



## Coordination of Biological and Chemical IT Research Activities

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## Project Publications – Year 2

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## 1. Special issue of *BioSystems*

The First Annual COBRA Workshop on BioChemIT resulted in a special issue of the Elsevier journal, *BioSystems* (Vol. 109, No. 1, pages 1-86 (July 2012)) . This is available at <http://www.sciencedirect.com/science/journal/03032647/109/1>, and was co-edited by Amos and Dittrich. It contains eight original scientific papers, covering both computational and experimental aspects of bio/chemIT. We reproduce here the editorial:

“This special issue contains papers arising from the First COBRA Workshop on Biological and Chemical Information Technologies (BioChemIT), which was held as part of the European Conference on Artificial Life (ECAL), Paris, 2011. COBRA is a coordination action, funded by the European Commission Future and Emerging Technologies (FET) programme.

*“Traditional information technology (IT) relies on human-engineered solutions implemented on a siliconbased substrate. Although powerful in terms of raw processing capabilities, modern computers lack the adaptability, resilience and flexibility of natural systems. Even the simplest organisms are capable of reconfiguring their internal architectures in response to combinations of external signals and internal “programming”; a process that is inherently bio-chemical in nature. The field of biological and chemical information technologies (bio/chem IT) seeks to harness the capabilities of natural and chemical systems. Rather than simply deriving inspiration from living systems, bio/chem IT researchers seek to directly use or construct these systems for the purposes of engineering and computation.”*

We received twelve submissions, of which we accepted eight. In terms of content, the papers are divided equally between laboratory implementations and computational investigations, so we naturally partition the issue (acknowledging, of course, that laboratory work is often informed by computation, and vice versa).

The first paper, by McCaskill, *et al.*, describes a route to complex programmable chemistry, via an approach that hybridizes self-constructing chemical systems with electronic computation. The paper of Zauner *et al.* also focuses on chemical computation, this time from the perspective of reaction media in microfluidics. Stano *et al.* describe semi-synthetic minimal cells capable of communicating with living organisms, and Chaplin *et al.* close the experimental section with a description of their work on implementing Boolean logic using photochromic molecules.

The computational section opens with Goni Moreno and Amos' discussion of representation and measurement issues in engineered gene circuits. Kharma *et al.* then describe their design for a single-input delay flip-flop in *E. coli*. Holley *et al.* show how Boolean logic circuits may be implemented in an excitable chemical medium, before we close the issue with Manca and Marchetti's consideration of how the dynamical inverse problem may be solved using metabolic P systems.

We thank the European Commission for supporting the COBRA project, the ECAL organizers for accommodating the workshop, the anonymous reviewers and the BioChemIT participants. The next COBRA BioChemIT workshop will be held as part of Unconventional Computation and Natural Computation, September 6 2012, Orleans, France.”

## **2. Special issue of the MIT Press journal *Artificial Life***

Papers from the Second COBRA Workshop, D3.3, are currently being submitted and reviewed for a special issue of the MIT Press journal *Artificial Life*.