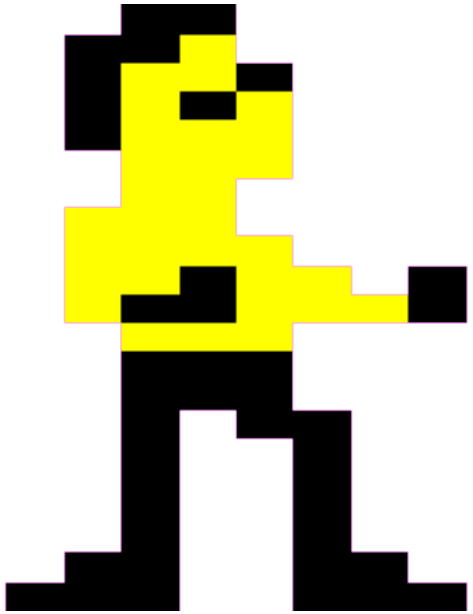
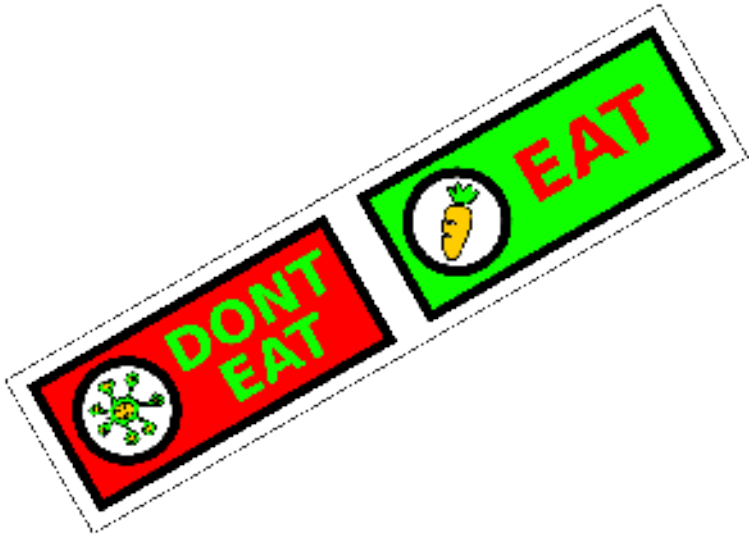
HACKTERIA.ORG

Open Source Biological Art, DIY Biology, Generic Lab Equipment





BioHacking and Open Source Biological Art

vs. BioCyberKidzz and wetPONG

Dr. Marc R. Dusseiller aka dusjagr

www.dusseiller.ch/labs

Schweizerische Gesellschaft für Mechatronische Kunst

SGMK

HACKTERIA.ORG

n|w Fachhochschule Nordwestschweiz

GALERIJA KAPELICA
KERSNIKOVA 4, LJUBLJANA

Acknowledements

Yashas Shetty, Srishti, Bangalore, Andy Gracie, Gijon, hackteria

Sachiko Hirosue, Spela Petric, Brain Degger, Mac Cowell et al

Stefan Doepner, Bostjan Leškovsek, Kapelica Gallery, Ljubljana

HONF, House of Natural Fiber, Yogyakarta

Markus Haselbach, Urs Gaudenz, Tobias Hoffmann und alle Mechatroniker

René Bauer, GameDesign, ZhdK

Gabor Csucs, Martin Willeke, Marcus Textor, ETH Zürich

Funding by: Migros Kulturprozent, BAK, Pro Helvetia, Stadt Zürich, FHNW, EPFL, Autodesk, Atelier Nord and more...

Acknowledements

Nur Akbar Arrofattulah, Agus Tri Budiarto, Dr. Irfan Dwidya Prijambada (UGM)

HackteriaLab 2011 – Visit from Togar, Akbar and many more // dusjagr visits Yogya

The Art of Fermentation, Oechslemeters and tropical Agriculture

Šmall is Beautiful

"Any intelligent fool can make things bigger, more complex, and more violent. It take a touch of genius -- and a lot of courage -- to move in the opposite direction."

E. F. Schumacher, *Small is Beautiful: A Study of Economics As If People Mattered (1973)*

German economist, Buddhist & environmentalist (1911 - 1977)

NanoŠmano in Yogya?

NanoŠmano – LifeSeason, LifeSystems, LifeForms // Slovenia 2012

Stefan Doepner, Marc Dusseiller, Bostjan Leškovsek, Kapelica

House of Natural Fiber – Yogyakarta

Haemocytometer – PS3 Eye Hacks

Collaboration with House of Natural Fiber and UGM, Yogyakarta

“Education is an admirable thing, but it is well to remember from time to time that nothing that is worth knowing can be taught.”

Oscar Wilde, *“The Critic as Artist”, 1890*
Irish dramatist, novelist, & poet (1854 - 1900)

Education and Outreach

I hear and I forget
I see and I remember
I do and I understand

Confucius

“Creativity is becoming more important than knowledge.
Knowledge is distributed on the Internet where anyone can find it.”

James Gimzewski

“As the circle of light [scientific knowledge] increases,
the circumference of darkness also increases.”

Albert Einstein

How can I teach creativity? Is there an intuitive understanding of Nanosystems?
Whats the benefit of transdisciplinary projects? How can scientists learn to talk?

Fields of Activity

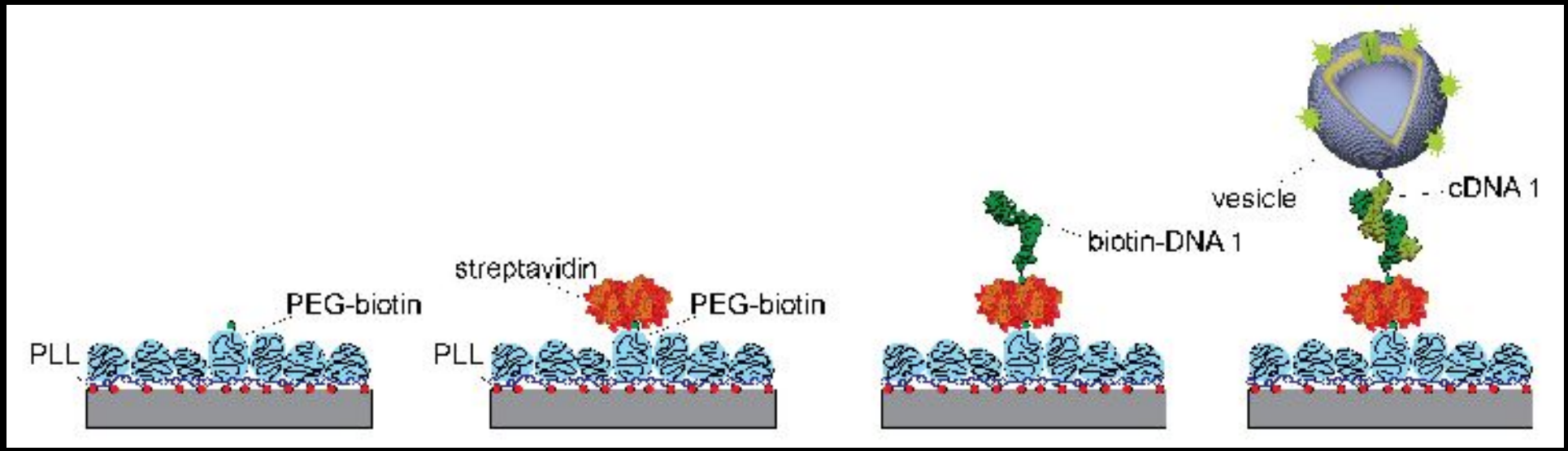
dusjagr labs – transdisciplinary Scholar and Artist

http://www.dusseiller.ch/labs/

- SGMK | MechArtLab, diy* festival
  - http://www.mechatronicart.ch/
- Hackteria | Open Source Biological Art
  - http://hackteria.org
- PlayAround 2010 - Taipei | DIWO Culture
  - http://2010.playaround.cc
- Dock18 | Raum für Medienkultur
  - http://www.dock18.ch/
- FHNW, HLS | wetPONG - Hybrid Games, Micro- and Nanotechnology and Life Sciences
  - http://wetpong.net
- ZHdK | SlowGames
- ETH Zürich | Traditional Materials

First Transdisciplinary Experiences bridging Material Science and Biology

The NanoBioInterface

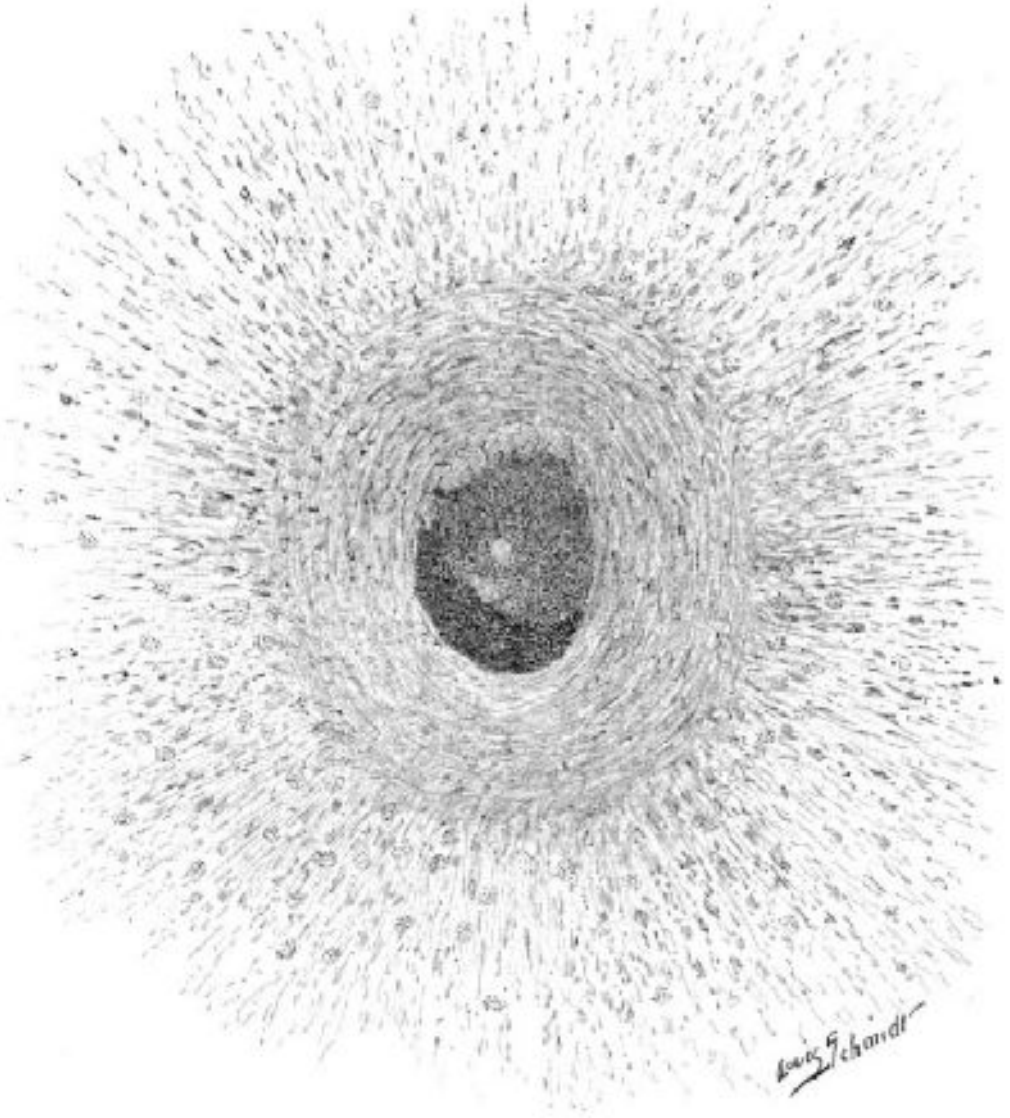


Laboratory for Surface Science and Technology, ETHZ
Janos Vörös, Marcus Textor, Viola Vogel, Nic Spencer

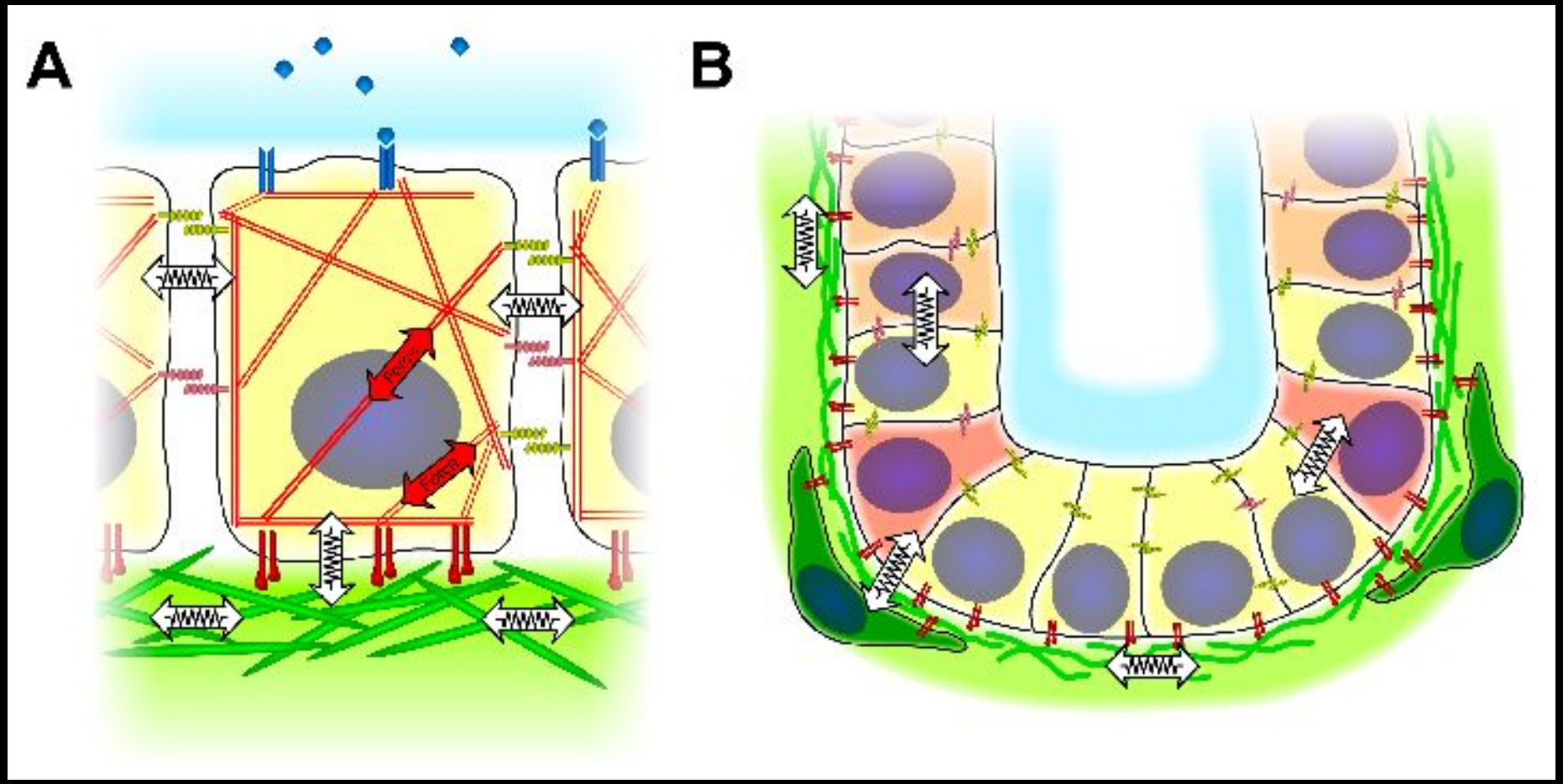
ON THE PERMANENT LIFE OF TISSUES OUTSIDE OF THE ORGANISM.*

By ALEXIS CARREL, M.D.

(From the Laboratories of The Rockefeller Institute for Medical Research, New York.)



µ3D Cellular Environments



Microfabricated three-dimensional environments for single cell studies

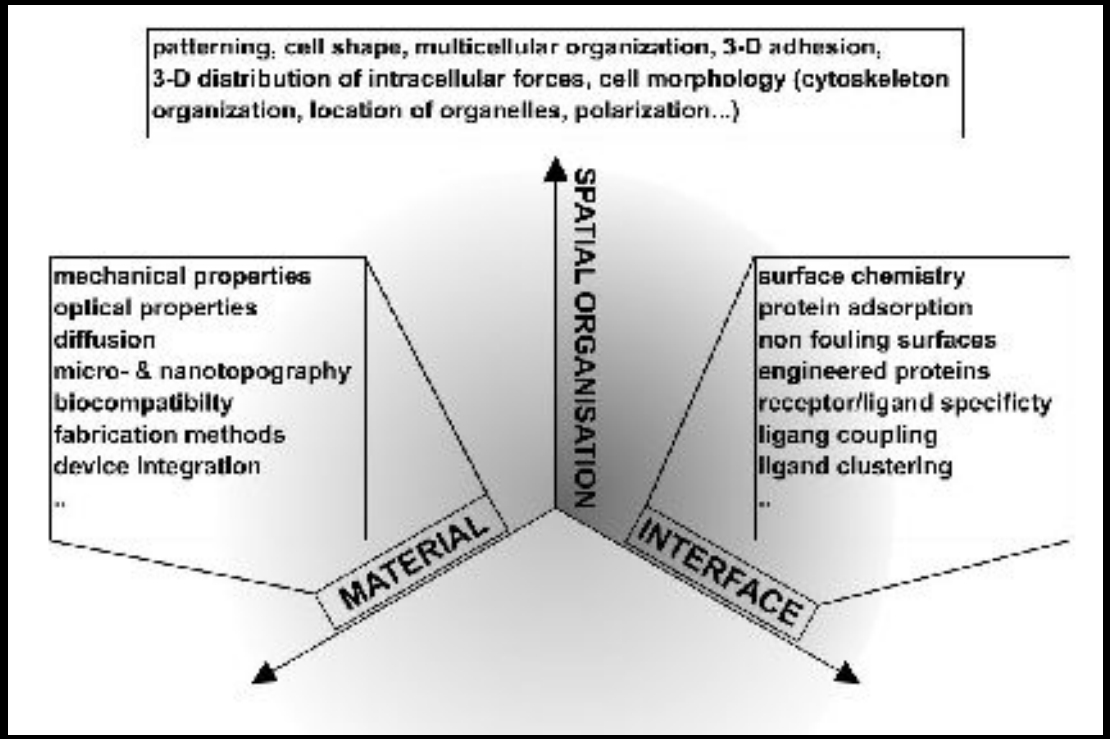
Marc Dusseiller, Michael Smith, Viola Vogel, and Marcus Textor

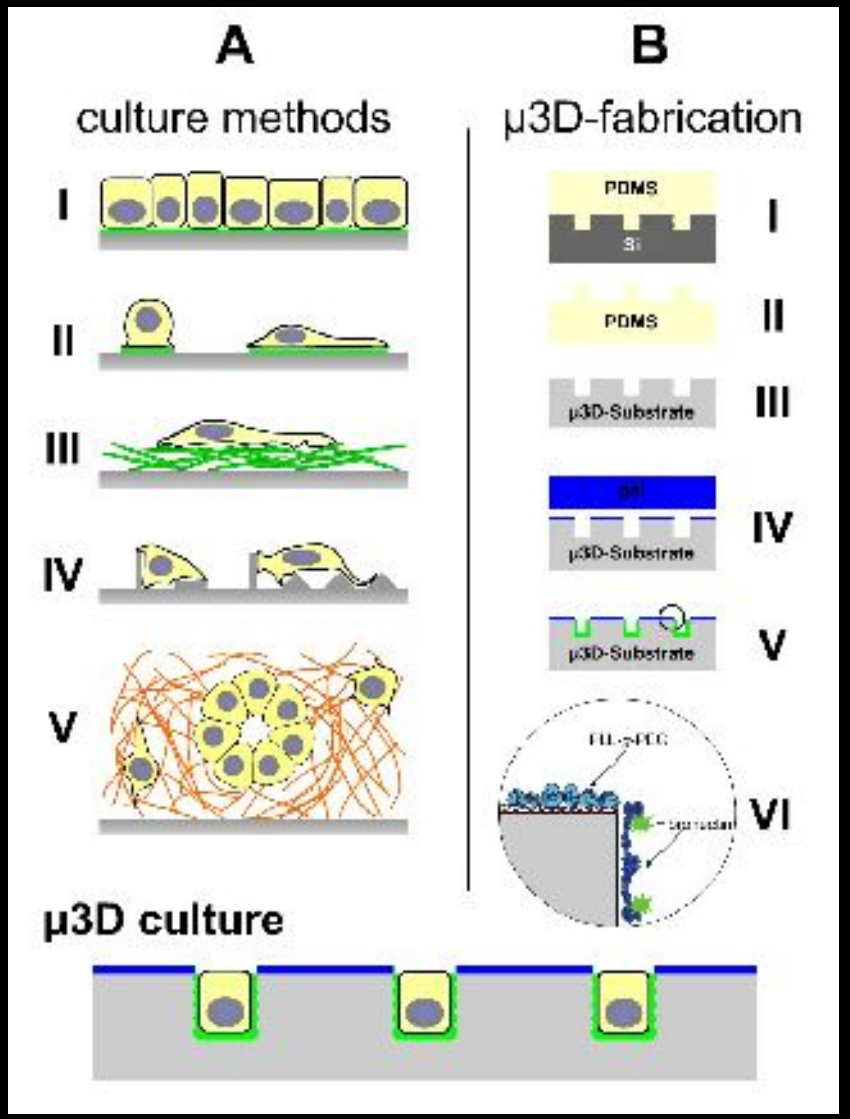
Design of Cellular Patterns 2D

HeLa Cells on patterned substrate, 20 hours timelapse

Alexa Kiss, Gabor Csucs, ETHZ

µ3D Cellular Environments

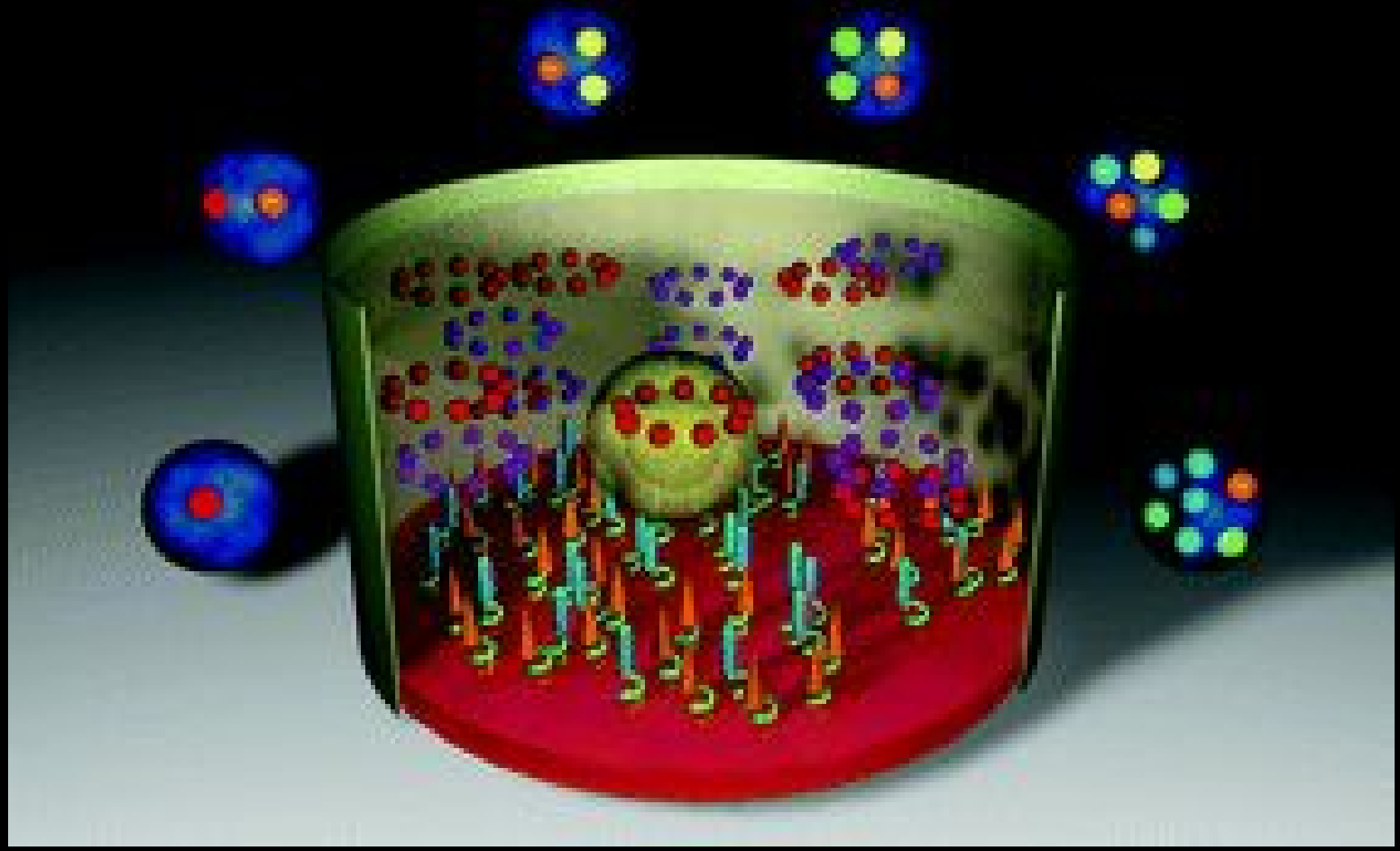




Microfabricated three-dimensional environments for single cell studies

Marc Dusseiller, Michael Smith, Viola Vogel, and Marcus Textor

Meanwhile...



Perturbation of single hematopoietic stem cell fates in artificial niches

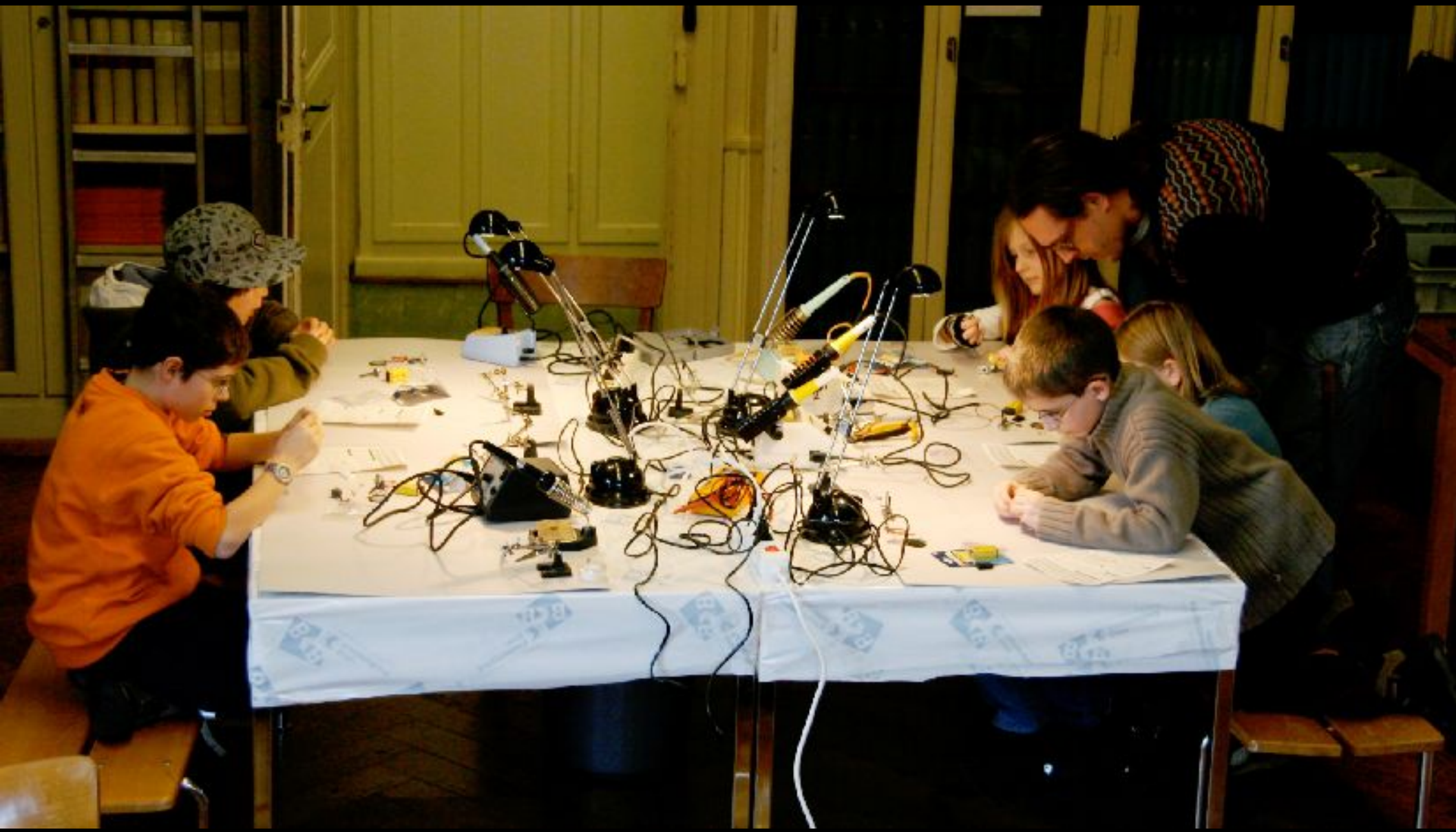
M. Lutolf et al, Integrative Biology 2009

On Teaching
to Kids, Geeks and Artists

Workshops for Artists, Kids and Geeks

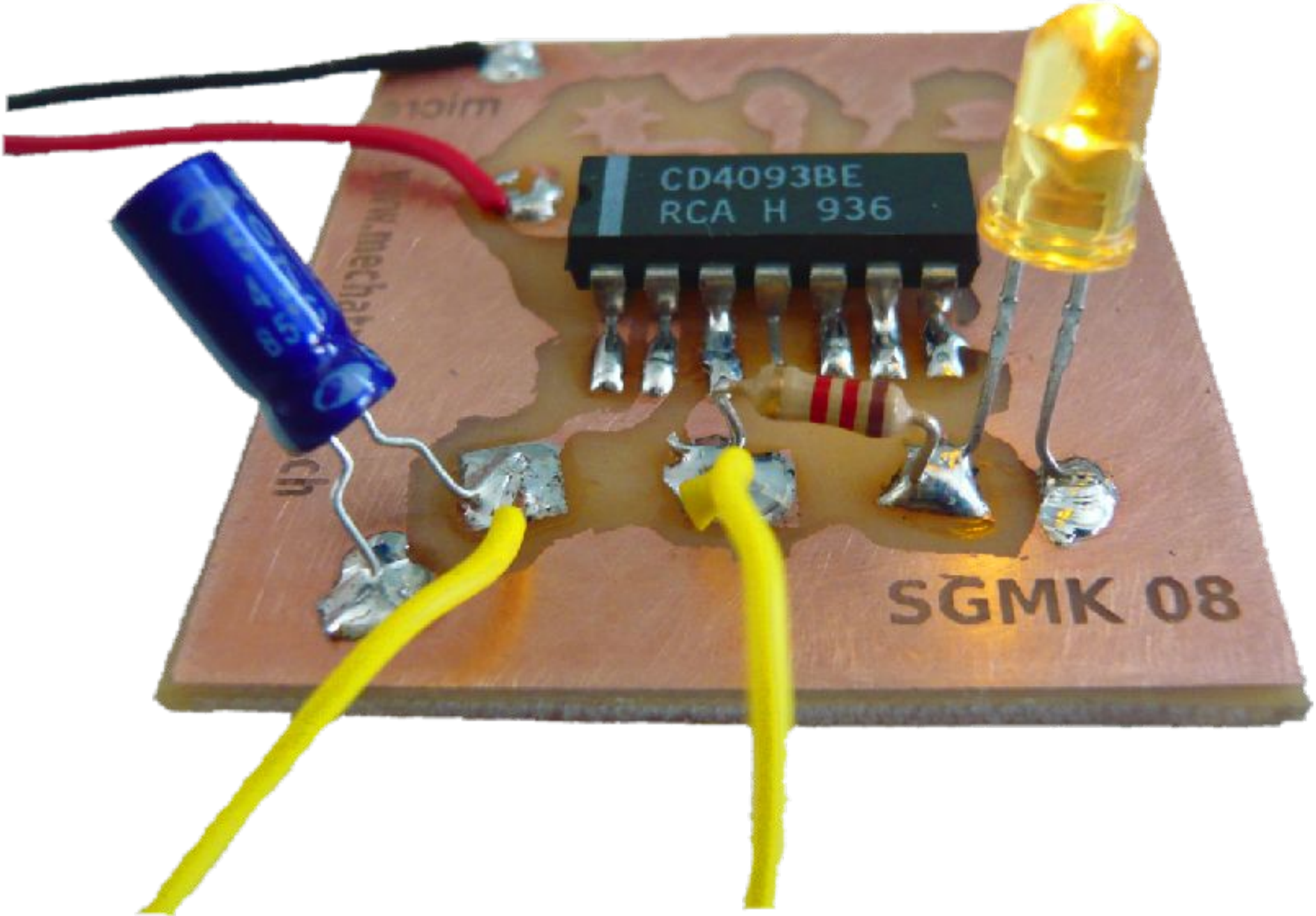
SMAS Swiss Mechatronic Art Society
SSAM Société Suisse d'Art Méchatronique
SGMK Schweizerische Gesellschaft für Mechatronische Kunst
www.mechatronicart.ch

Skematic
BS2



MechArtLab

SGMK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Hackteria
Open Source Biological Art

HACKTERIA.ORG

Open Source Biological Art, DIY Biology, Generic Lab Equipment

Hackteria is a community based platform and information portal for the open sharing of knowledge, instructions, critical reflections and theoretical articles about open source art project dealing with biology | lifescience | biotechnology

http://hackteria.org

Hackteria is a collection of Open Source Biological Art Projects instigated in February 2009 by Andy Gracie, Marc Dusseiller and Yashas Shetty, after collaboration during the Interactivos?09 Garage Science at Medialab Prado in Madrid. The aim of the project is to develop a rich web resource for people interested in or developing projects that involve DIY bioart, open source software and electronic experimentation. As a community platform hackteria tries to encourage the collaboration of scientists, hackers and artists to combine their experitise, write critical and theoretical reflections, share simple instructions to work with lifescience technologies and cooperate on the organization of workshops, festival and meetings. The hackteria project is supported by: Bundesamt für Kultur, Migros Kulturprozent, Sir Ratan Tata Trust and Shristi.

To summarise, Hackteria is:

* An open source 'make' resource for protocols, processes, tools, techniques and information for 'bio'-art and 'bio'-artists
* A group of artists and scientists who organise and hold workshops, presentations and discussion forums based on these resources
* A platform for the development and dissemination of knowledge related to DIY and open source hardware, software and wetware techniques for artists and researchers.

CC BY NC

What is a hack?

Originally:
„A quick job that produces what is needed, but not well.“

1950s:
Amateur radio enthusiasts defined the term hacking as creatively tinkering to improve performance.

Today:
"A clever solution to a problem."

„An appropriate application of ingenuity.“

Hacker's Jargon

For a short introduction the following movie gives a nice overview of the hackteria project:
http://vimeo.com/18052500

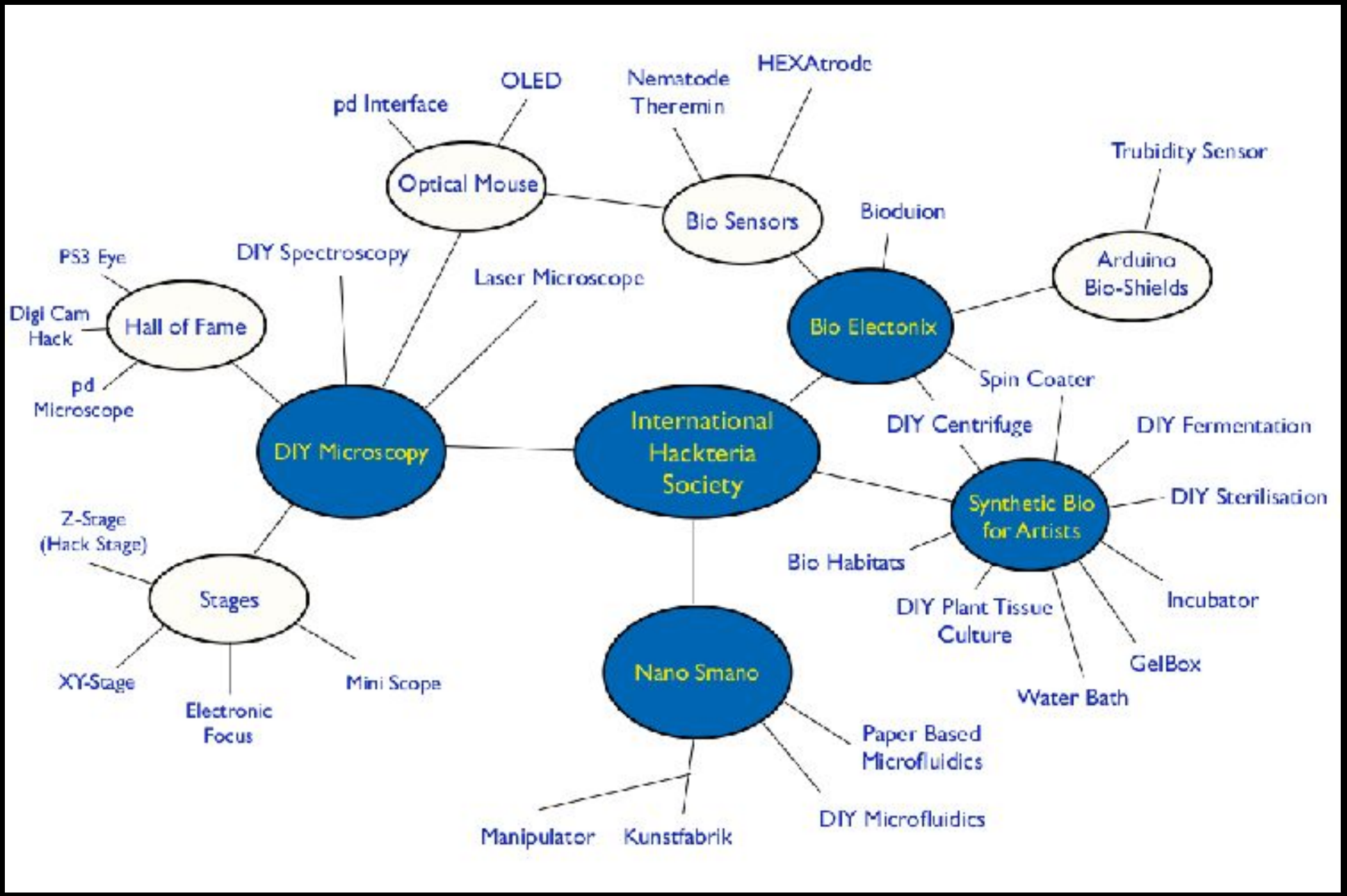
HACKTERIA.ORG

Open Source Biological Art, DIY Biology, Generic Lab Equipment

In the last 3 years, since the founding of hackteria, we have been actively searching for collaborators, who share the same enthusiasm of sharing and developing techniques to work artistically with living systems and turn this knowledge into instructions and workshops, accessible to the amateur scientist/artist/hacker. Some important and fruitful collaborations are mentioned here.

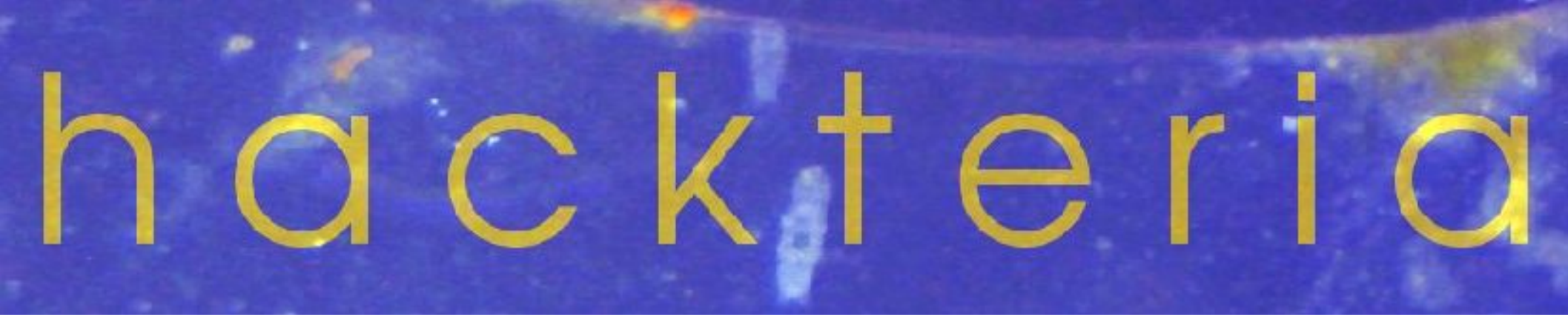
Collaborators
The House of Natural Fiber, Yogyakarta, Indonesia
Georg Tremmel, Bioprescence, Japan/Austria
Antony Hall, Owlproject, UK
Stefan Doepner, F18institue, Slowenia/Germany
Alejo Duque, Switzerland/Columbia
Mac Cowell, DIYbio Boston, USA
Urs Gaudenz, SGMK & HSLU, Switzerland
Spela Petric & Maja Smrekar, Kapelica Gallery, K6/4, Slowenia
Brian Degger, Transitlab, Newcastle
Sachiko Hirosue, EPFL
And many more...

Overview of Projects



Background: Interactivos?'09

MEDIALAB PRADO



Open Source Biological Art

Marc Dusseiller
Scientist / Lecturer / Artist

BioInterfaces (ETH)
Micro/Nanotechnology (FHNW)
Tissue engineering

Cultural facilitator (dock18, diy*)
DIY electronics (SGMK)
Experimental music

www.dusseiller.ch/labs
www.mechatronicart.ch

Yashas Shetty
Artist / Scholar / Musician

Media Art (CEMA)
Art|Sci (NCBS)

Programmer
Data sonification
Tissue engineering
Synthetic biology
Experimental music

www.thedepartment.in
www.cema.srishti.edu.in

Andy Gracie
Artist

Art|Sci

Installations
Robotics
Biology
Artificial life
Hybrid symbiosis

www.hostprods.net

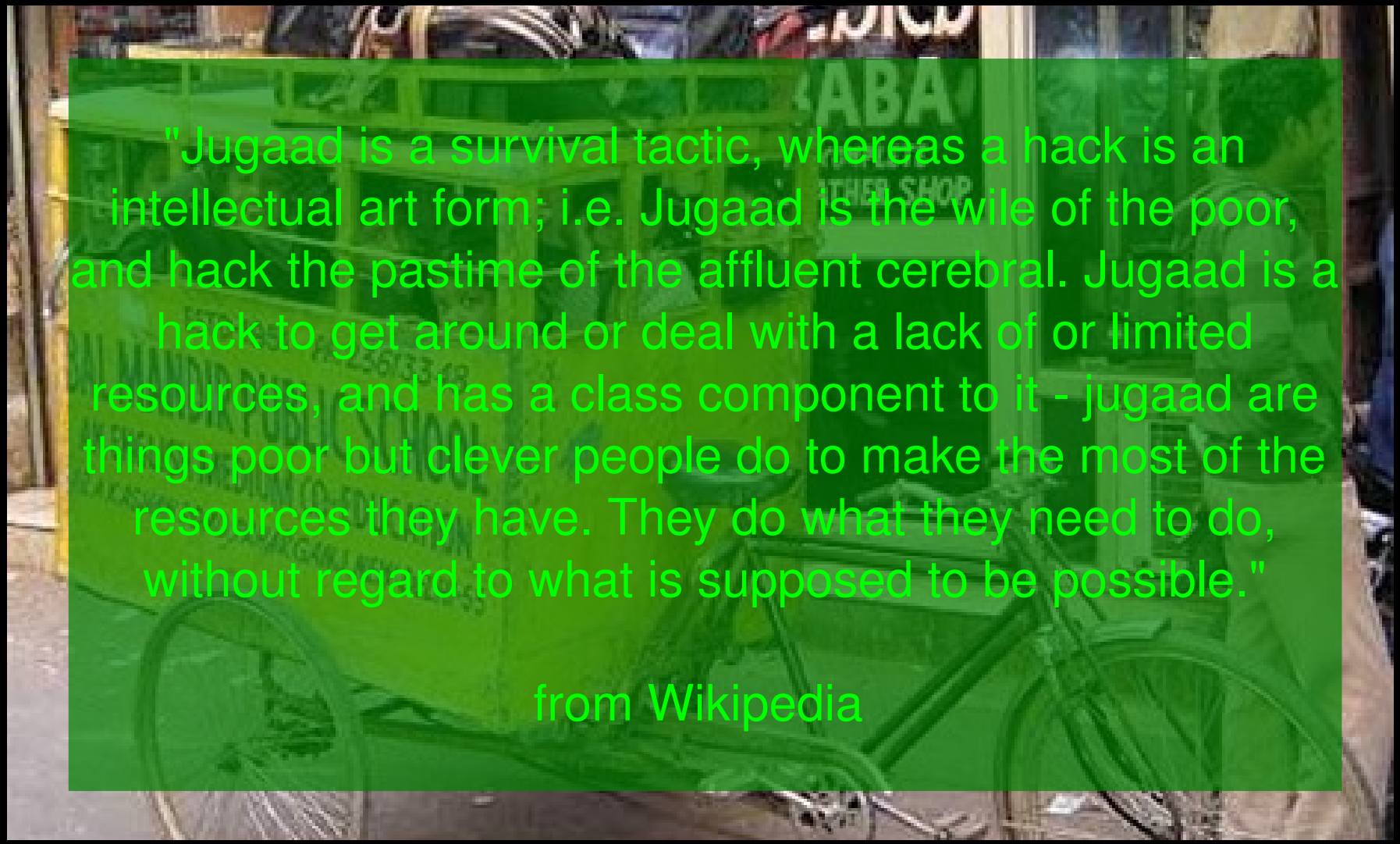
Yashas Shetty, CEMA – Bangalore

Why should artists/designers/outsiders get involved with Synth-Bio(in particular) and Sci-Tech(in General)

"There is the obvious reasons that all outsiders bring in unique perspectives to any form of thinking-the artist/hacker has the courage to ask "stupid questions" which may not turn out to be stupid at all. the other is that the hacker/artist/designer may also come from spaces in which the technology is as important as the different contexts that it exists in -cultural/social/political which because a scientist(at least the way in which most of them are trained) may not be aware of or not be interested in."

Jugaad

Hack vs. Jugaad



From Jugaad to Systematic Innovation

ArtScience Bangalore | IGEM

IGEM 2009 // 2010 // 2011 // Biomod 2011

Yashas Shetty (IN), Mukund Thatai (IN) and Srishi Students

HackteriaLab 2010

Dock18, Zürich, April 2010

4 Days

HackteriaLab 2011 – The Retrat

L'Arc, Romainmôtier, August 2011

7 Days

Jugaad PCR Thermocycler

Cheap PCR thermocycler from hacked hairdryer // in progress...

Bengt Sjolen (SE), Mac Cowell (US), Sachiko Hirosue (JP/CH)

HackteriaLab 2011 – The Reflection

Walcheturm, Zürich, August 2011

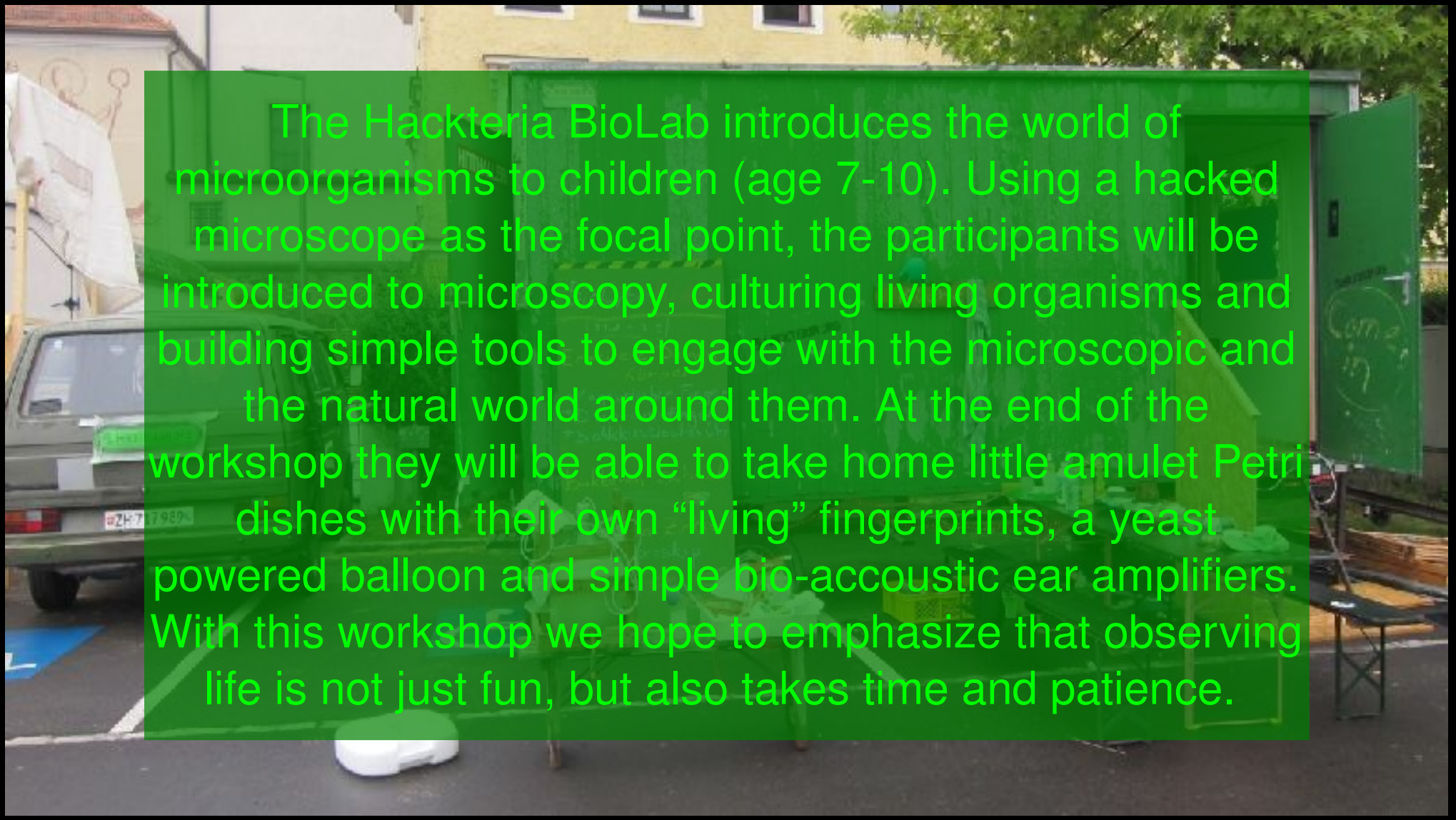
3 Days

Education at the Art/Sci Interface

Ear on Arm, ongoing project

Stelarc

BioCyberKidzz



The Hackteria BioLab introduces the world of microorganisms to children (age 7-10). Using a hacked microscope as the focal point, the participants will be introduced to microscopy, culturing living organisms and building simple tools to engage with the microscopic and the natural world around them. At the end of the workshop they will be able to take home little amulet Petri dishes with their own “living” fingerprints, a yeast powered balloon and simple bio-accoustic ear amplifiers. With this workshop we hope to emphasize that observing life is not just fun, but also takes time and patience.

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz
Špela Petrič, Maja Smrekar, Marc Dusseiller, Yashas Shetty

BioCyberKidzz | Acknowledgements

The BioCyberKidzz Workshop has been developed as a result of collective brainstorms of many individuals and communities that are devoting their rich experiences in creating the alternative crossovers between arts and science. The dialogues have been encouraged by **HACKTERIA** and **Swiss Mechatronic Art Society** movements as the core iniciatives for many open art & science projects which are establishing new meanings to DIY. Within this context the acknowledgments go to **Yashas Shetty, Nur Akbar Arofatullah/HONF, Julian Abraham - Togar/HONF** and **KOELSE** for executing new funky approaches to fermentation/biotechnology. **Sachiko Hirosue** and **Brian Degger** for sharing with us their creative perspectives on microbiology as well as **Mackenzie Cowell** for introducing us his original way of understanding the field of body enhancements. **Jonas Ohrstom/anorg.net** by lending us his vehicle which has an amazing ability to serve us as a mobile lab and a flat at the same time as well as **Cirkulacija2** and **Ljudmila** for sharing with us their inspirational environments where our ideas could be executed to its final point. We are interested in introducing those vivid "invisible" worlds that are, as if they are not seen, very much present in our every day life.

BioCyberKidzz | Body Enhancements

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz

Špela Petrič, Maja Smrekar, Marc Dusseiller, Yashas Shetty

BioCyberKidzz | Yeast Powered Balloons

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz

Špela Petrič, Maja Smrekar, Marc Dusseiller, Yashas Shetty

BioCyberKidzz | Living Jewelery

POTATO STARCH MEDIUM:
Slice potatoes and boil them in 1 L of water for 1 h; drain the liquid through a sieve and gauze to get rid of the potatoes; add 10g of sugar and 13g of agar; stir; pour liquid in glass container, add enough water to the pressure cooker to cover the bottom (0,5 cm); heat under pressure for 20 min; let steam out; pour medium into plates (0,25 cm); let set for at least 4 hours.

MAKING THE JEWELRY:
For the living bacterial jewelry press a finger gently onto the plate, seal Petri dish with hot-glue gun and add string, a ring or a broche needle. Colonies will appear in a day or two, at first bacterial cultures, as the culture ages filamentous fungi will overgrow.

see more on: http://hackteria.org/wiki/

TRANSLATION?

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz
Špela Petrič, Maja Smrekar, Marc Dusseiller, Yashas Shetty

BioCyberKidzz | DIY Microscopy

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz
Špela Petrič, Maja Smrekar, Marc Dusseiller, Yashas Shetty

Upcoming Workshops in Yogya

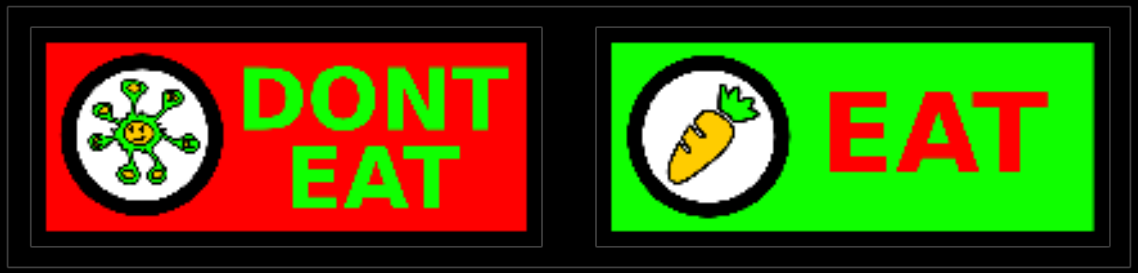
“BioCyberkidz Workshop” | 16. Jan
Art and science workshop for children in the HONF lab Garden

“We are the Lab” | 25 – 31 Jan 2012
Presentations, discussions, HONFablab introduction and closing party…
See complete details on the HONF website

MobileKitchenLab Workshop | 28 – 30 Jan
The workshop will be hold in the new HONFablab, Jalan Taman Siswa no 59

Info about the workshop on the hackteria wiki

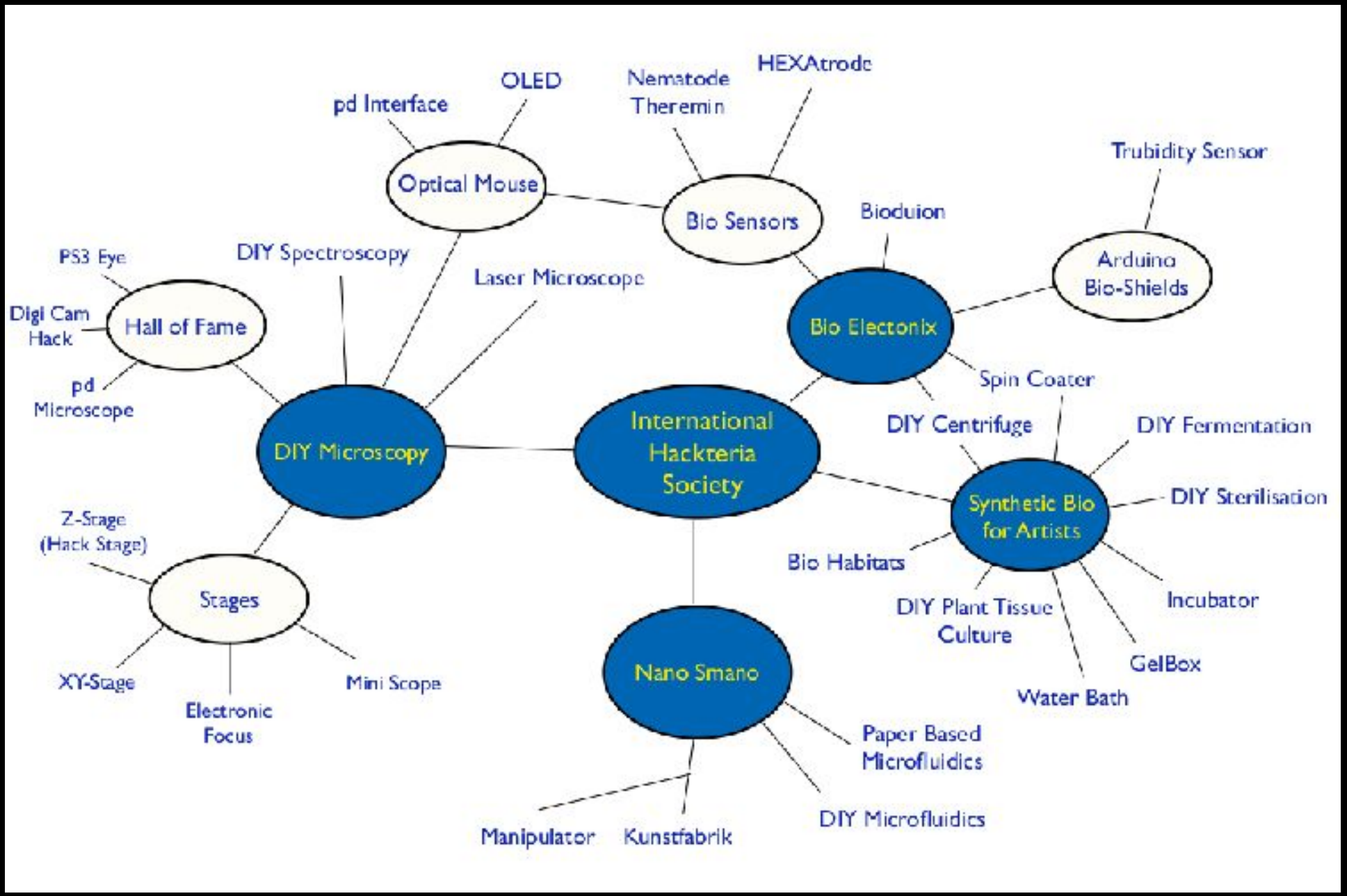
The Lab Come2U – 31 Jan 2012
The moving portable lab goes to the street, everybody can join and do their experiments at the lab, followed by the closing party at HONFablab.



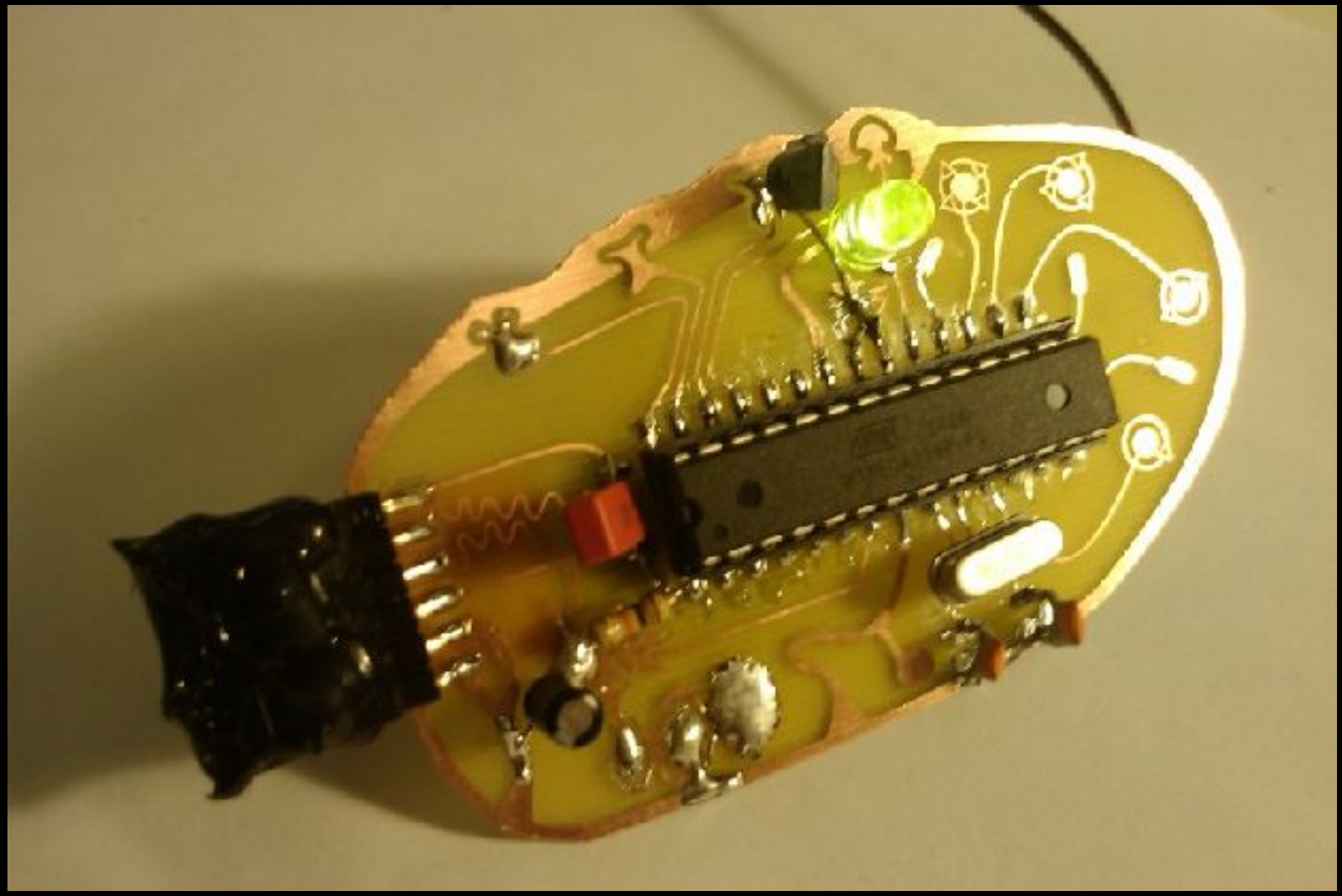
MobileKitchenLab Workshop // MicroCells#02, Yogyakarta

Marc Dusseiller (CH), Denisa Kera (CZ/SG), HONF team (ID)

Overview of Projects

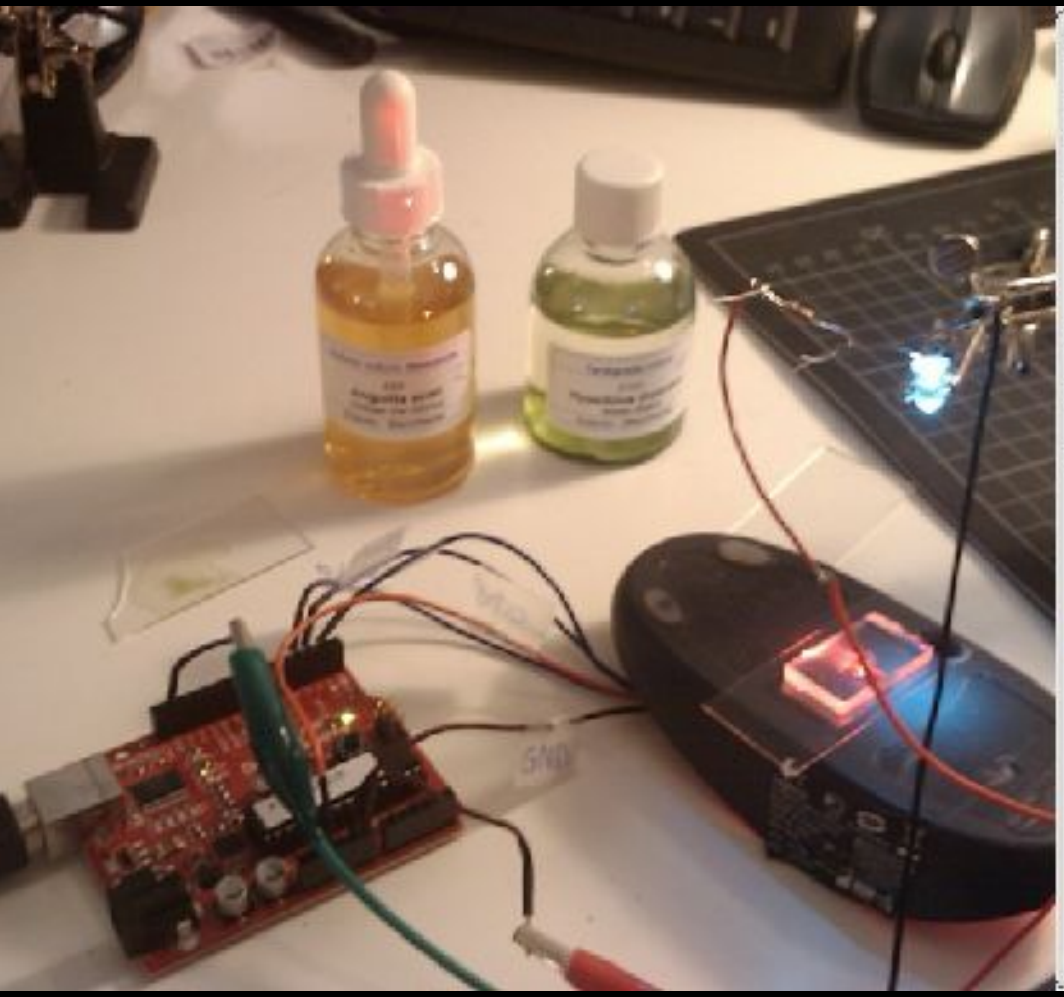


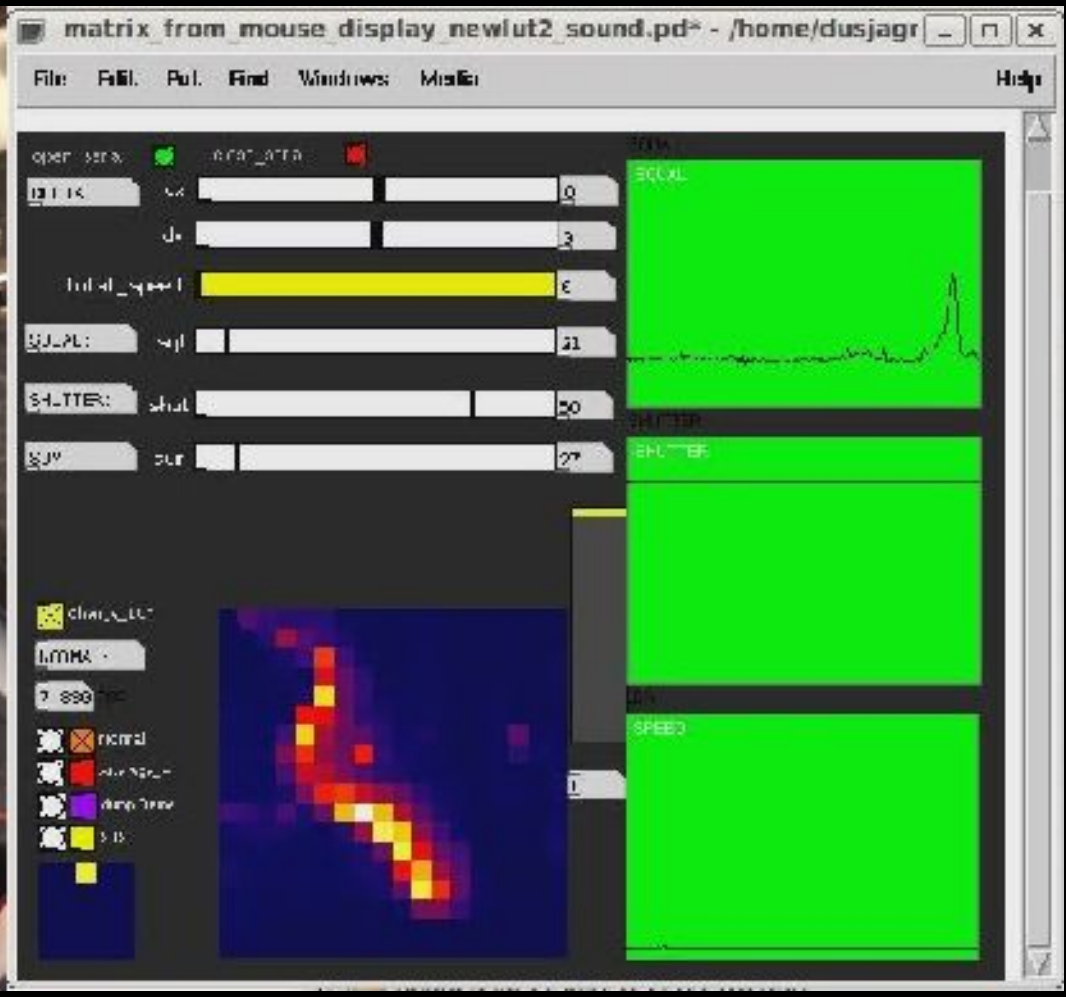
Bioelectronix – DIWO Chip hackteria



A bioinspired Arduino-Clone

Hacked Optical Mouse





Collaboration with Urs Gaudenz SGMK, Budi Prakiosa HONF

Worm is a VJ

DIY Fermentation – Wine Making

Collaboration with House of Natural Fiber and UGM, Yogyakarta

Winner of Transmediale Award 2011, IB:SC

DIY Cyber-Oechslemeter & Kilju (FIN)

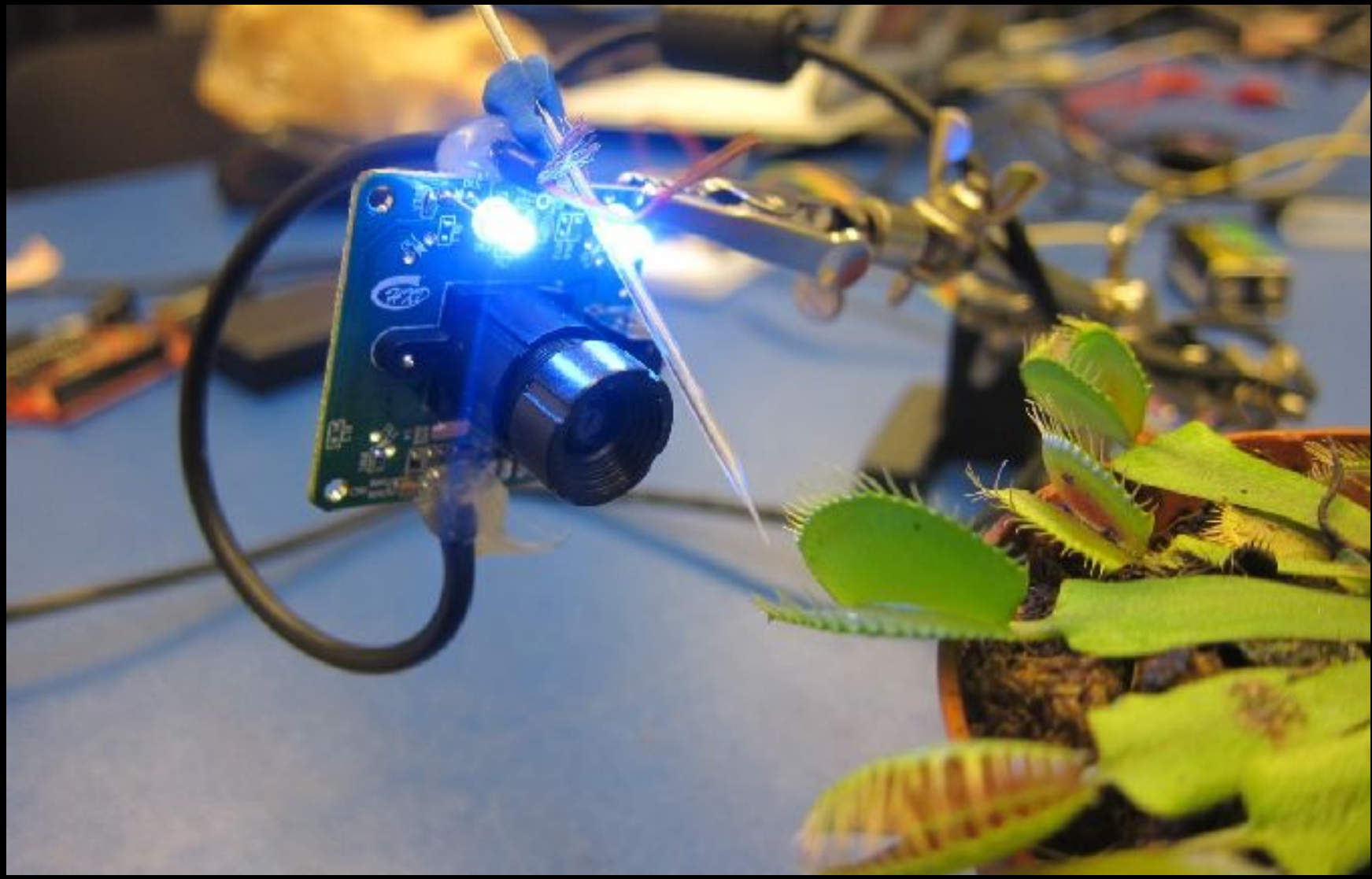
Collaboration with House of Natural Fiber and KOELSE

BioCyberKidzz | Blasinator 2

Hackteria BioLab // Create Your World | Ars Electronica Festival 2011, Linz

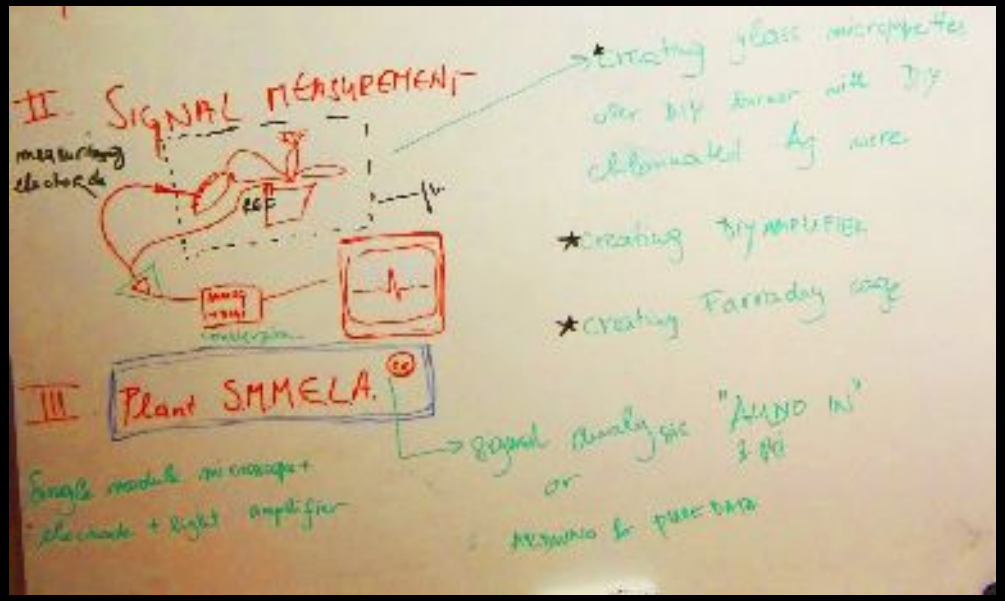
Špela Petrič, Maja Smrekar, Marc Dusseiller

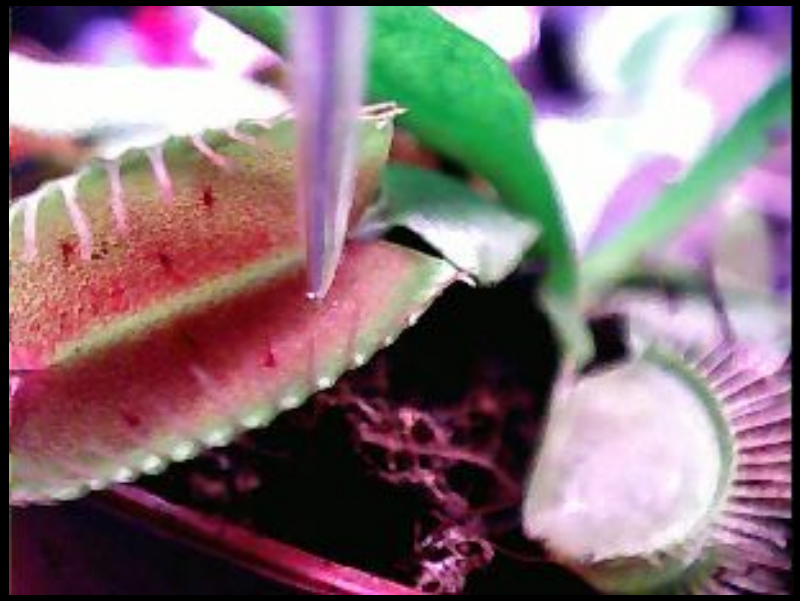
Getting on Plant's Nerves...

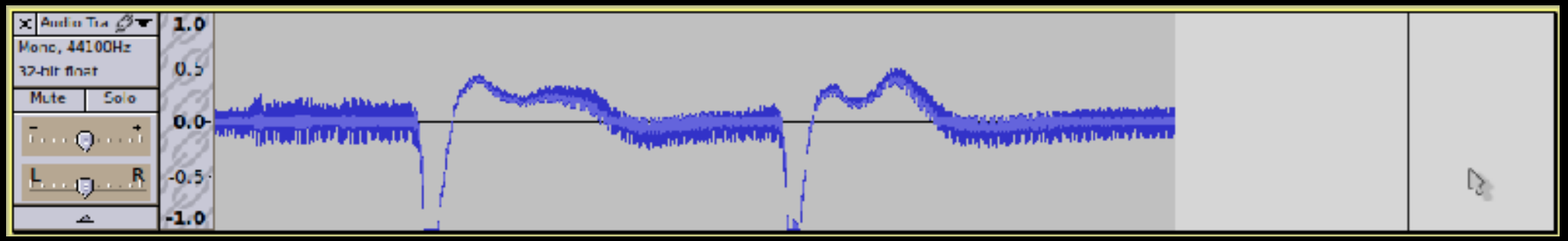


Workshop with Špela Petrič and Andrej Meglič, HAIP 2010

Getting on Plant's Nerves...





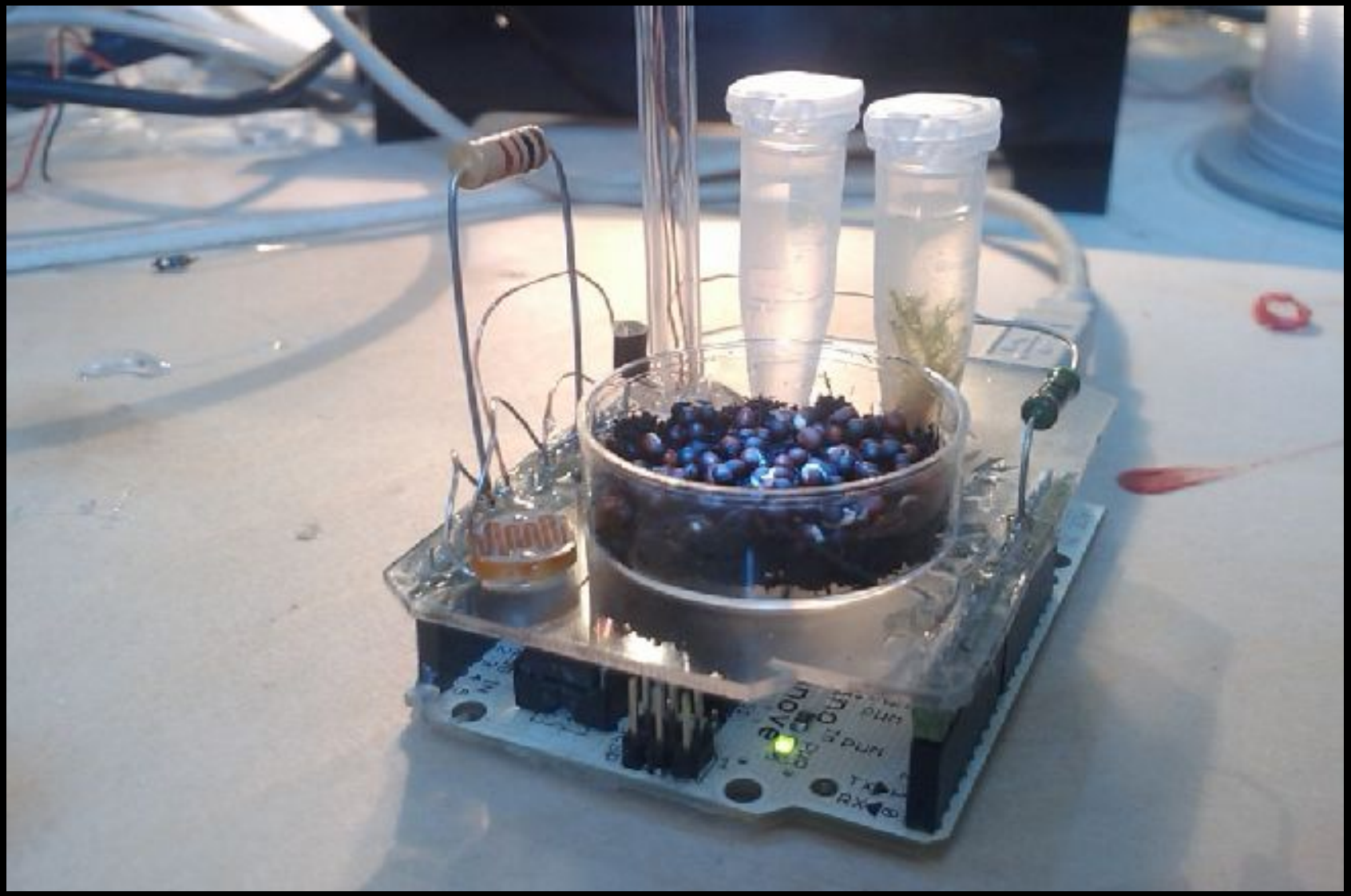


Workshop with Špela Petrič and Andrej Meglič

DIY implants? Tooth hacking?

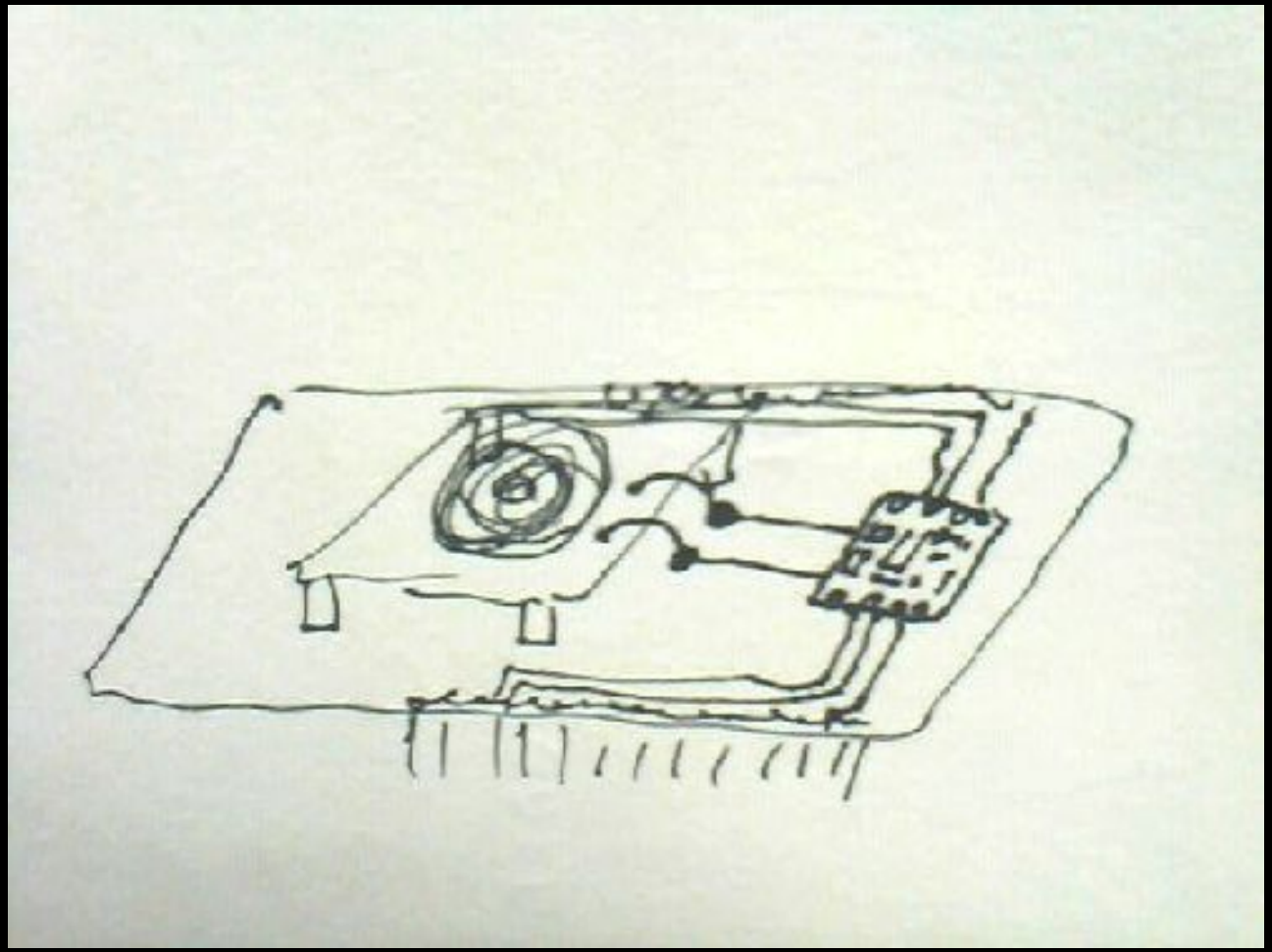
Claude Treptow, poolloop Festival 2011, Zurich

Kresse Shields for Arduino



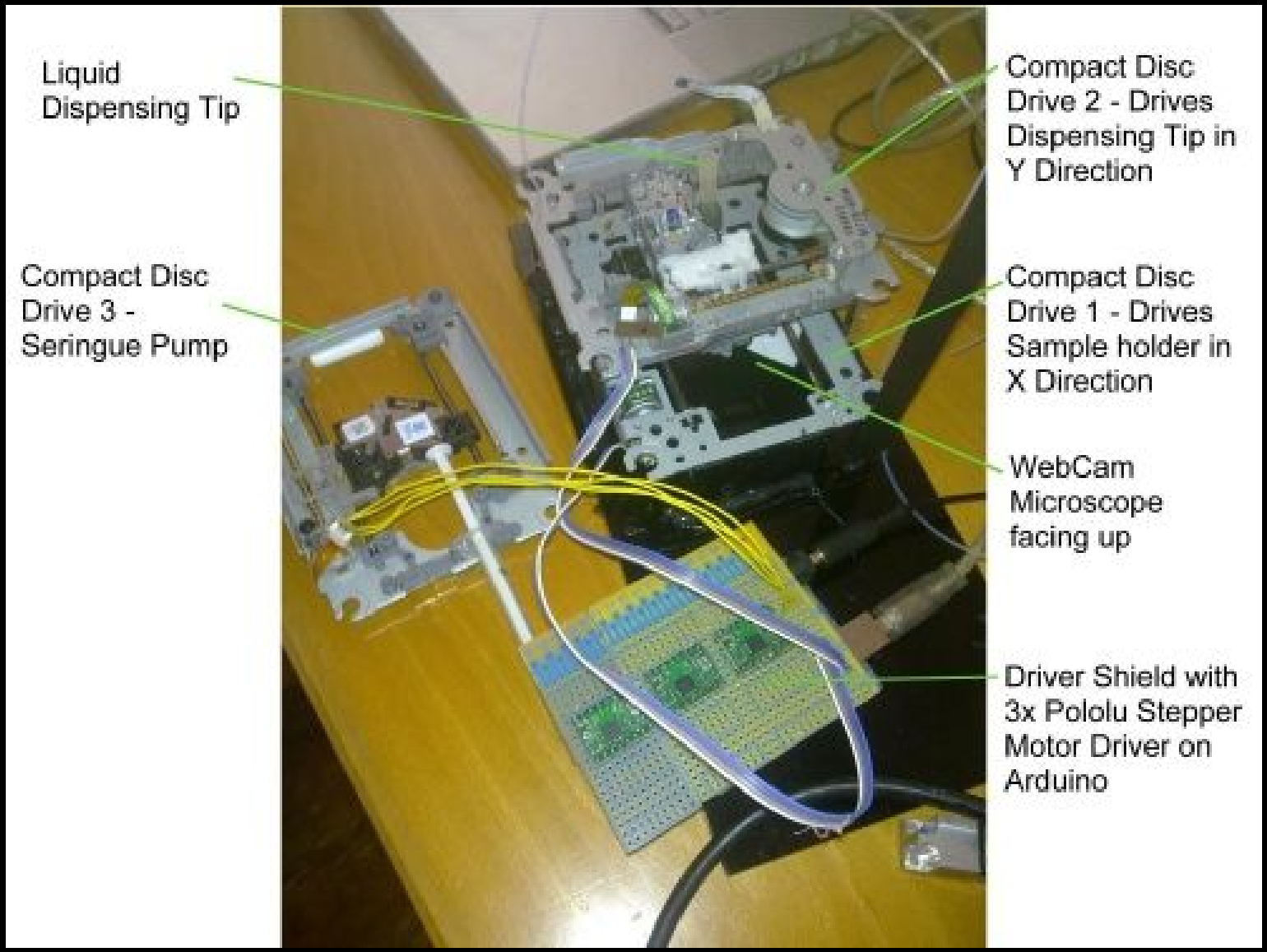
Dusjagr during pachube hackaton

Lab-on-Arduino



Dusjagr, Anyma, Mac Cowell

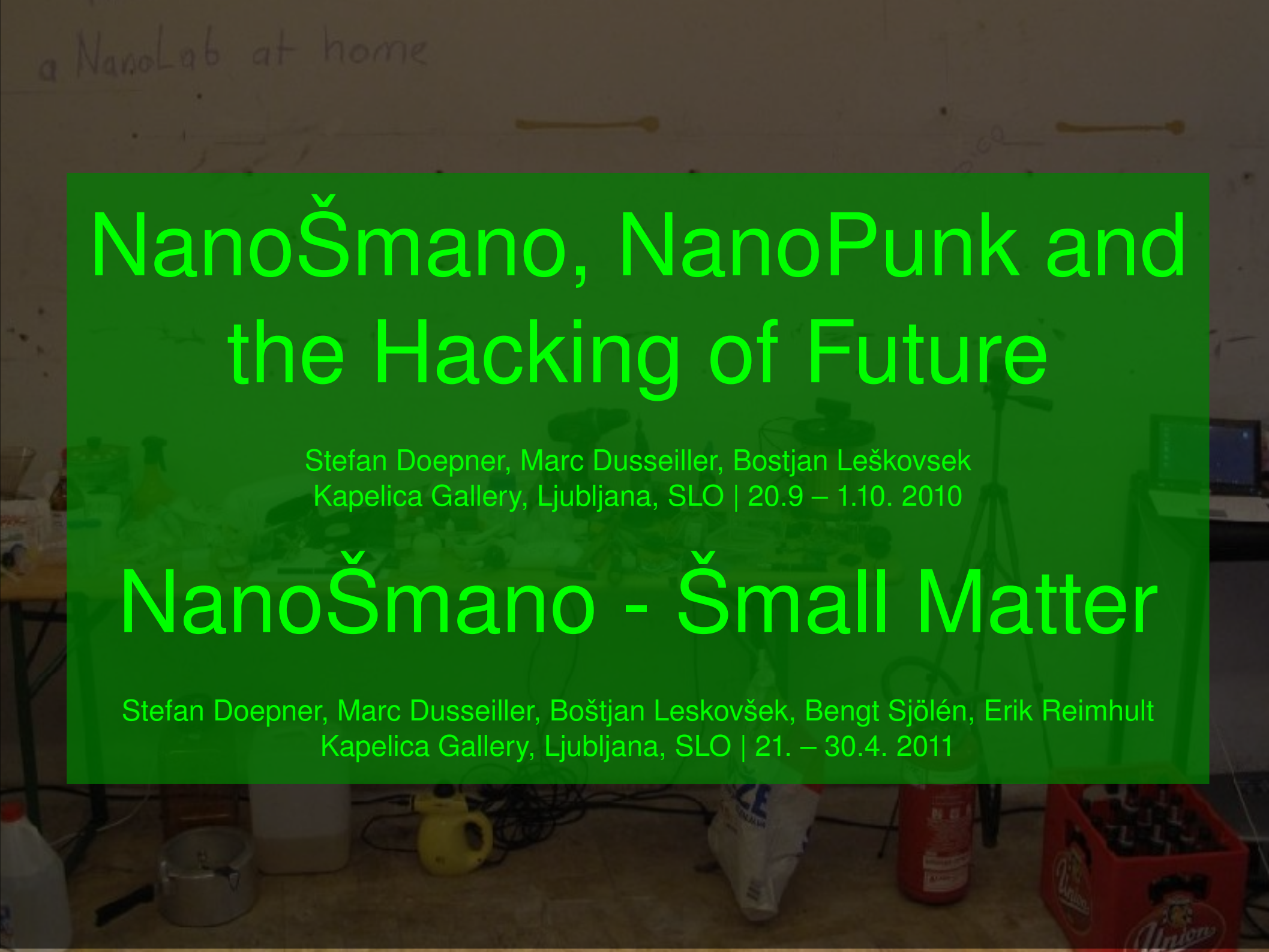
DIY Micro Dispensing and Bio Printing



Urs Gaudenz et al

Garage BioLab Radionica, Zagreb

Workshop at I'MM, Zagreb, October 2011



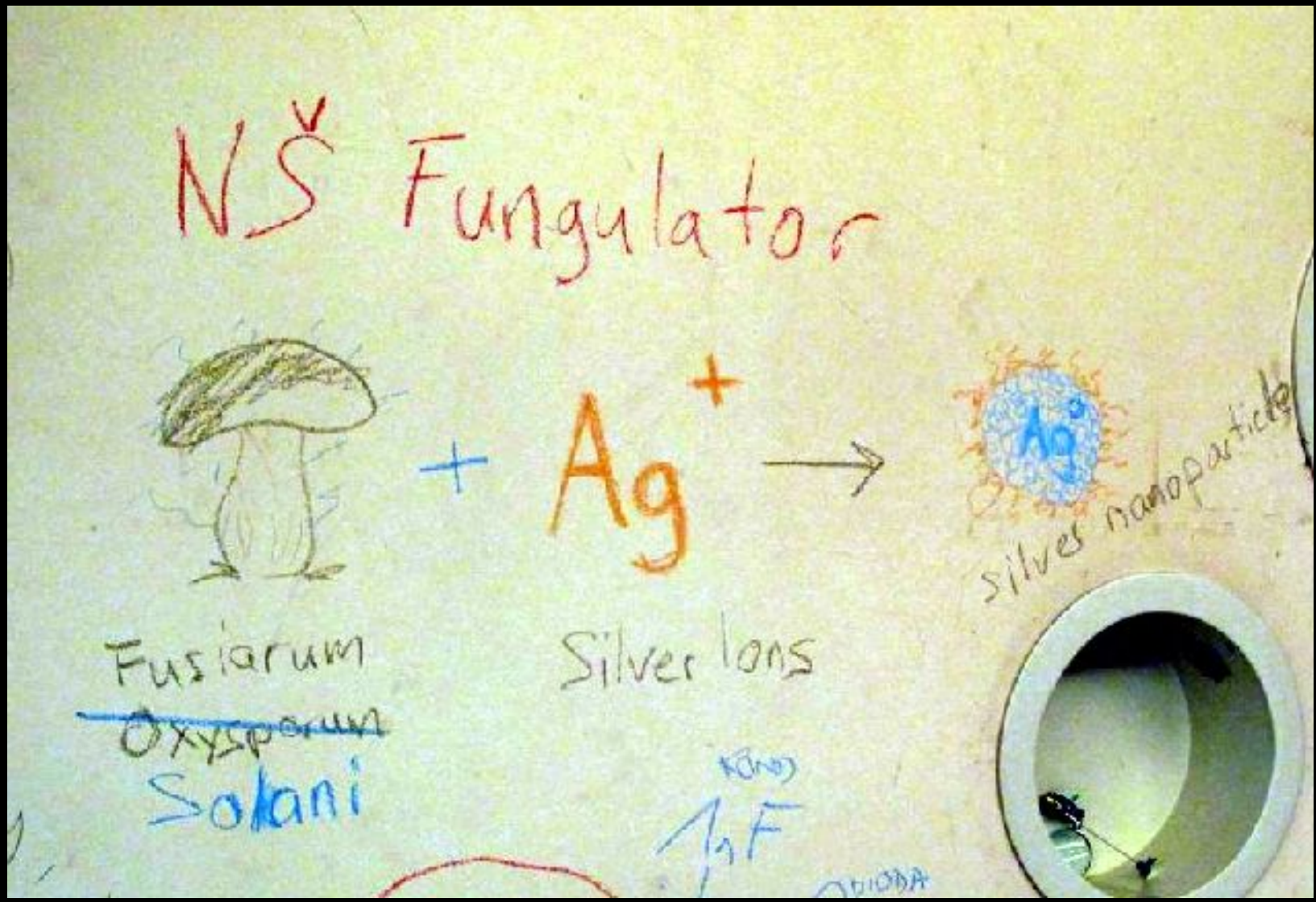
NanoŠmano, NanoPunk and the Hacking of Future

Stefan Doepner, Marc Dusseiller, Bostjan Leškovsek
Kapelica Gallery, Ljubljana, SLO | 20.9 – 1.10. 2010

NanoŠmano - Šmall Matter

Stefan Doepner, Marc Dusseiller, Boštjan Leskovšek, Bengt Sjölén, Erik Reimhult
Kapelica Gallery, Ljubljana, SLO | 21. – 30.4. 2011

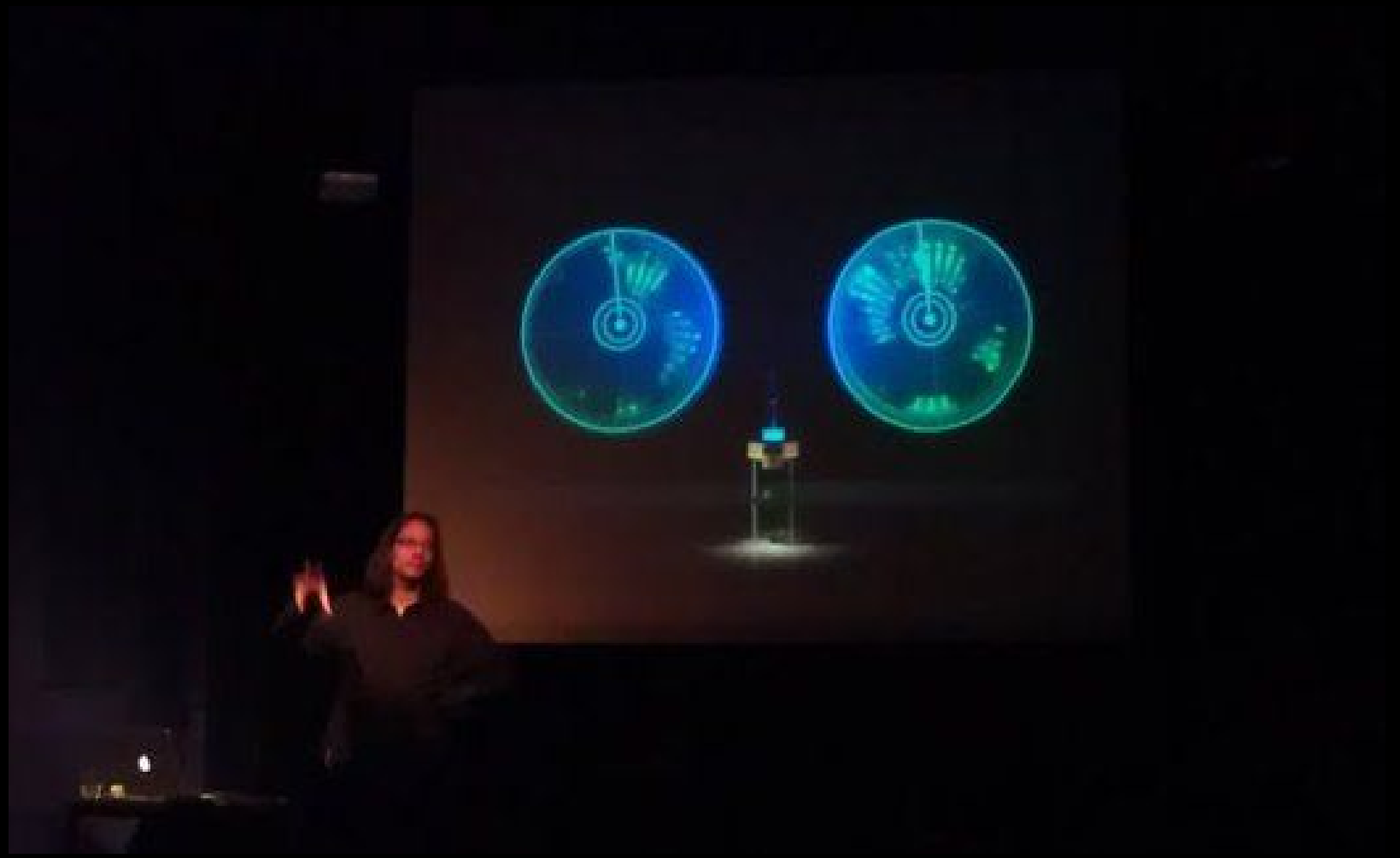
NanoŠmano Fungulator



Extracellular biosynthesis of silver nanoparticles using the fungus Fusarium oxysporum
Absar Ahmad et al, Pune, India, Colloids and Surfaces B: Biointerfaces 28 (2003)

NanoŠmano Fungulator

PLEXUS aka hackteria vs. Kapelica



Ocular Revision , 2010. Presented in Kapelica Gallery

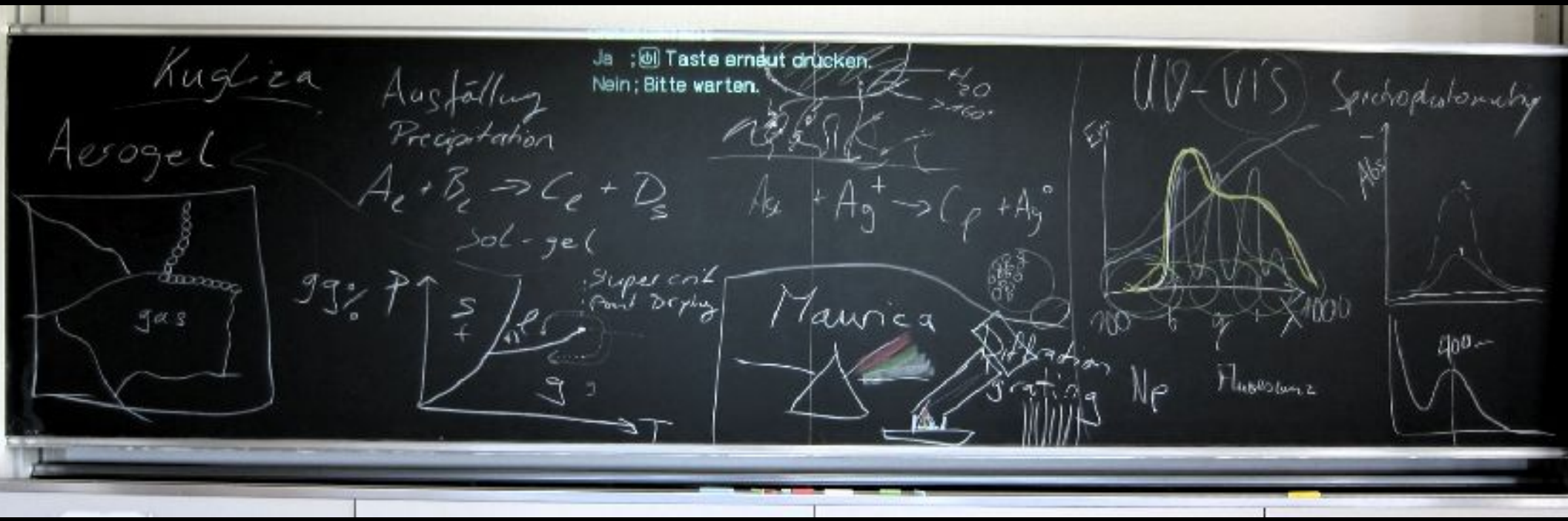
Paul Vanouse

PLEXUS aka hackteria vs. Kapelica

MaSm Metatransformation , 2011. Produced by Kapelica Gallery

Maja Smrekar, Špela Petrič

Teaching to Students



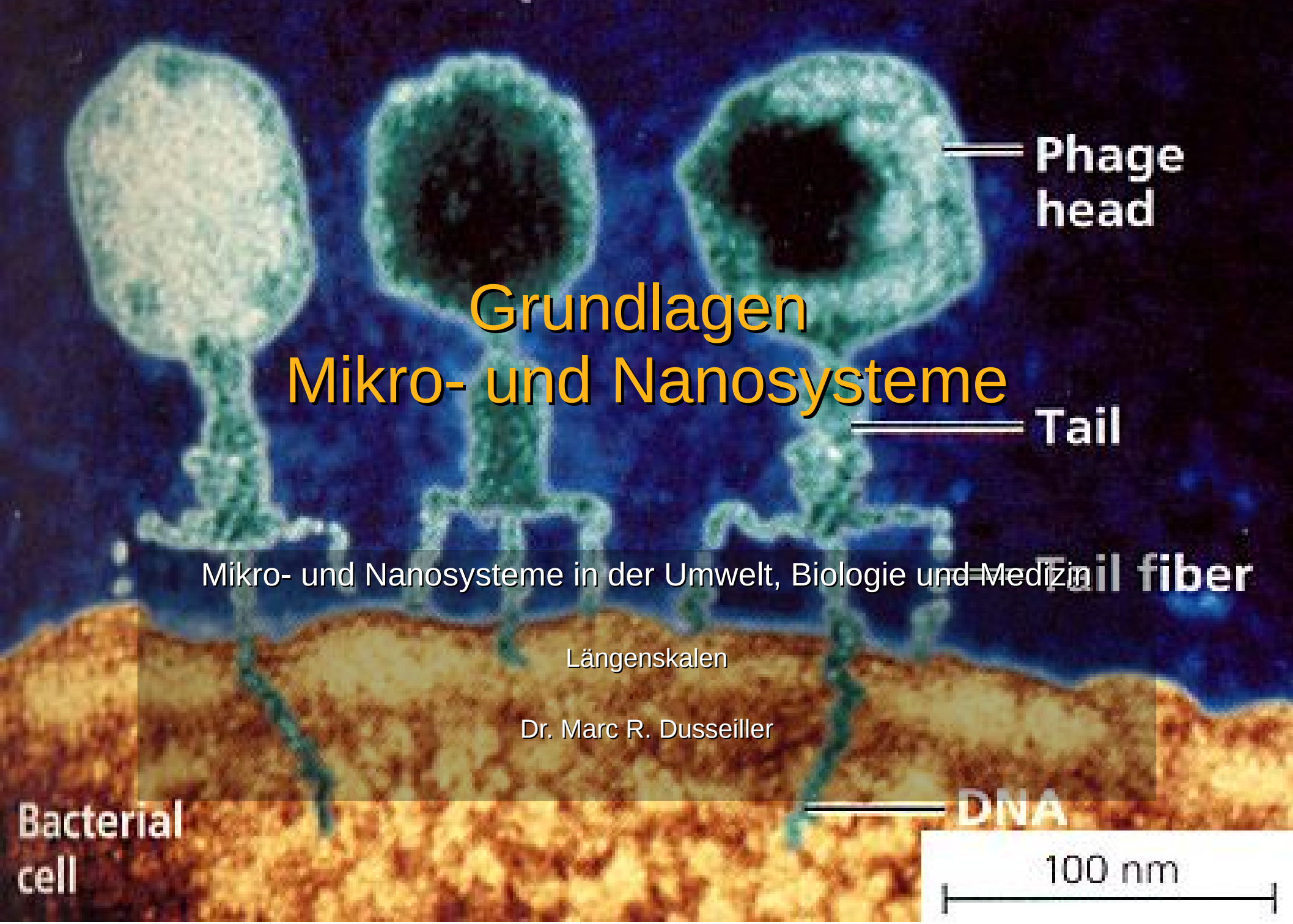
Micro- and Nanosystems for Life Scieces

Grundlagen Mikro- und Nanosysteme

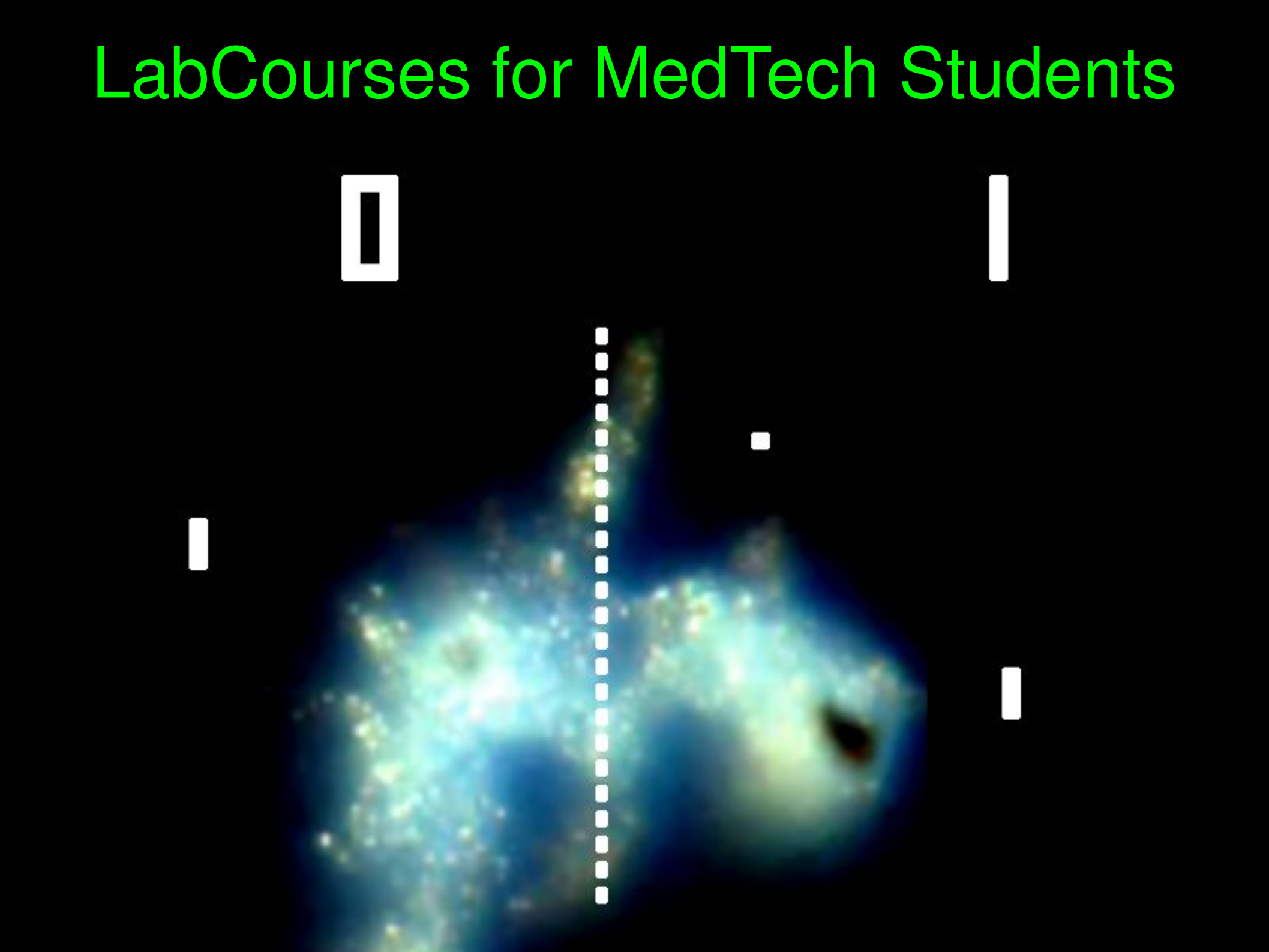
Mikro- und Nanosysteme in der Umwelt, Biologie und Medizin

Längenskalen

Dr. Marc R. Dusseiller

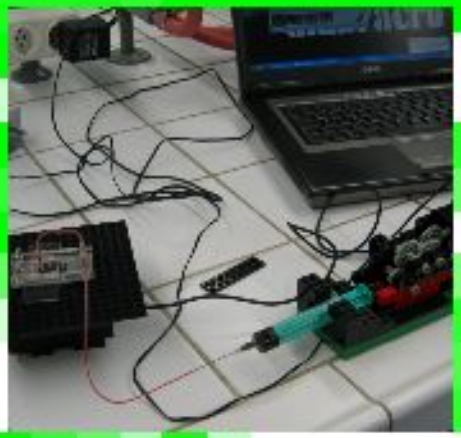


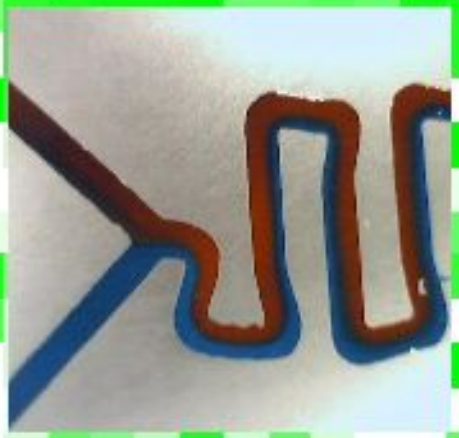
LabCourses for MedTech Students



wetPONG

Platform for Hybrid-Games, Micro- and Nanotechnology and Life Sciences





"Creativity is becoming more important than knowledge,
Knowledge is distributed on the Internet where anyone can find it."

James Gimzewski, UCLA Distinguished Professor of Chemistry and Biochemistry

wetPONG is an international student competition based on a creativity approach in project based learning in microfluidics. The goal of the project is to design and build a prototype system of a playful game-concept that combines components of micro- and nanotechnology and living organisms. Interdisciplinary thinking, team collaboration and creativity are the main learning objectives. The entered projects will be presented at an international meeting and awarded by a jury of invited experts.

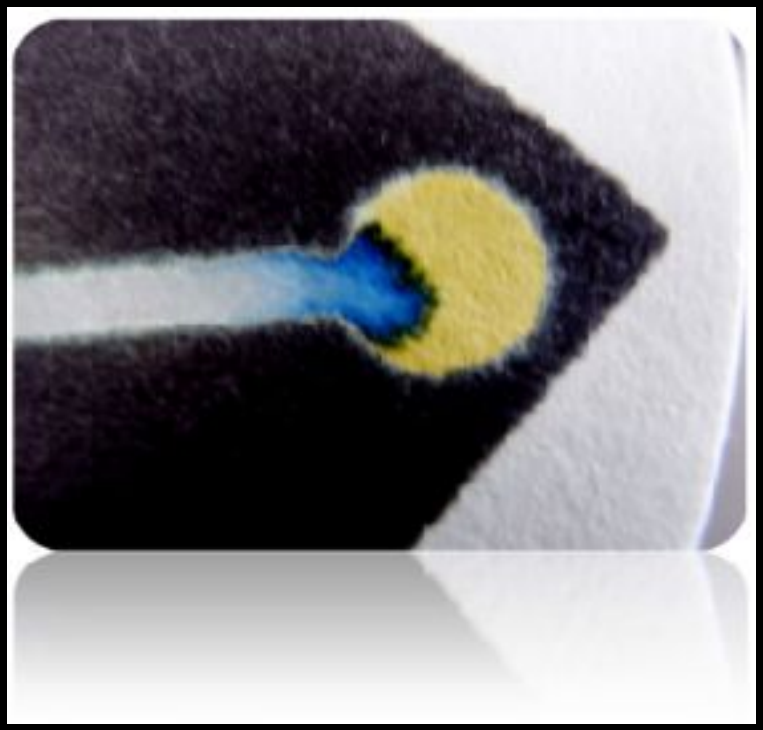
cc http://wetpong.net

HomeMade Microfluidics

ChipFab

All Projects online on Wiki

- Projekt 1 | Paper µFluidics Diagnostics
- Projekt 2 | Worm Chips II
- Projekt 3 | FlexPrint/PhotoResist µFluidics
- Projekt 4 | Maizena Mania
- Projekt 5 | Aschenbrödel Fluidics



http://www.dusseiller.ch/mis_wiki/index.php?title=%CE%9C-wetPONG
FHNW, School for Life Sciences, Muttenz

Meanwhile...

PAPER www.rsc.org/loc | Lab on a Chip

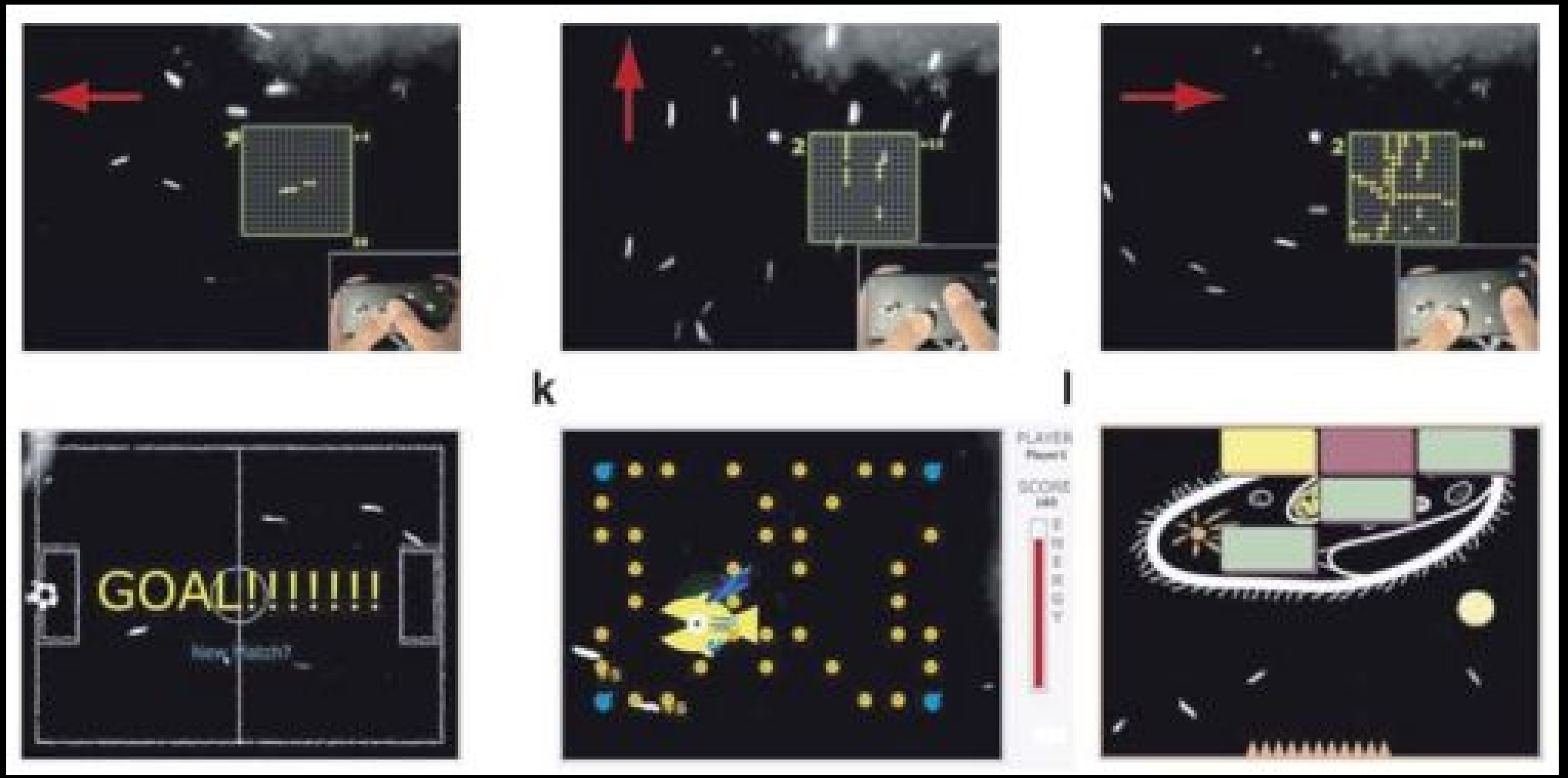
Design, engineering and utility of biotic games†‡§

Ingmar H. Riedel-Kruse,¶* Alice M. Chung, Burak Dura, Andrea L. Hamilton and Byung C. Lee

Received 11th September 2010, Accepted 23rd September 2010
DOI: 10.1039/c0lc00399a

Games are a significant and defining part of human culture, and their utility beyond pure entertainment has been demonstrated with so-called 'serious games'. Biotechnology – despite its recent advancements – has had no impact on gaming yet. Here we propose the concept of 'biotic games', *i.e.*, games that operate on biological processes. Utilizing a variety of biological processes we designed and tested a collection of games: 'Enlightenment', 'Ciliaball', 'PAC-mecium', 'Microbash', 'Biotic Pinball', 'POND PONG', 'PolymerRace', and 'The Prisoner's Smellemma'. We found that biotic games exhibit unique features compared to existing game modalities, such as utilizing biological noise, providing a real-life experience rather than virtual reality, and integrating the chemical senses into play. Analogous to video games, biotic games could have significant conceptual and cost-reducing effects on biotechnology and eventually healthcare; enable volunteers to participate in crowd-sourcing to support medical research; and educate society at large to support personal medical decisions and the public discourse on bio-related issues.

Meanwhile...



Open Questions

- How can we teach creativity?
- How can artists/scientists profit from collaborations with each other?
- Is a transdisciplinary education crucial for innovation, especially in Nanotechnology?

Thanks for listening