The Spanish Network on Biomolecular and Biocellular Computing: Bio-inspired Natural Computing in Spain

by Mario de Jesús Pérez Jiménez, Alfonso Ortega de la Puente and José M. Sempere

The Spanish Network on Biomolecular and Biocellular Computing (Redbiocom) is a consortium of seven Spanish research groups whose research activities focus on the bio-inspired approach to Natural Computing. The Network was founded in 2009 and it was funded by the Spanish Ministry of Science and Innovation under the Complementary Action TIN2008-04487-E/TIN.

Redbiocom is composed of the Bio-inspired Computing and Complex Systems group at Autonoma University of Madrid (UAM), the Computational Biology and Bioinformatics Group at Balearic Islands University (UIB), the Decision Modelling, Computation and Simulation group at University of Lleida (Ull), the Natural Computing group at Polytechnic University of Madrid (UPM-I), Laboratorio de Inteligencia Artificial (LIA) at Universidad Politécnica de Madrid (UPM-II), the Computation Models and Formal Languages group at Polytechnic University of Valencia (UPV), and the Natural Computing group at University of Seville (USe).

The main research areas of Redbiocom are Membrane Computing and P Systems, Networks of Bio-inspired Processors, DNA computing and Synthetic Biology, Computational Biology and Bioinformatics.

Current research projects of the consortium in these areas are:
• the "Alignment of metabolic networks modelled as Petri nets and P-systems" (UIB), where researchers try to generalize the comparison algorithms developed for Petri nets to P-systems, exploiting the relationship between both models
• the construction of a simple computer, using bacteria rather than silicon (UPM-II) in the European Project BACTOCOM
• the simulation of biological processes and design of biomolecular information processing devices (UPM-II)
• the development of a complete platform for natural computation software, its application to concrete linguistic problems, and the proposal of techniques in the field of evolutionary computation which will hybrid different disciplines (evolutionary computation, formal languages, data struc-

tures in the theory of algebraic complexity, automatic learning) and makes it possible to provide automatic (genetic) programming tools for natural computation (UAM)
• The full development of a computational model based on bio-inspired operations over strings organized as a
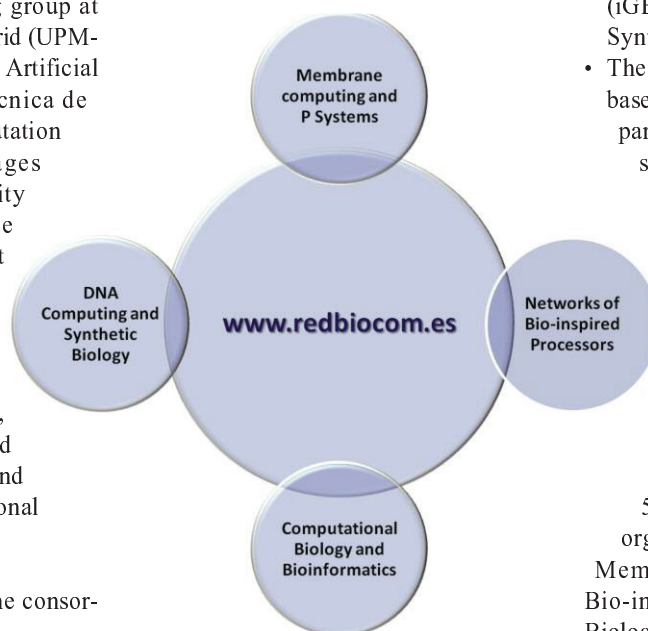

Figure 1: main research areas of Redbiocom.

network of bio-inspired processors (UAM, UPM-I and UPV)
• The development of a multi-compartmental, stochastic and discrete modelling framework based on P systems for the study of systems biology models ranging from bacterial colonies to ecosystems (USe). From a synthetic biology perspective this project aims at developing models of synthetic gene regulatory networks inducing desirable phenotypes in multicellular bacterial systems. These models are used as blue-prints to assess the viability of the different possible designs prior to their implementation in the wet lab
• A systems and synthetic biology approach to the modelling and implementation of biological systems with

prefixed behaviour (USe and Prof. Gheorghe Paun, initiator of the Membrane Computing discipline). Researchers associated with this project participate as instructors in the team that represents the University of Seville in the International Genetically Engineered Machines competition (iGEM), the premiere undergraduate Synthetic Biology competition
• The production of a simulation tool, based on the Membrane Computing paradigm, that helps the experts to study different ecological systems (Ull).

Currently, the joint efforts of the research groups in the network have been oriented to organize the First International School on Biomolecular and Biocellular Computing (ISBBC) which will be held in Osuna (Spain) from September 5th to 7th, 2011. The school will be organized in three different topics: Membrane Computing, Networks of Bio-inspired Processors and Synthetic Biology and DNA computing.

Links:
http://www.redbiocom.es
http://www.p-lingua.org/wiki/index.php/Main_Page
First International School on Biomolecular and Biocellular Computing
http://www.redbiocom.es/ISBBC/ISBBC11

Please contact:
Mario de Jesús Pérez Jiménez
University of Seville, Spain
E-mail: marper@us.es

Alfonso Ortega de la Puente
Autonoma University of Madrid
E-mail: alfonso.ortega@uam.es

José M. Sempere
Polytechnic University of Valencia / SpaRCIM, Spain
E-mail: jsempere@dsic.upv.es