistics, management, etc. A comprehensive presentation of this research area (considered in 2003 by ISI as “fast emerging research front in computer science”) can be found in the monograph *Membrane Computing. An Introduction* (by Gh. Păun), Springer, Berlin, 2002, with a series of applications being reported in the collective volume *Applications of Membrane Computing* (edited by G. Ciobanu, Gh. Păun, M.J. Pérez-Jiménez), Springer, Berlin, 2005. Up-to-date

and complete information about membrane computing can be found at the Website <http://psystems.disco.unimib.it>.

The meetings from Seville were rather successful, both in what concerns the number of participants – more than 50, hence more than the last year – and, especially, in the intensity and efficiency of interaction, with many discussions and considerable joint work, with many papers continued or started during the meeting. These papers were collected in two preliminary volumes, both of them published soon after the meetings by Fenix Editora, Seville, and both of them available in the above mentioned web page.

A selection of these papers, both from the complexity workshop and from the brainstorming itself, continued after the meetings, further polished and additionally refereed, are included in the present volume. These papers cover a wide range of topics currently investigated in membrane computing, dealing both with theoretical aspects (mainly computing power and efficiency: the power of symport/antiport systems with a small number of membranes, the role of time and its influence on the behavior of P systems, relationships with brane calculi, the difference between the unary and the binary encoding of inputs in P systems solving decision problems, the possibility to formulate Gandy's principles in terms of membrane computing, etc.) and with applications (mainly in computer science and biology: simulating parallel architectures, dynamical systems developments for membrane computing, probabilistic P systems, with several bio-chemical processes analyzed in this framework, etc.). All of these papers have a provocative contents, by the results contained and by the research topics formulated.

As mentioned above, the meetings were organized by the Research Group on Natural Computing from Seville University (<http://www.gcn.us.es>) – and all the members of this group were involved in the organization. The ESF Exploratory Workshop was supported by ESF PESC (grant EW04–134), while the Brainstorming benefited from the support of the project TIC2002–04220–C03–01 of the Ministerio de Ciencia y Tecnología of Spain, of the Acción Coordinada IMUS 2003, and of the Research Group PAI TIC 193 of the Junta de Andalucía.

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