

Editorial

## Fourth Brainstorming Week on Membrane Computing

The present volume contains a selection of papers resulting from the Fourth Brainstorming Week on Membrane Computing (BWMC4), held in Sevilla, from January 30 to February 3, 2006. The meeting was organized by the Research Group on Natural Computing (RGNC) from the Department of Computer Science and Artificial Intelligence of Sevilla University. The previous editions of this series of meetings were organized in Tarragona (2003), and Sevilla (2004, 2005), and on those occasions special issues of *Natural Computing* (volume 2, number 3, 2003), *New Generation Computing* (volume 22, number 4, 2004), *Journal of Universal Computer Science* (volume 10, number 5, 2004), *Soft Computing* (volume 9, number 9, 2005), and the *International Journal of Foundations of Computer Science* (volume 17, number 1, 2006) were published.

Membrane computing is an area of natural computing which studies models of computation inspired by the structure and functioning of living cells, and the organization of cells into tissues and other structures. The resulting models (called P systems) are distributed parallel computing devices, processing multisets in compartments defined by membranes. Most classes of P systems are computationally universal and, if an exponential working space can be produced in polynomial time (e.g., by membrane division), then they are able to solve computationally hard problems in a feasible time. A series of applications were recently reported, especially in biology and medicine, but also in computer graphics, cryptography, linguistics, economics, approximate optimization, etc. Several simulation programs (useful in applications) are available by now. Comprehensive information about this research area (considered in 2003 by ISI as a “fast emerging research front in computer science”) can be found at the Website <http://psystems.disco.unimib.it>.

At this web address, one can also find the two volumes published in 2006 by Fenix Editora, Sevilla, containing *all* the papers resulting from BWMC4. As usual, the meeting was extremely successful, in both the number of participants – about 45 – and, especially, the efficiency of their interactions, with many discussions and considerable joint work resulting, with many papers either continued or initiated during the meeting.

For the present volume, we have selected only a few of these papers; they have been thoroughly reworked after the meeting and then they have gone through the standard refereeing procedure of the journal. Because of the scientific profile of TCS-C, we have chosen mainly theoretical papers. We believe that all the selected papers are significant contributions to the development of the field. The topics range from basic issues (such as the power of deterministic catalytic P systems, the power of multiset grammars and transducers) to specific topics (such as the degree of parallelism), new ideas (such as connections to quantum computing, and spiking neural P systems), and intriguing questions (such as that of the size of universal P systems). Of particular interest are the papers motivated by applications: solving systems of differential equations by means of procedures specific to membrane computing, or the study of molecular dynamics in the framework of membrane computing. Besides sound new results, all these papers contain stimulating ideas and generate important research questions for further investigations.

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