

Workshop on

# Membrane Computing

At the Crossroads of Cell Biology and Computation



WMC7

17 – 21 July 2006

Lorentz Center, Leiden



pre-proceedings of the

7<sup>th</sup> Workshop on  
**Membrane Computing**

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## Description and Aim

The basic function of biological membranes is to define compartments and to relate compartments to their environment, including neighboring compartments. Membranes allow certain molecules to pass through, e.g., waste products and nutrients. Also, membranes form a communication structure, allowing signals to be received or to be transmitted. The compartmentalization by membranes, with each area having its own set of molecules and reactions, with the transport of molecules and the communication through membranes, is the paradigm underlying membrane computing – see, e.g., [G. Păun, Membrane Computing, an Introduction, Natural Computing Series, Springer Verlag, 2002]. The original motivation behind membrane computing was not intended to model the functioning of biological membranes. Rather, the motivation was to explore the computational nature (potential) of various features of membranes – i.e., one investigates how such features can be used for the purpose of computing. To this aim, one abstracts from a number of principles underlying the functioning of biological membranes, and uses this abstraction to construct a novel model of computing. Information available at <http://psystems.disco.unimib.it/>

## Goals of the Workshop

We aim at getting a deeper insight into the above research topic. In particular that means to redirect some research in membrane computing into the realm of original biological motivation: the role and the functioning of biological membranes. We want to use the opportunity to strengthen the mutual feedback between biological, dynamical and computational research of basic life processes. In particular, the study of the qualitative behavior of these processes leads to fundamental questions in the theory of dynamical systems and probability theory, which can only be solved in close interaction with computational science.

## Local Organisers

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## Preface

The present volume contains the papers accompanying presentations at the **Seventh Workshop on Membrane Computing, WMC7**, organized in Leiden, The Netherlands, from 17 to 21 of July, 2006. The first three workshops were held in Curtea de Argeș, Romania – they took place in August 2000 (with the proceedings published in *Lecture Notes in Computer Science*, volume 2235), in August 2001 (with a selection of papers published as a special issue of *Fundamenta Informaticae*, volume 49, numbers 1–3, 2002), and in August 2002 (with the proceedings published in *Lecture Notes in Computer Science*, volume 2597). The next three workshops were organized in Tarragona, Spain, in July 2003, in Milan, Italy, in June 2004, and in Vienna, Austria, in July 2005, with the proceedings published as volumes 2933, 3365, and 3850, respectively, of *Lecture Notes in Computer Science*.

The papers included in this volume were refereed by two members of the program committee. Still, the volume should be considered as a working material; in the tradition of the previous workshops, it is expected that most of the papers will be further elaborated and improved according to the discussions which will take place during the meeting. This will be favored also by the way the workshop is organized this year, namely, with emphasis on interaction and interdisciplinarity (explicitly, the workshop has the subtitle “At the crossroads of Cell Biology and Computing”). Shortly after the workshop, a selection from these papers, additionally refereed, will be also published in a *Lecture Notes in Computer Science* volume.

As an indication of the healthy state of the domain, it is worth noting that both the number of papers and the total number of authors was bigger this year than last year, while also the number, the variety, and the intricacy of applications (in biology) are visibly increasing.

The workshop was organized by the Lorentz Center, Leiden, under the auspices of the European Molecular Computing Consortium (EMCC).

The program committee consisted of Matteo Cavaliere (Trento, Italy), Erzsebeth Csuhaj-Varjú (Budapest, Hungary), Marian Gheorghe (Sheffield, UK), Hendrik Jan Hoogeboom (Leiden, The Netherlands – Co-chair), Oscar H. Ibarra (Santa Barbara, USA), Natasha Jonoska (Tampa, Florida), Shanhara Narayanan Krishna (Bombay, India), Gheorghe Păun (Bucharest, Romania, and Sevilla, Spain – Co-chair), Mario J. Pérez-Jiménez (Sevilla, Spain), and Claudio Zandron (Milano, Italy).

The editors are indebted to the members of the program committee (for a real *tour de force* in reading the papers in a short time), to the authors of the papers, and in particular to Marloes van der Nat at the Leiden Institute of Advanced Computer Science, and Gerda Filippo at the Lorenz Center, for their efficiency in organizing the workshop and making possible the timely publication of this volume.

June 2006

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Gregorz Rozenberg



## Lorentz Center

The Lorentz Center is an international center aiming to coordinate and host workshops in the sciences, based on the philosophy that science thrives on personal interaction between creative researchers. Lorentz Center workshops focus on new collaborations and interactions between scientists from different countries and fields, and with varying seniority.

In order to allow both junior and senior researchers to catch up with the rapid international developments and to establish new contacts and collaboration. Lorentz Center workshops bring together groups of 20 to 50 junior and senior researchers, usually for a period of one to two weeks in a stimulating environment with working space for all participants: offices with desks, personal computer and white boards, as well as meeting rooms. A combination of informal talks, working sessions, tutorials and discussions enables participants to assess the status of a field and its future, to collaborate, establish new international contacts, and to spot upcoming talent. The Lorentz Center actively promotes public awareness of science and is open to workshops addressing this issue.

The Lorentz Center is located in Leiden University's J.H. Oort Building which also hosts the Instituut-Lorentz for theoretical physics, the Kamerlingh Onnes Laboratory and the Leiden Observatory. The Mathematics and Chemistry Departments and the Leiden Institute of Advanced Computer Science are located in adjacent buildings. All Dutch universities and research institutes can easily be reached by public transport; the universities in Amsterdam, Utrecht, Delft and Rotterdam can be reached by train within an hour. The train ride from Amsterdam/Schiphol International Airport to Leiden takes only 15 minutes.

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<http://www.lorentzcenter.nl>



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