MICREAgents September Workshop

Don Orione Artigianelli and ECLT Venice, September 7-9, 2014

1. Programme

Time	Day 1 - Sunday, September 7, 2014 Location: Meeting room at Don Orione Artigianelli - Canova room (ground floor)
17:00-17:30 **17:30-18:00** **18:00-19:30**	Lablet Design & Fab: Current Overall Status McCaskill (30 min) Discussion: Project Status, Options, Problems: All (30 min) Work on joint papers, in small groups (90 min)
20:00	**Common Dinner organised by ECLT staff**

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Time	Day 2 - Monday, September 8, 2014 Location: ECLT
9:00-10:20	**Lablet Sensors, Power and Coatings** *Lablet sensors,* **WP5, 1** Cronin (40 min) *Sensor, sponges, gels & amplification,* **WP3, 1** Willner (40 min)
10:20-11:00	**Reversible lablet docking & self-assembly** *Switchable DNA surface docking,* **WP2** Herrmann (40 min)
11:00-11:20	**Coffee Break**
11:20-12:45	**Lablet & Dock Design & Fab** *Lablet & Dock CMOS: Design, Tests, Next* **WP6, 7** Mayr, Funke (40 min) *Chargeable Lablets,* **WP6** Wagler (30 min) *Dock & lablets: Integration, Interface, Software* **WP6, 7** Maeke (15 min)
12:45-13:30	**Lunch at ECLT**
13:30-14:10	**Applications: Synthesis, delivery, biodocking** *Lablets and programmed delivery & uptake,* **WP9** Stepanek (40 min)
14:10-14:50	**Lablet cloning and amplification** *Lablet SPREAD & DNA amplification,* **WP4** Sorge (20 min) **Lablet evolution/optimisation** *Evolvable lablet patterning schemes for self-assembly,* **WP6, 2** Packard (20 min)
14:50-15:10	**Coffee Break**
15:10-17:30	Discussion and Coordination of Joint Papers
TBD	General Council Meeting (Others time to discuss in small groups OR GC meeting after dinner)
19:00	**Common Dinner organised by ECLT staff**

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Time	Day 3 - Tuesday, September 9, 2014 Location: ECLT
9:00-10:00	**Lablet coding and computation** *Computational model of lablet processing,* **WP10** Rasmussen, McCaskill, Wills, Tangen (60 min)
10:00-10:40	**Report on joint publications** All (40 min)
10:40-11:00	**Coffee Break**
11:00-13:00	**Planning Session**: Planning of future experiments & future work on publications (60 min) Internal deliverables, joint experiments, exchanges **Plenum** (60 min)
13:00-13:50	**Lunch at ECLT**
13:50-15:20	**Plenum**: Major deliverables period 2 and review meeting preparation (30 min) Closing Discussion of Main Scientific Targets in Second Period (30 min) Planning of upcoming meetings and ECLT activities (15 min) Web Site and Dissemination Planning (15 min)
15:20-16:00	Work on collaborations & joint papers (40 min)
16:00	**Coffee Break**
	Discussion and departures

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2. Abstract

Microscale Chemically Reactive Electronic Agents

The goal of the project is to give electronics and chemistry an equal autonomous say in programming complex chemical constructions, processes and analyses at the nano and microscales: the same scale where information processing in living systems occurs – where "to construct is to compute". To do this ***MICREAgents*** (***MI***croscopic ***C***hemically ***R***eactive ***E***lectronic ***Agents***) will develop novel electronically active microreactor components, called lablets, that self-assemble at a scale less than 100 µm, approaching that of living cells. The project will integrate the necessary components to ensure autonomous action of millions of these "very smart chemicals", including electronic logic, supercapacitors for power, pairwise coupling for communication, programmable chemical sensors and electronic actuation of chemical processing. Key examples of MICREAgents actuation are to reversibly switch their association, load or dose chemicals, modify surfaces, initiate reactions and control locomotion in complex chemical environments. MICREAgents lablets can join forces to communicate both chemicals and electronic information in order to solve complex tasks, acting as smart collective agents of chemical change. Like cells, they will be essentially genetically encoded, but with chemical and electronic memories, translating electronic signals into constructive chemical processing and recording the results of this processing. They will also reversibly employ DNA molecules as chemical information, for example to control surface-surface binding of lablets, or to program chemical sensors, not to synthesize proteins as in cells. The project builds on pioneering FET-funded work towards electronic chemical cells, taking a giant stride to cell-like microscopic autonomous chemical electronics with self-assembling electronic membranes controlling the entry and exit of chemicals.

These autonomous mobile smart reactors will provide a novel form of computation that microscopically links reaction processing and chemical construction with computation, providing a radical integration of autonomous chemical experimentation. The self-assembling smart micro reactors can be programmed for molecular amplification and other chemical processing pathways, that start from complex mixtures, concentrate and purify chemicals, perform reactions in programmed cascades, sense completion, and transport and release products to defined locations. The project defines a continuous achievable path towards this ambitious goal, making use of a novel pairwise local communication strategy to overcome the limitations of current smart dust and autonomous sensor network communication. It will provide a technical platform spawning research in new computing paradigms that integrate multilevel construction with electronic ICT. The 10 groups, from 8 countries including Israel and New Zealand, are all pioneers in the multidisciplinary areas required to achieve the project goals, with a common grounding in IT.

3. Participants

Ruhr-Universität Bochum (RUB)

***RUB-BioMIP*:**
John McCaskill
Thomas Maeke
Uwe Tangen
Patrick Wagler

RUB-BioOrg
Günter von Kiedrowski
(*part. available via Skype?*)
Berit Sorge

RUB-AIS
Dominic Funke
Pierre Mayr

Hebrew University of Jerusalem (HUJI)
Itamar Willner

Rijksuniversiteit Groningen (RUG)
Andreas Herrmann
Jennifer Gerasimov

University of Glasgow (UOG)
Lee Cronin
Ommid Anamimoghadam

Syddansk Universitet (SDU)
Steen Rasmussen

Institute of Chemical Technology Prague (VSCHT)
Frantisek Stepanek
Ales Zadrazil

European Center for Living Technology (ECLT)
Norman Packard

University of Auckland (UOA)
Peter Wills
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