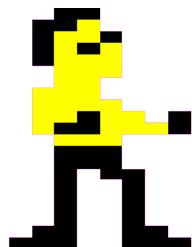


Transdisciplinary Approaches on Education at the NanoBioInterface

Dr. Marc R. Dusseiller aka dusjagr

www.dusseiller.ch/labs





n | w

Fachhochschule
Nordwestschweiz

Acknowledgements

Markus Haselbach, Urs Gaudenz, Tobias Hoffmann und alle Mechatroniker

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

René Bauer, GameDesign, ZHdK

Dock18, Mario Purkathofer

Stefan Doepner, Bostjan Leškovsek, Kapelica Gallery, Ljubljana

HONF, House of Natural Fiber, Yogyakarta

Gabor Csucs, Martin Willeke, Marcus Textor, ETH Zürich

Förderungen durch: Migros Kulturprozent, BAK, Stadt Zürich, FHNW

Teaching

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

Confucius



Fields of Activity

dusjagr labs – transdisciplinary Scholar and Artist

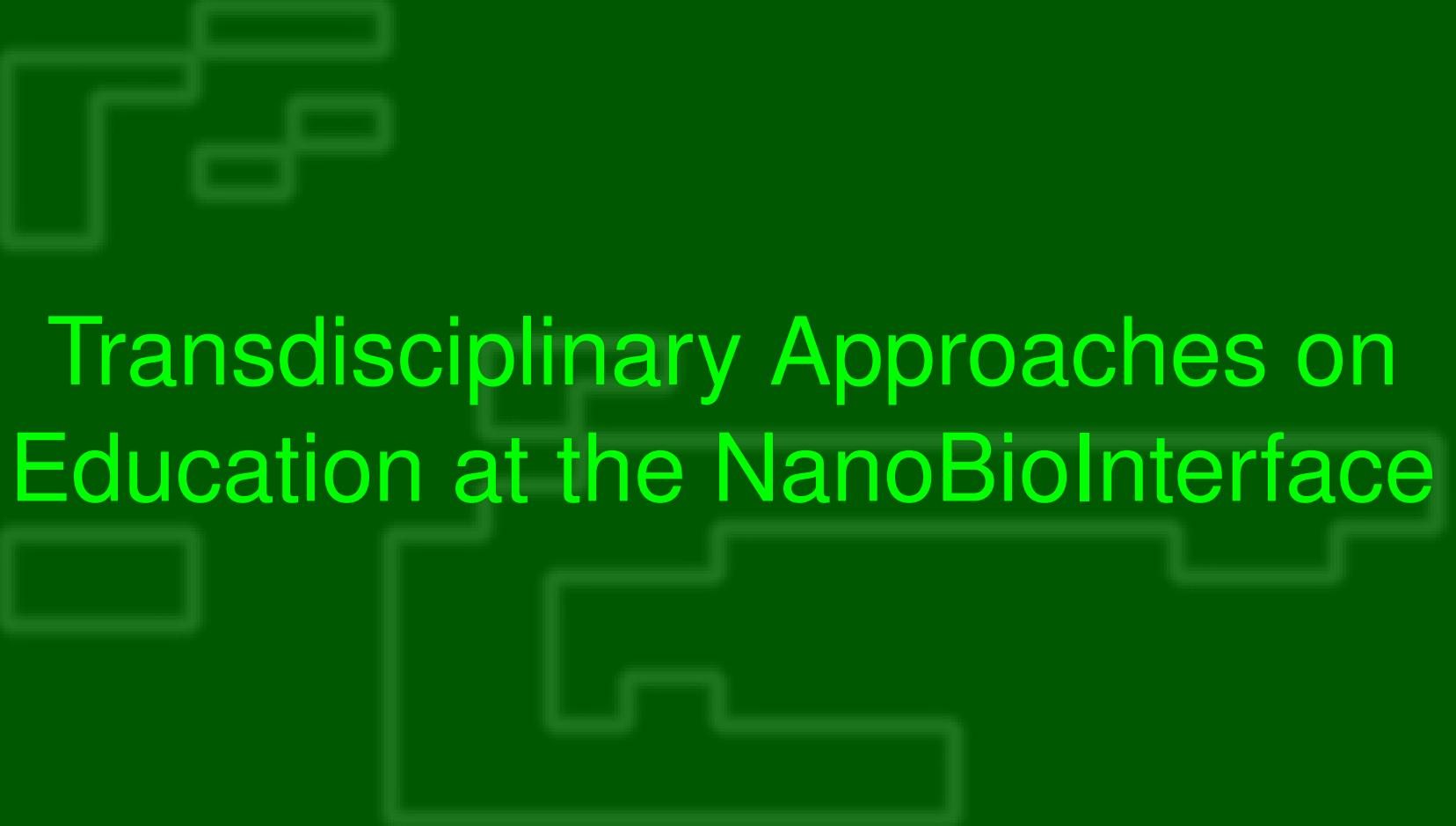
<http://www.dusseiller.ch/labs/>

- 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/](http://www.dock18.ch)
- FHNW, HLS | wetPONG - Hybrid Games, Micro- and Nanotechnology and Life Sciences
 - <http://wetpong.net>
- ZHdK | SlowGames
- ETH Zürich | Traditional Materials

Teaching what...



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



Transdisciplinary Approaches on Education at the NanoBiolInterface



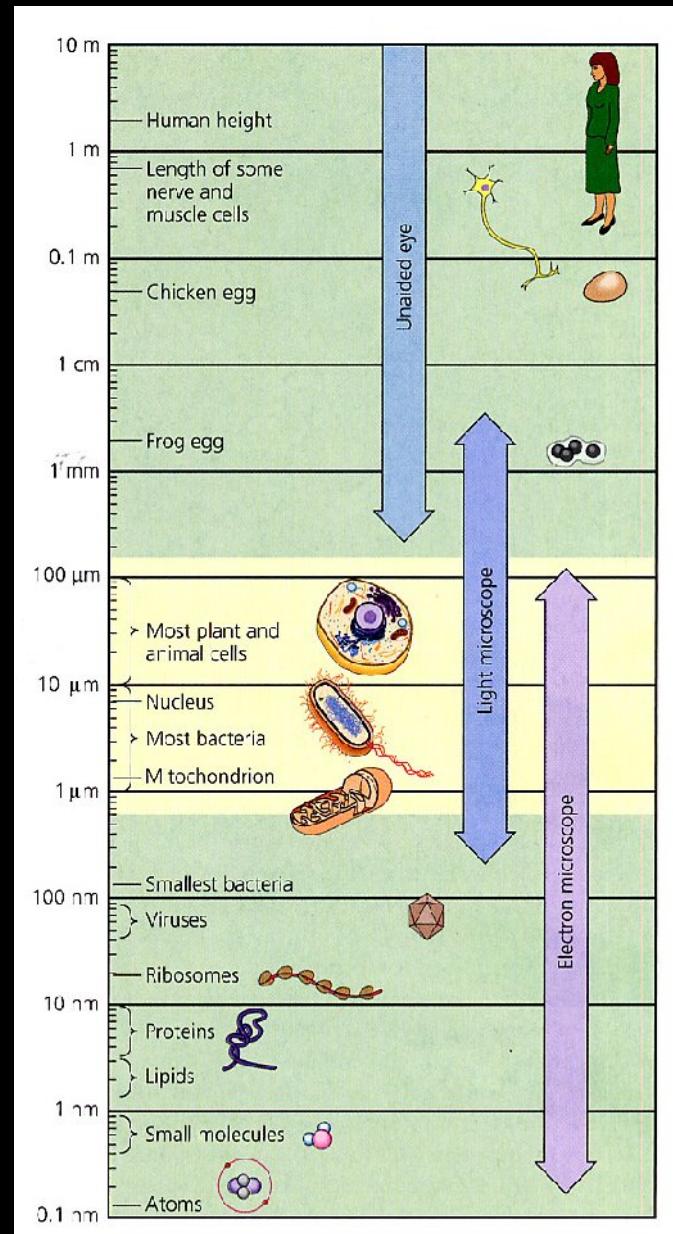
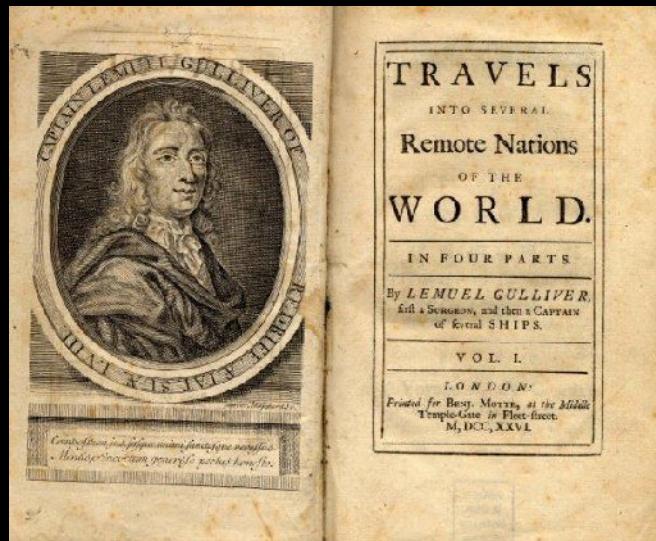
Nanotechnology

nan•o•tech•nol•o•gy (năñō'tek'nal'ĕjē) n.
technology of building electronic circuits by
joining individual atoms and molecules.

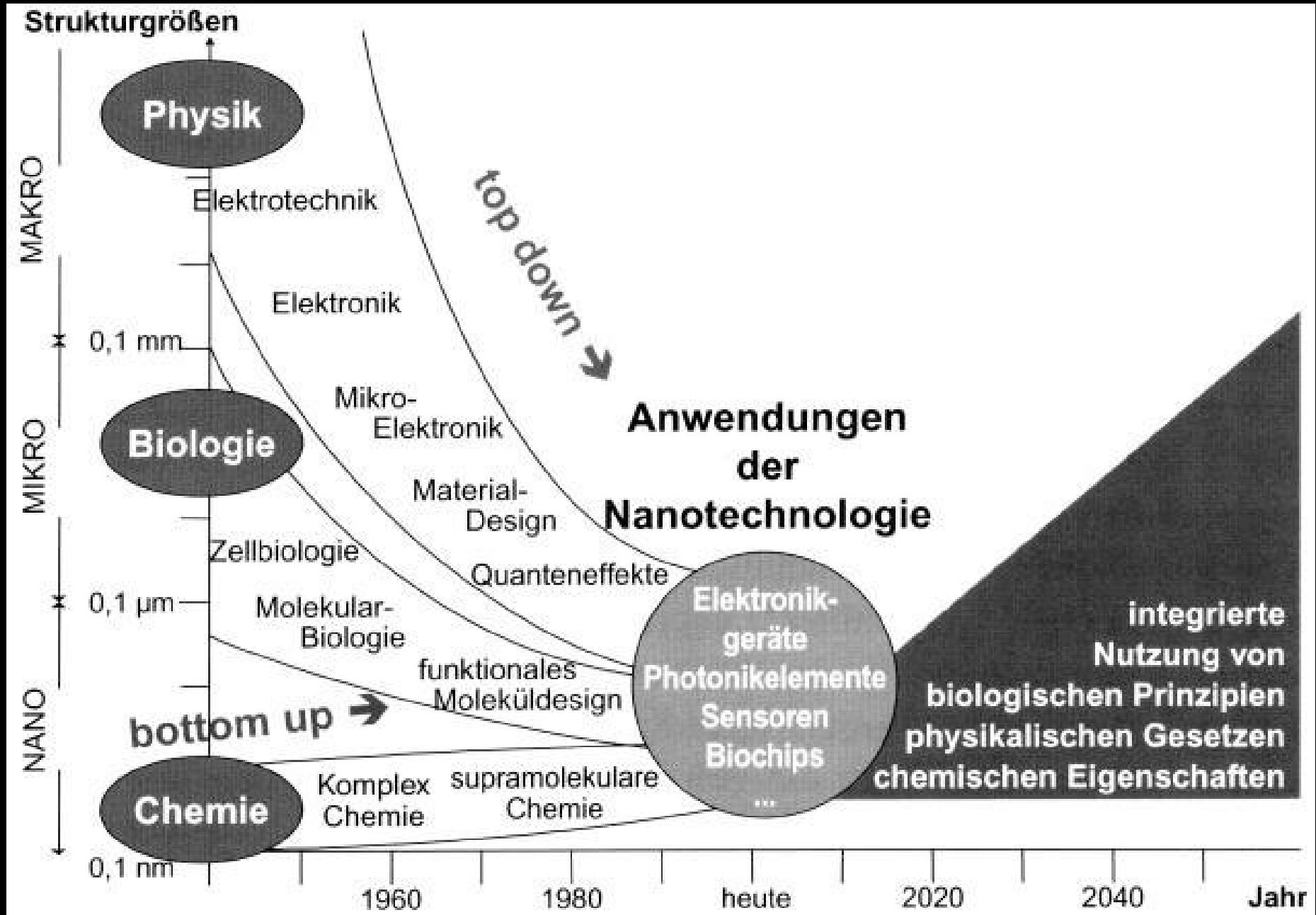
The Size of Things

“... nothing is great or little otherwise than by comparison.”

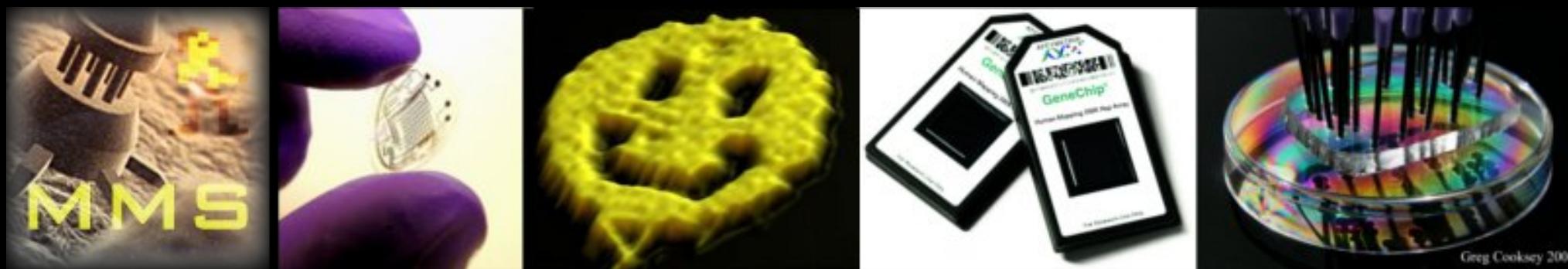
Jonathan Swift, “*Gulliver’s Travels*”, 1726
Irish essayist, novelist, & satirist (1667 - 1745)



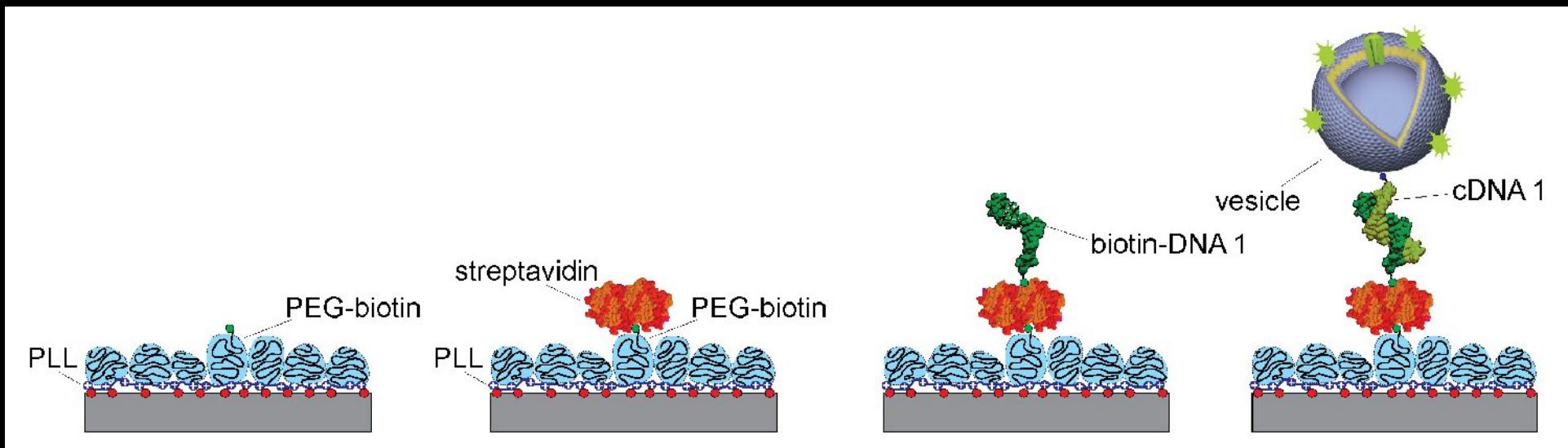
Convergence of Disciplines



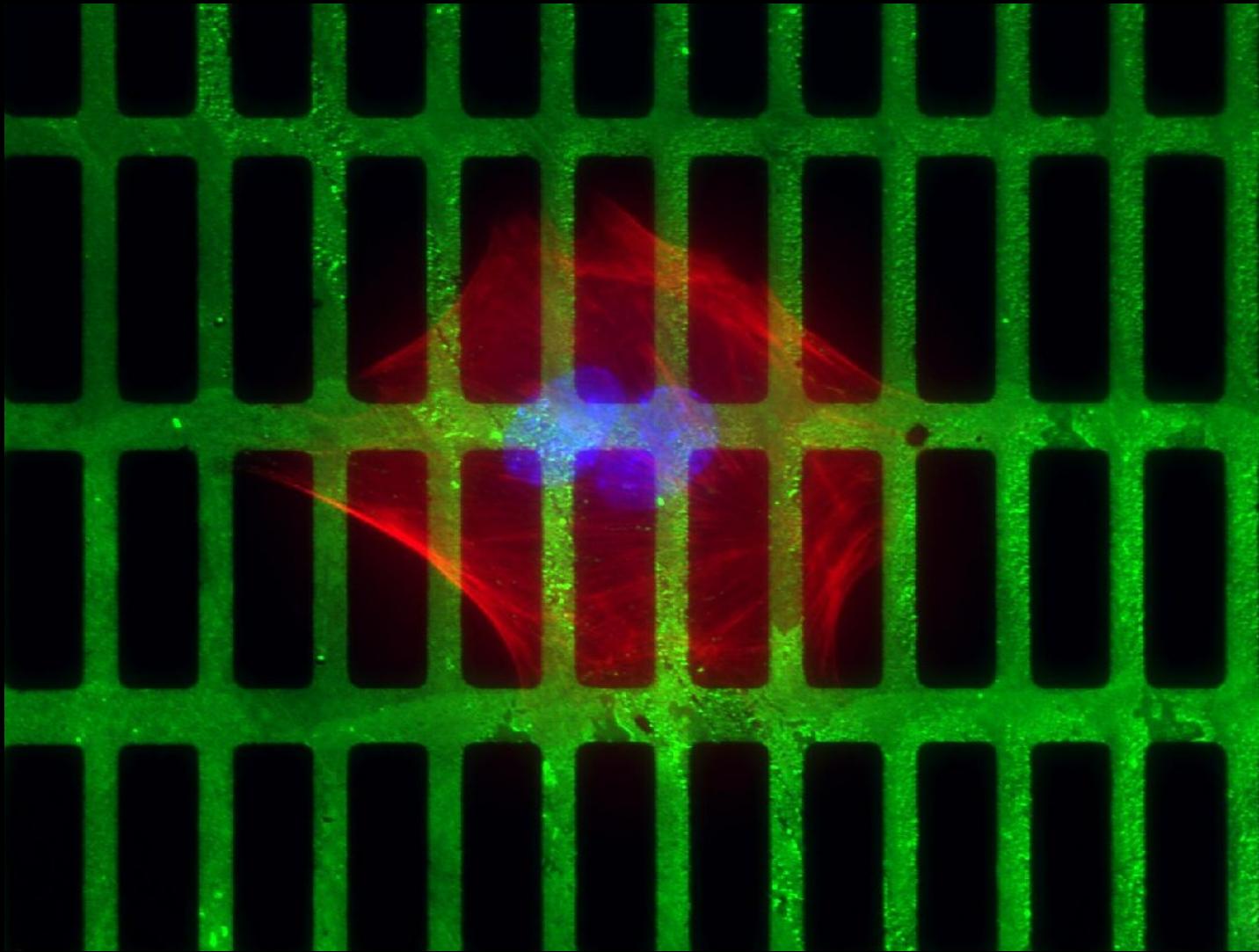
The NanoBiolInterface



Greg Cooksey 200

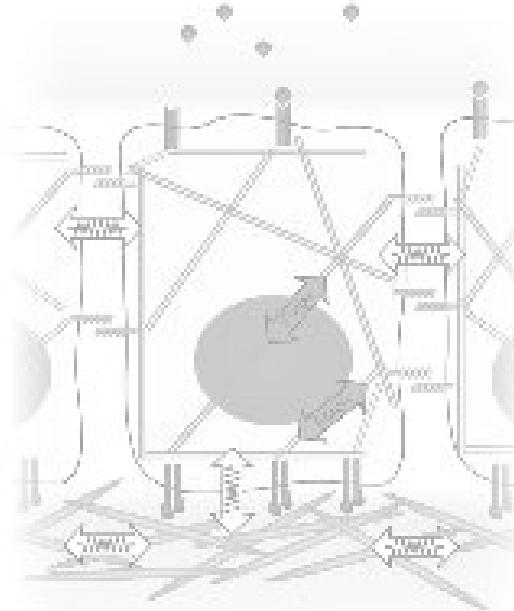


The NanoBiolInterface





ETH
 Eidgenössische Technische Hochschule Zürich
 Swiss Federal Institute of Technology Zurich
DMATL
 Department of Materials



ETH Zürich 2006

PhD Thesis at LSST, Department of Materials, ETH Zürich, 2006 - scholar.google.com/scholar?q=dusseiller
dusjagr labs, c/o Marc Dusseiller, Schöneggstr. 34, CH-8004 Zürich - +41 78 645 82 59 - marc@dusseiller.ch

Micro- and Nanoengineering the 3-Dimensional Environment of Cells in Culture

Marc R. Dusseiller
Diss. ETH No. 16433

Micro- and Nanoengineering the 3-Dimensional Environment of Cells in Culture



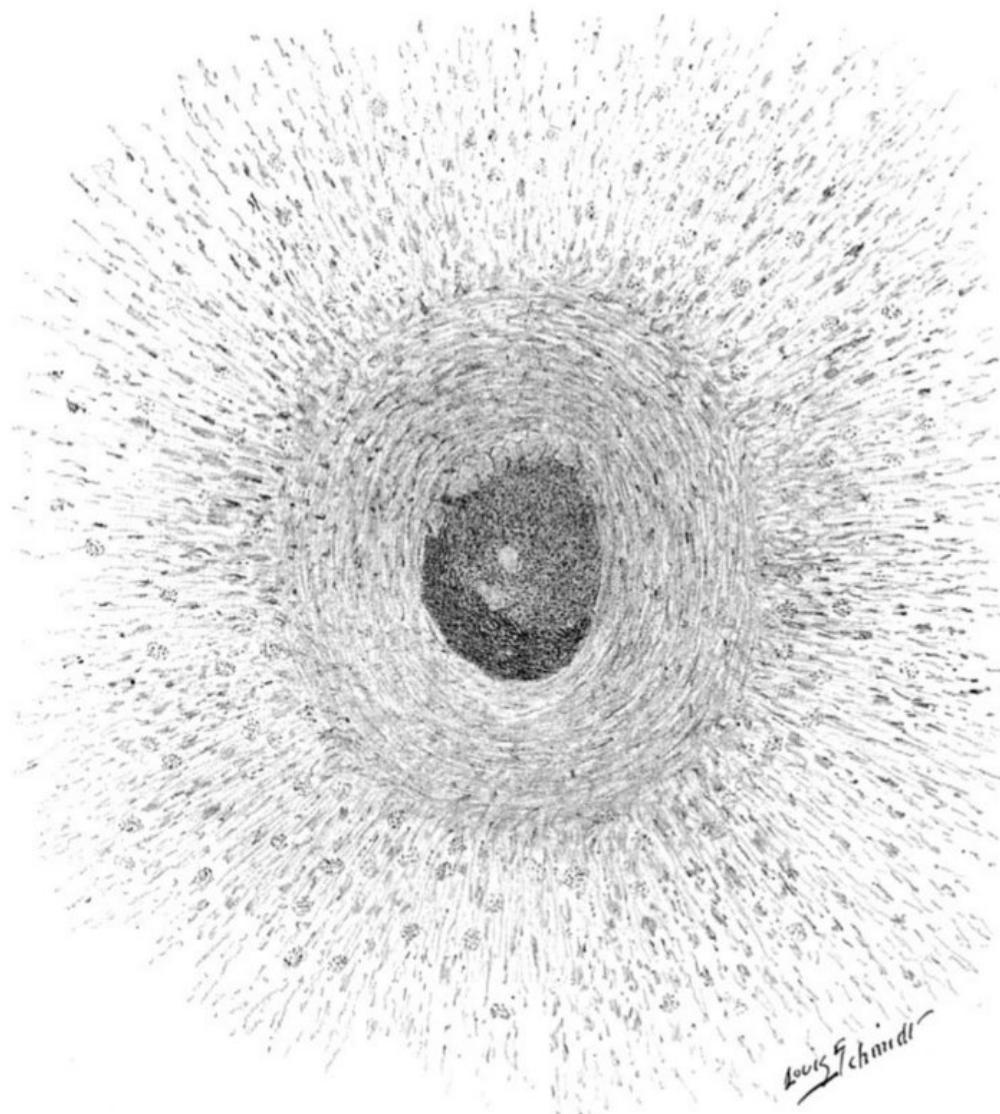
Marc R. Dusseiller

Diss. ETH No. 16433

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.*)

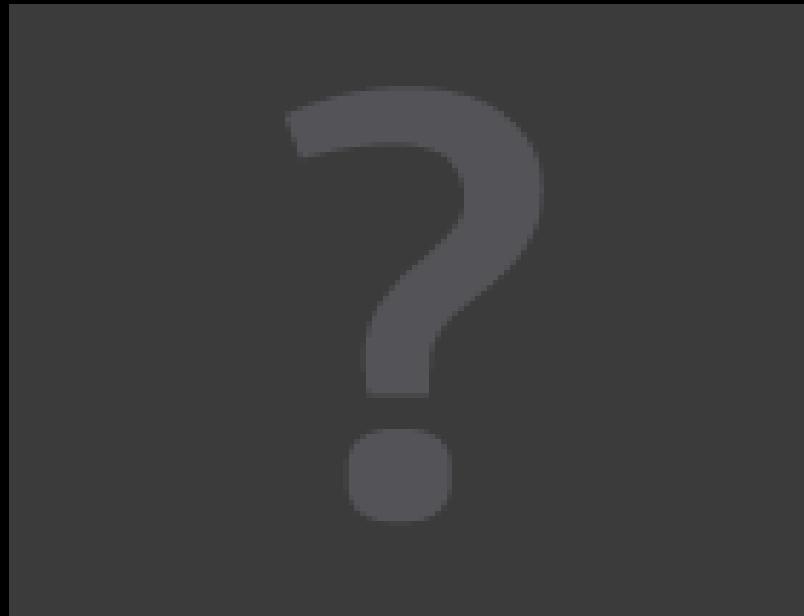


Design of Cellular Patterns 2D



HeLa Cells on patterned substrate, 20 hours timelapse
Alexa Kiss, Gabor Csucs, ETHZ

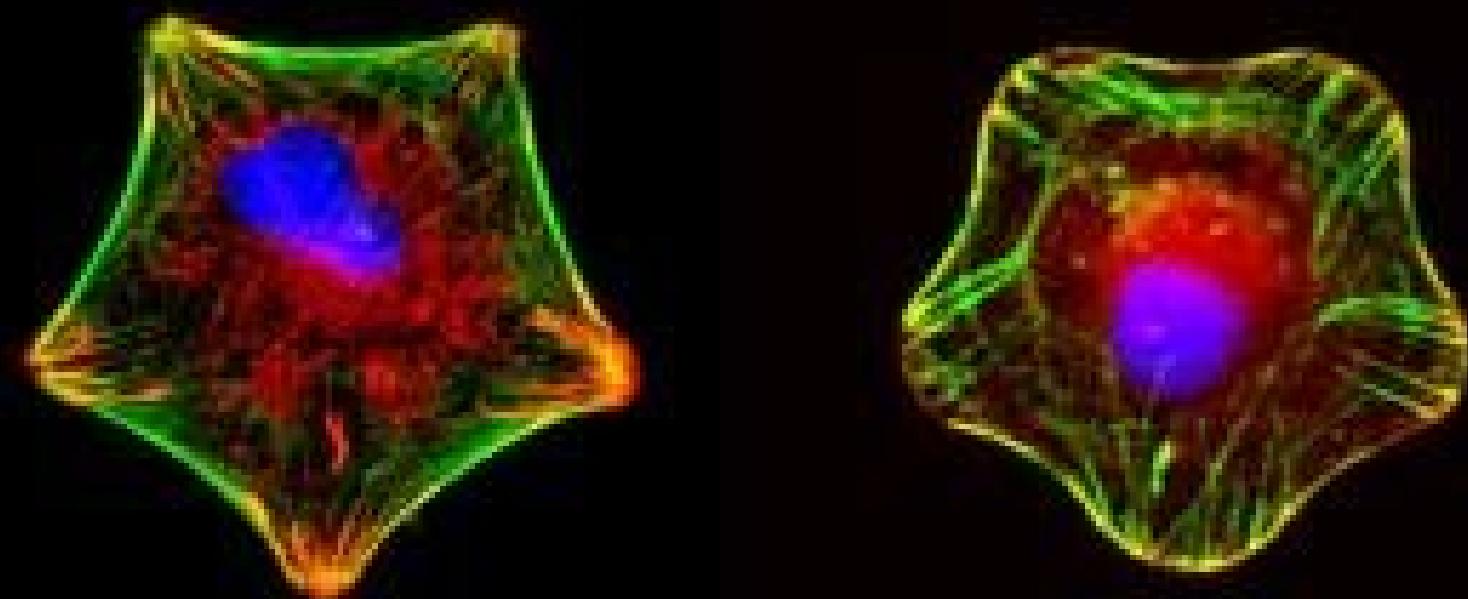
The Third Dimension



Single cell in 3 dimensional Microwell

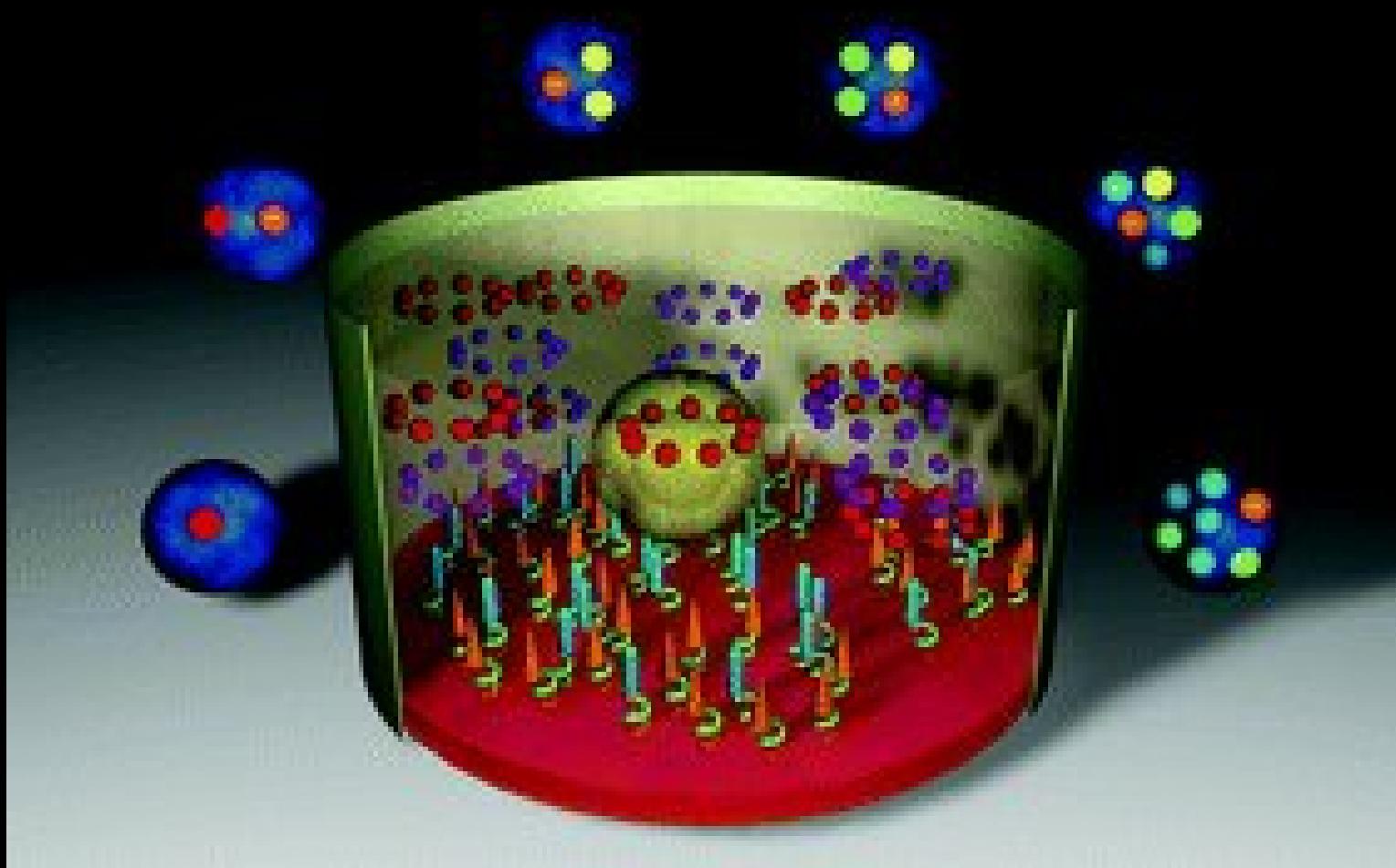
Fabian Anderegg, Marcus Textor, ETHZ

Meanwhile...



Geometric cues for directing the differentiation of mesenchymal stem cells
Kilian et al. PNAS 2010

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

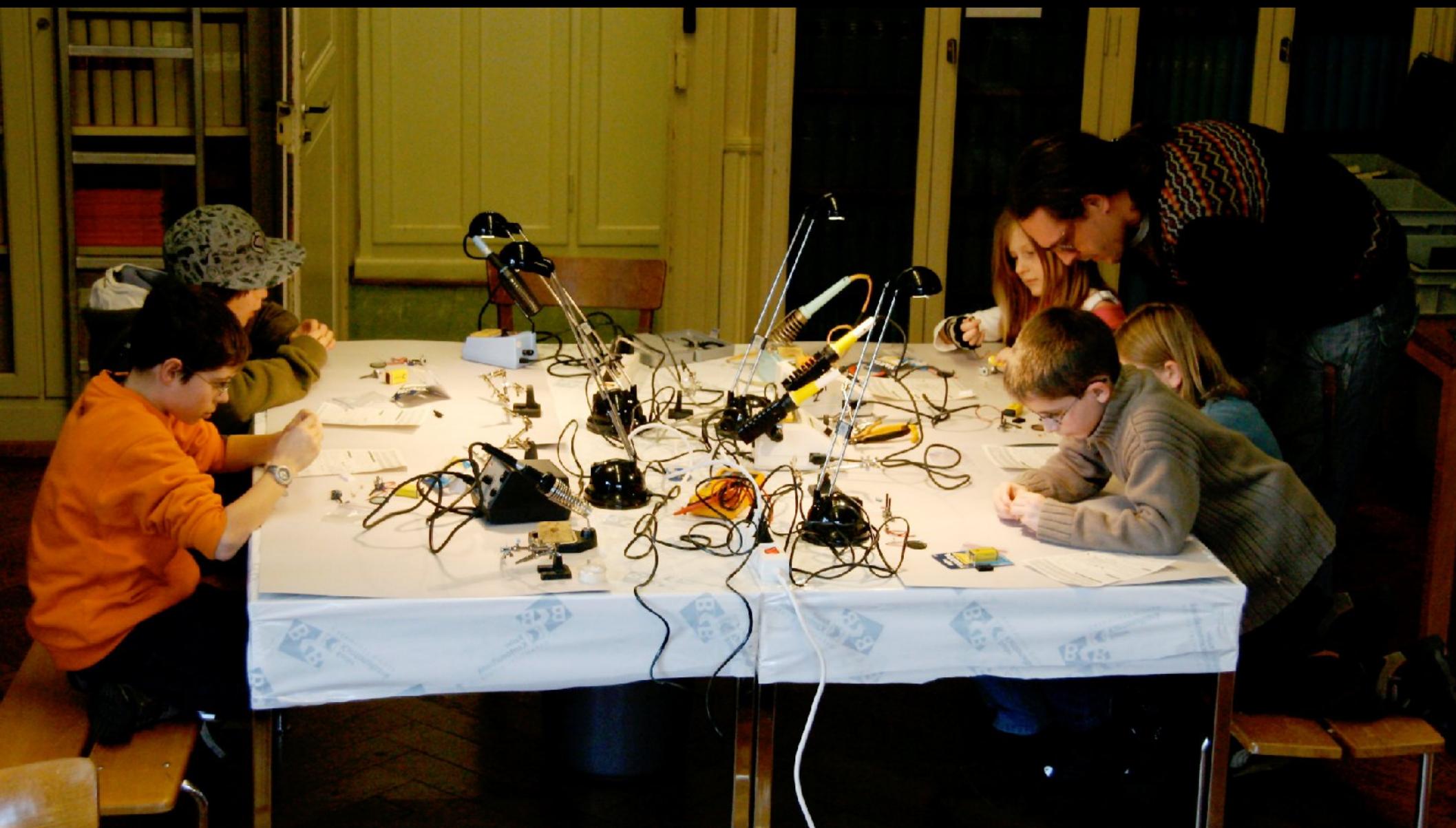
SSAM Société Suisse d'Art Méchatronique

SGMK Schweizerische Gesellschaft für Mechatronische Kunst

www.mechatronicart.ch







MechArtLab



CD4093BE
RCA H 936

SGMK 08

diy makeaway

Krachmacher bauen mit der Schweizerischen Gesellschaft für Mechatronische Kunst

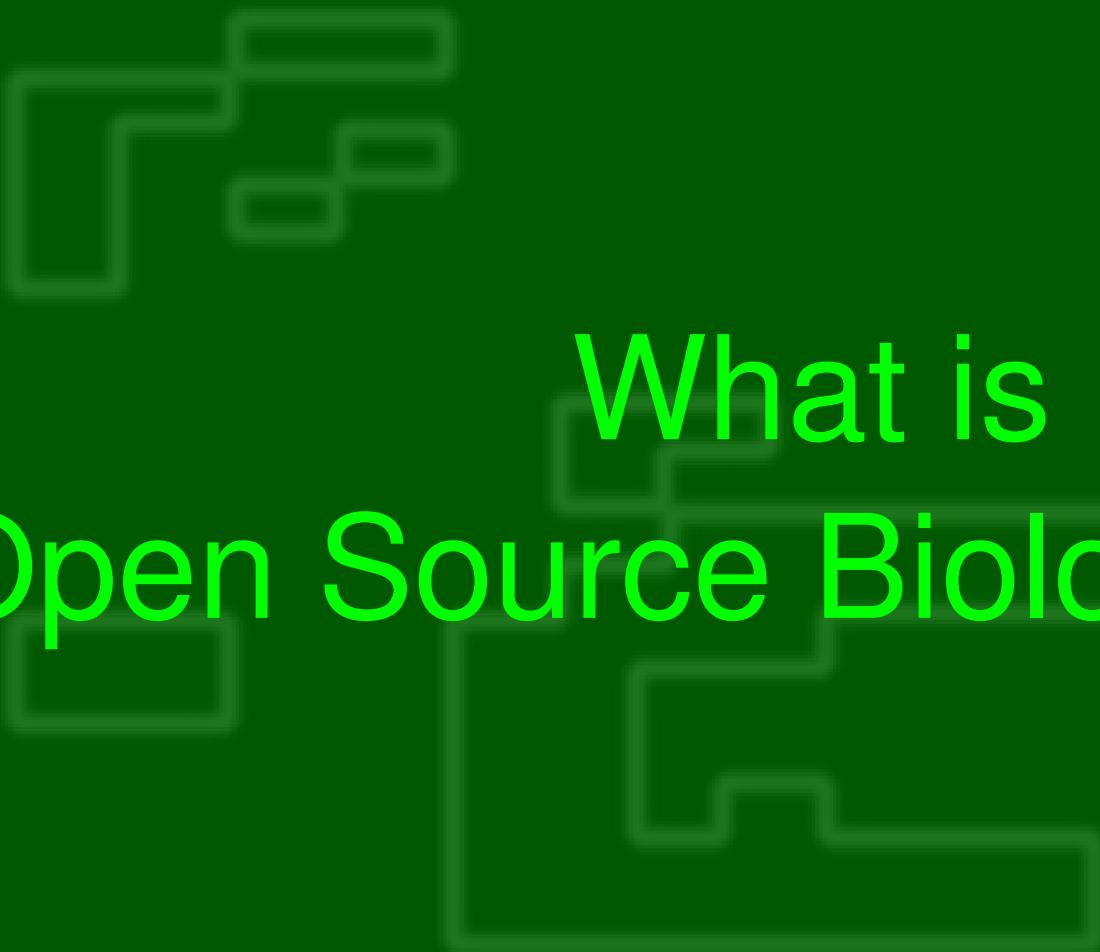


SHIFT
ELECTRONIC
ARTS
FESTIVAL
DER
ELEKTRONISCHE KÜNSTE
28.–31.10.

2010

diy डीआईमेकॉवे

Krachmacher bauen mit der Schweizerischen Gesellschaft für Mechatronische Kunst



What is
Open Source Biological Art?



HACKTERIA.ORG

Open Source Biological Art

Collaborators

Marc Dusseiller (Switzerland)

Yashas Shetty (CEMA, Bangalore)

Andy Gracie (Spain)

and more....

<http://hackteria.org>

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



Background: Interactivos?'09



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.

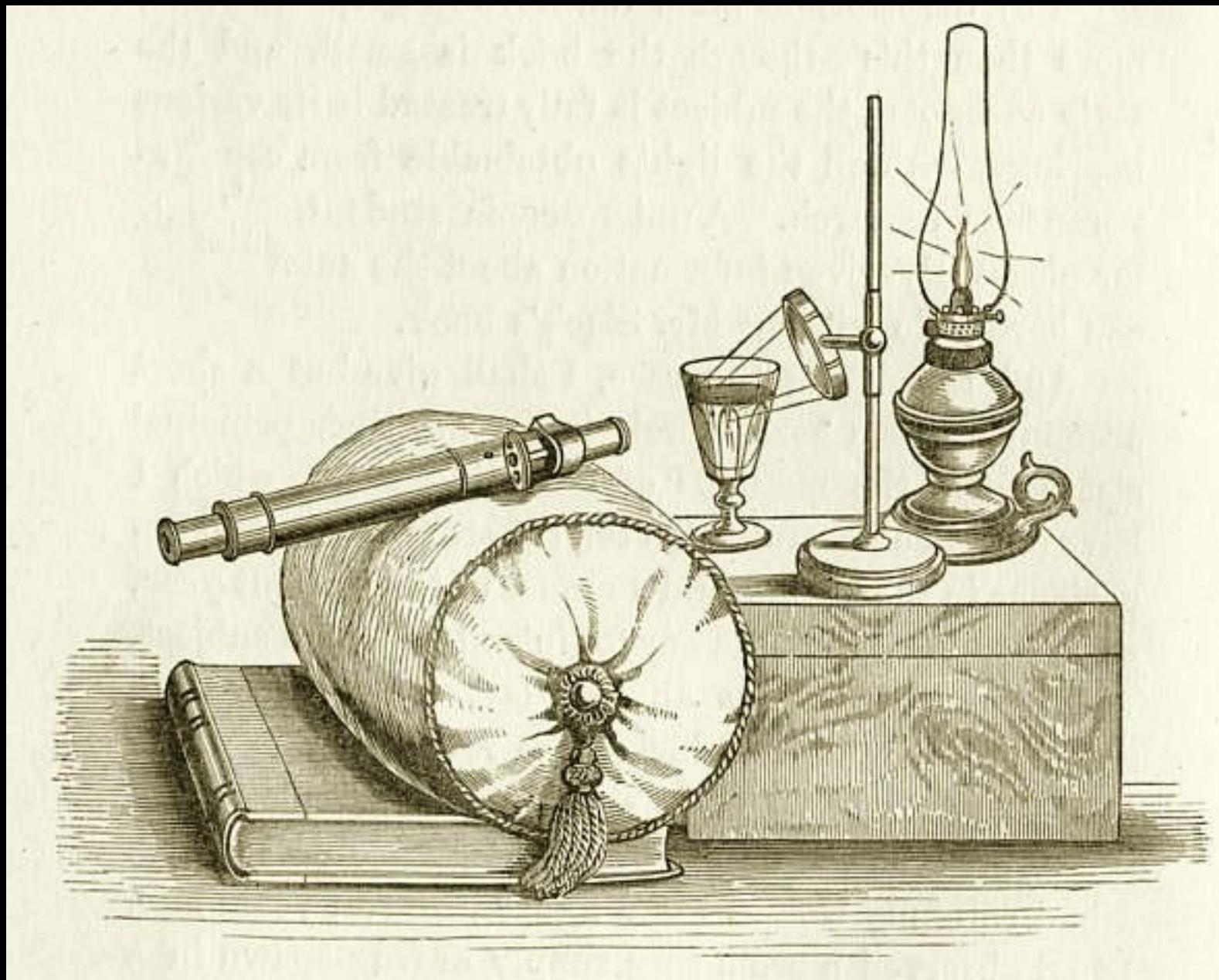
Today:

"A clever solution to a problem."

„An appropriate application of ingenuity.“

Hacker's Jargon

Microscopy – Victorian Scientist

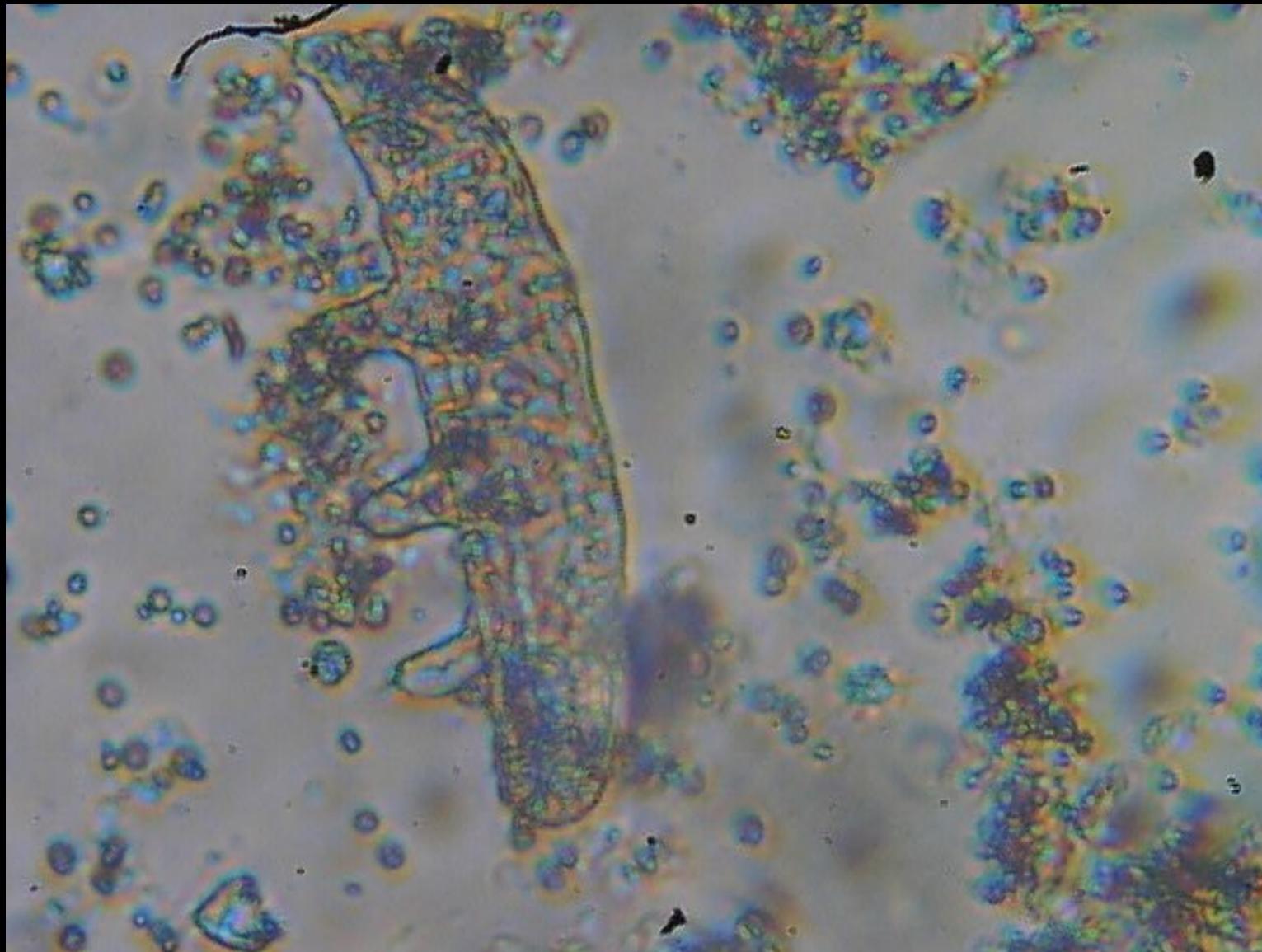


DIY Microscopy – hacked Webcam



Repositioning of the lens turns a
cheap webcam into a microscope

Yesterday's Experiments



Waterbear, *Tardigrada*, sadly its dead...

House of Natural Fiber – Yogyakarta

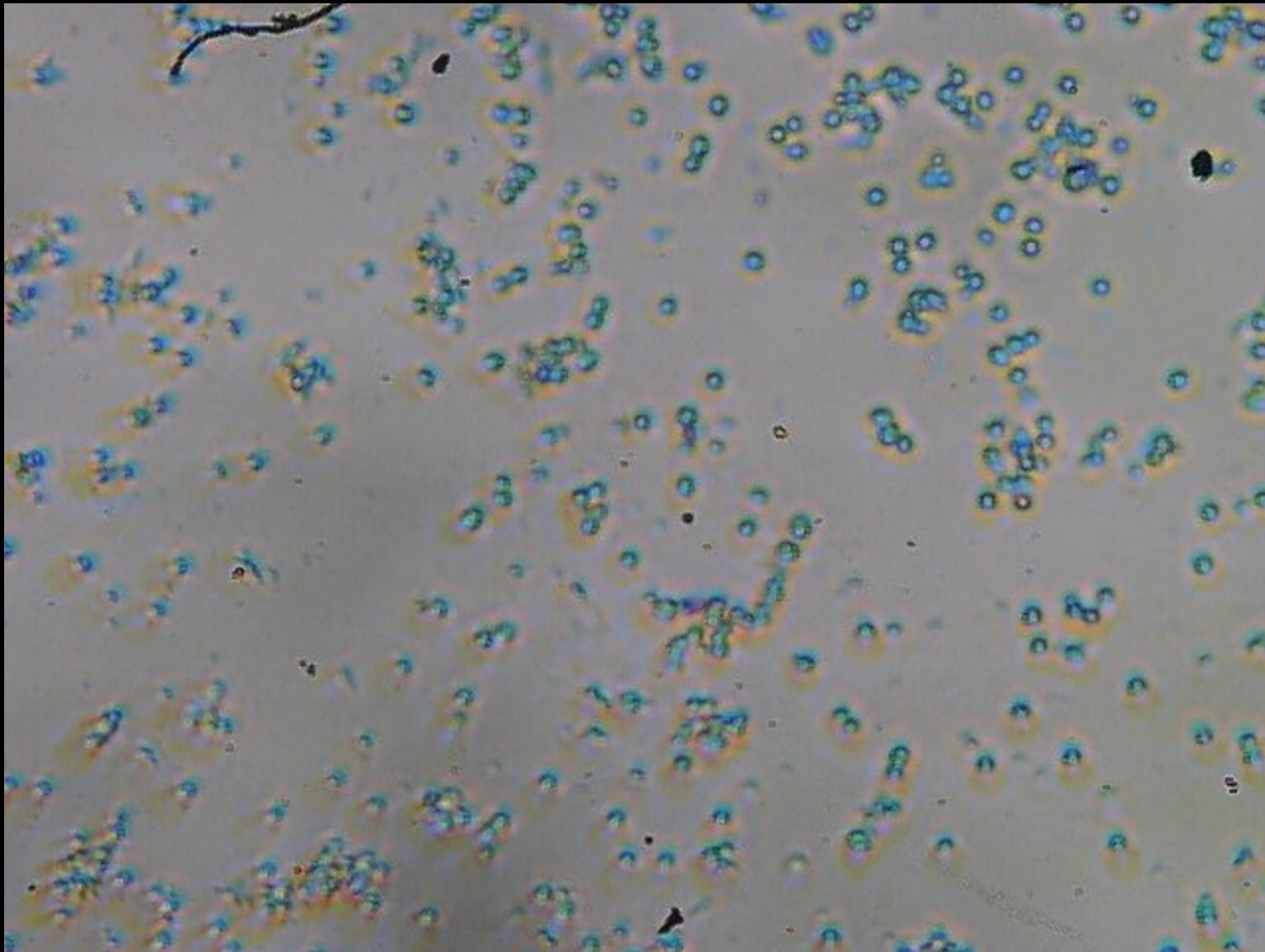


Haemocytometer – PS3 Eye Hacks



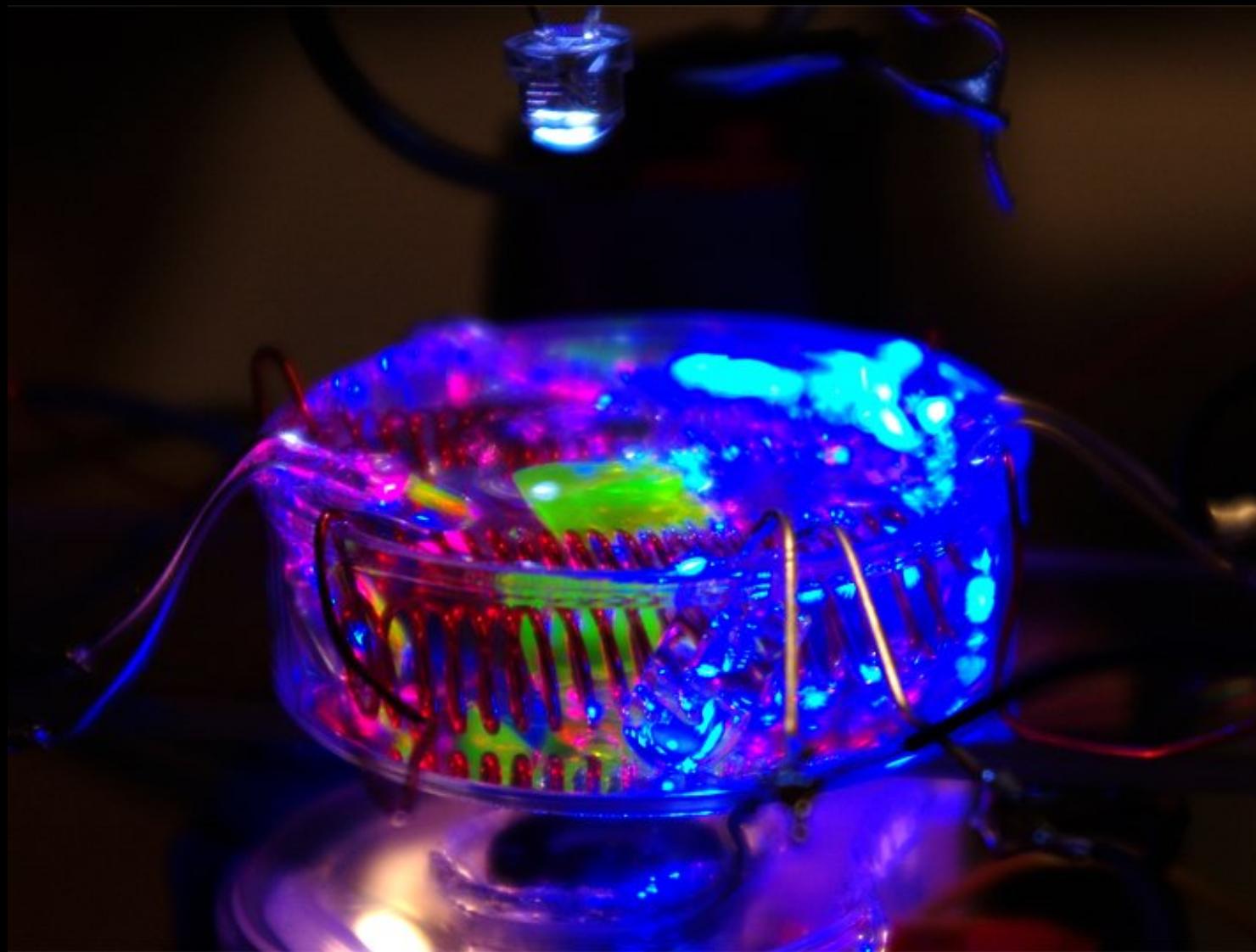
Collaboration with House of Natural Fiber and UGM, Yogyakarta

DIY fermentation



Yeast, *Saccharomyces cerevisiae*

Bioelectronix for Artists



Workshop with Andy Gracie

CEMA – Bangalore

Srishti School for Art, Design and Technology



International Genetically Engineered Art Competition

Hackteria & CEMA @ IGEM



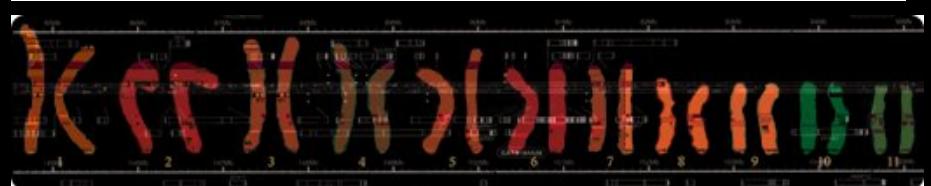
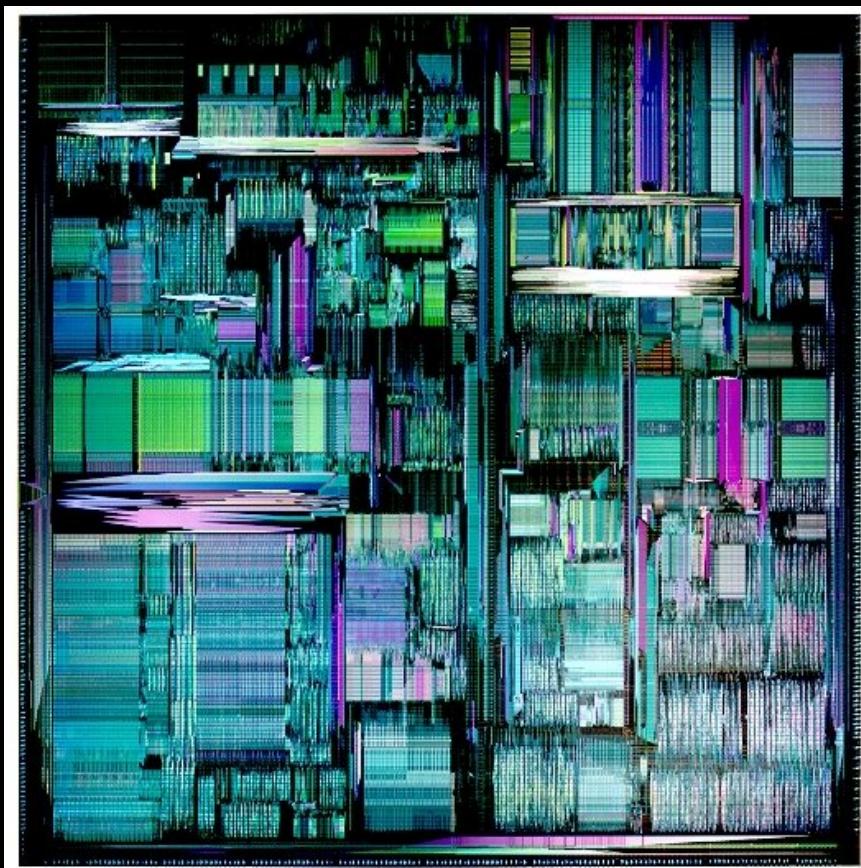
International Genetically Engineered Machines Competition

Yashas Shetty, CEMA – Bangalore

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

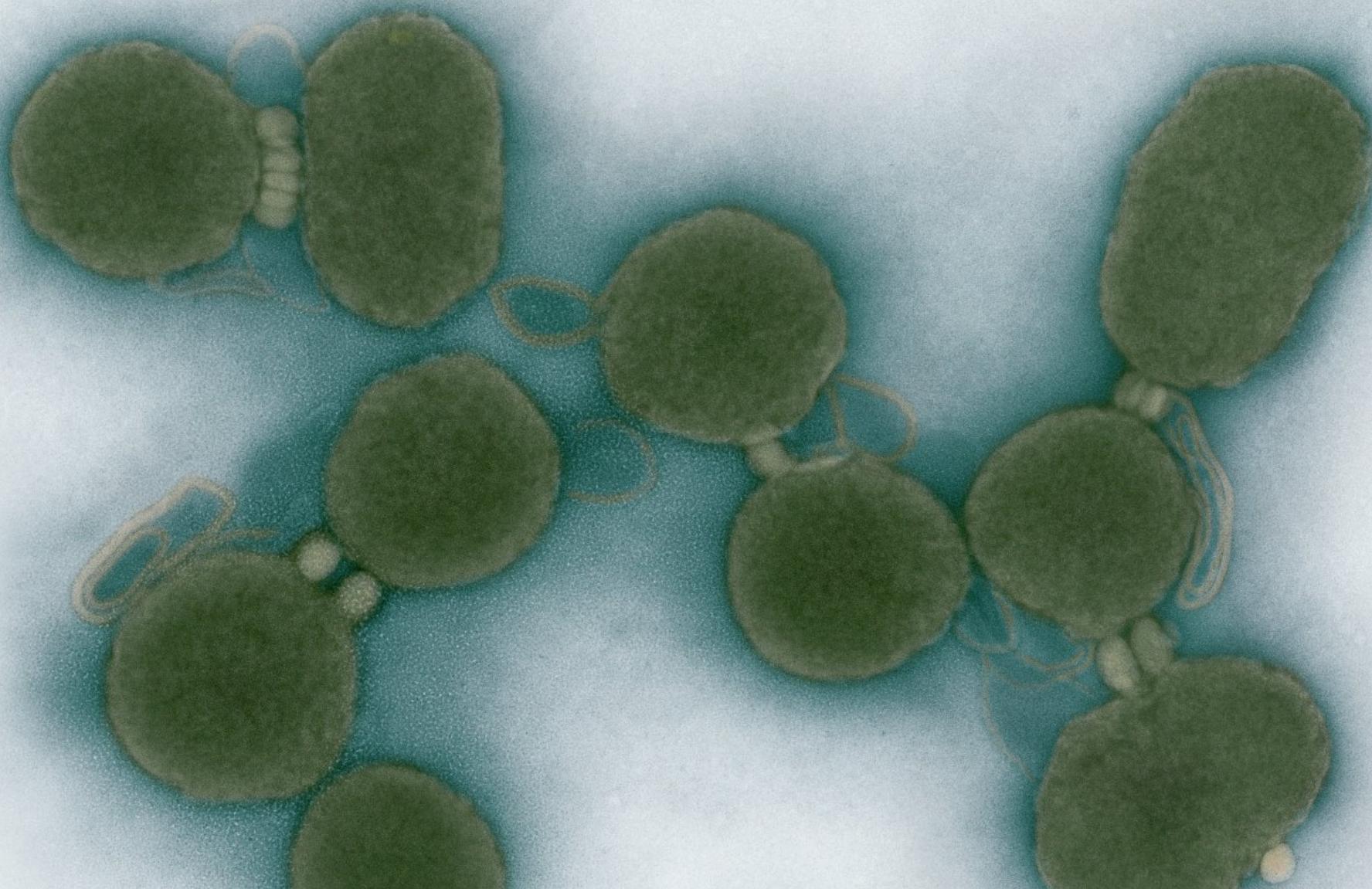
"There is the obvious reasons that all outsiders bring in unique perspectives to any form of thinking-the artist/hacker has the courage to ask "stupid questions" which may not turn out to be stupid at all. the other is that the hacker/artist/designer may also come from spaces in which the technology 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."

From Computers to Genes



Synthetic Biology

Mycoplasma mycoides JCVI-syn1.0



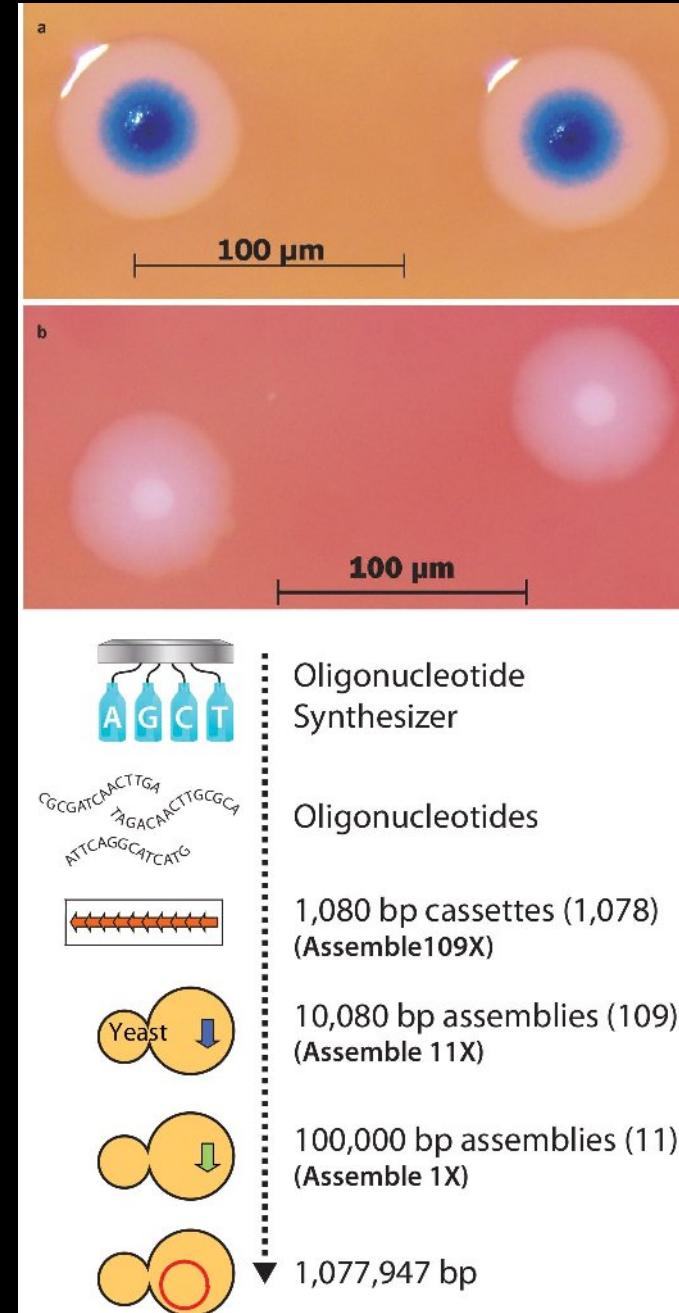
Synthetic Biology

What is Synthetic Biology

- the design and construction of new biological parts, devices, and systems
- the re-design of existing, natural biological systems for useful purposes

What is a Synthetic Cell?

- Self-replicating organism defined by synthetic chromosomes
- Process:
 - Design
 - Synthesis
 - Assembly
 - Transplantation
- Terminology
 - Hardware, Software, Bootable Systems



What's next?

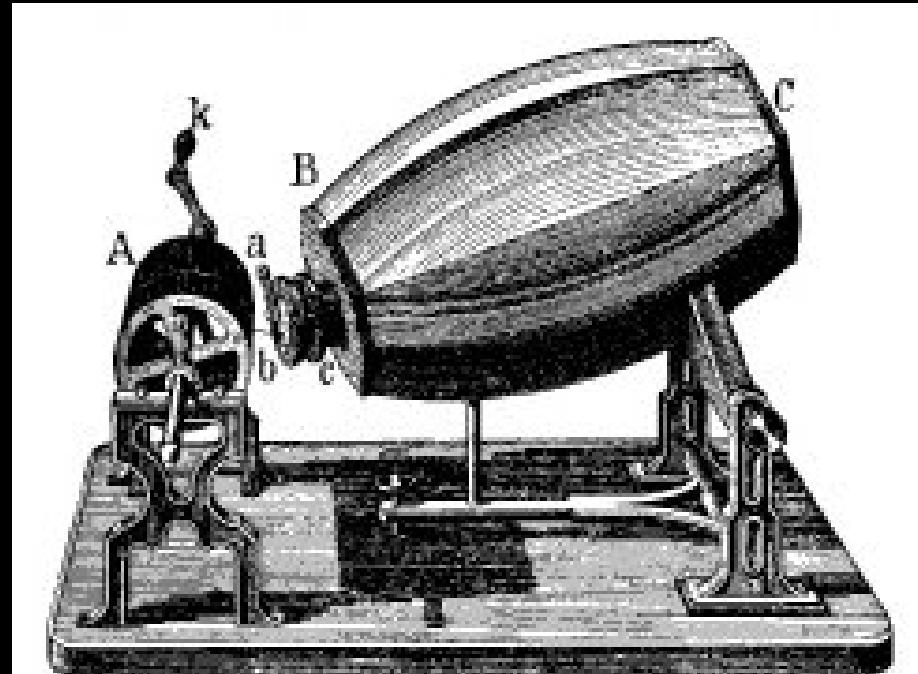
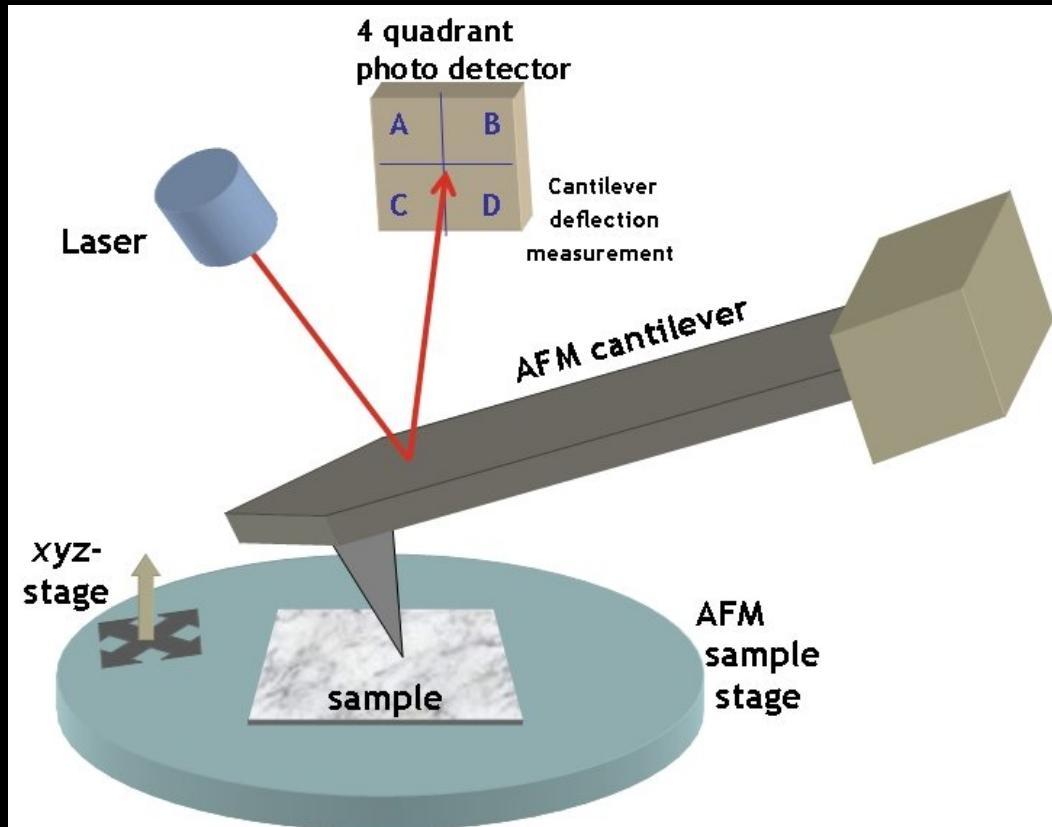


Art|Sci IGEM team, Bangalore, 2010

NanoŠmano, NanoPunk and the Hacking of Future

Stefan Doepler, Marc Dusseiller, Bostjan Leškovsek
Kapelica Gallery, Ljubljana, SLO | 20.9 – 1.10.2010

Atomic Force Microscope (AFM)



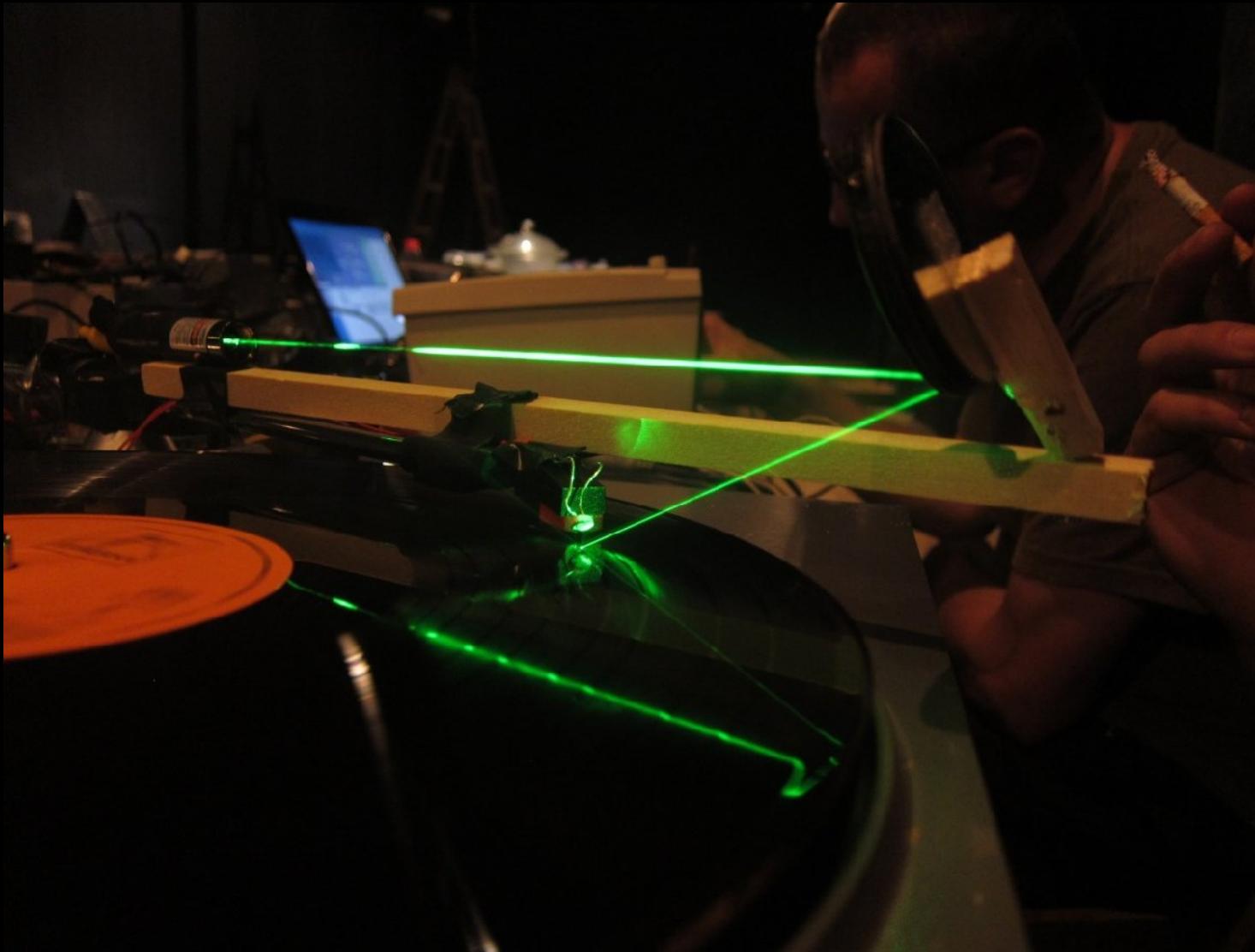
Phonograph.

BC, barrel with opening at C; a, brass tube with membrane and style at b, and movable piece e, by which the position of the social points can be regulated; A, handle to turn cylinder (d) covered with lampblackened paper.

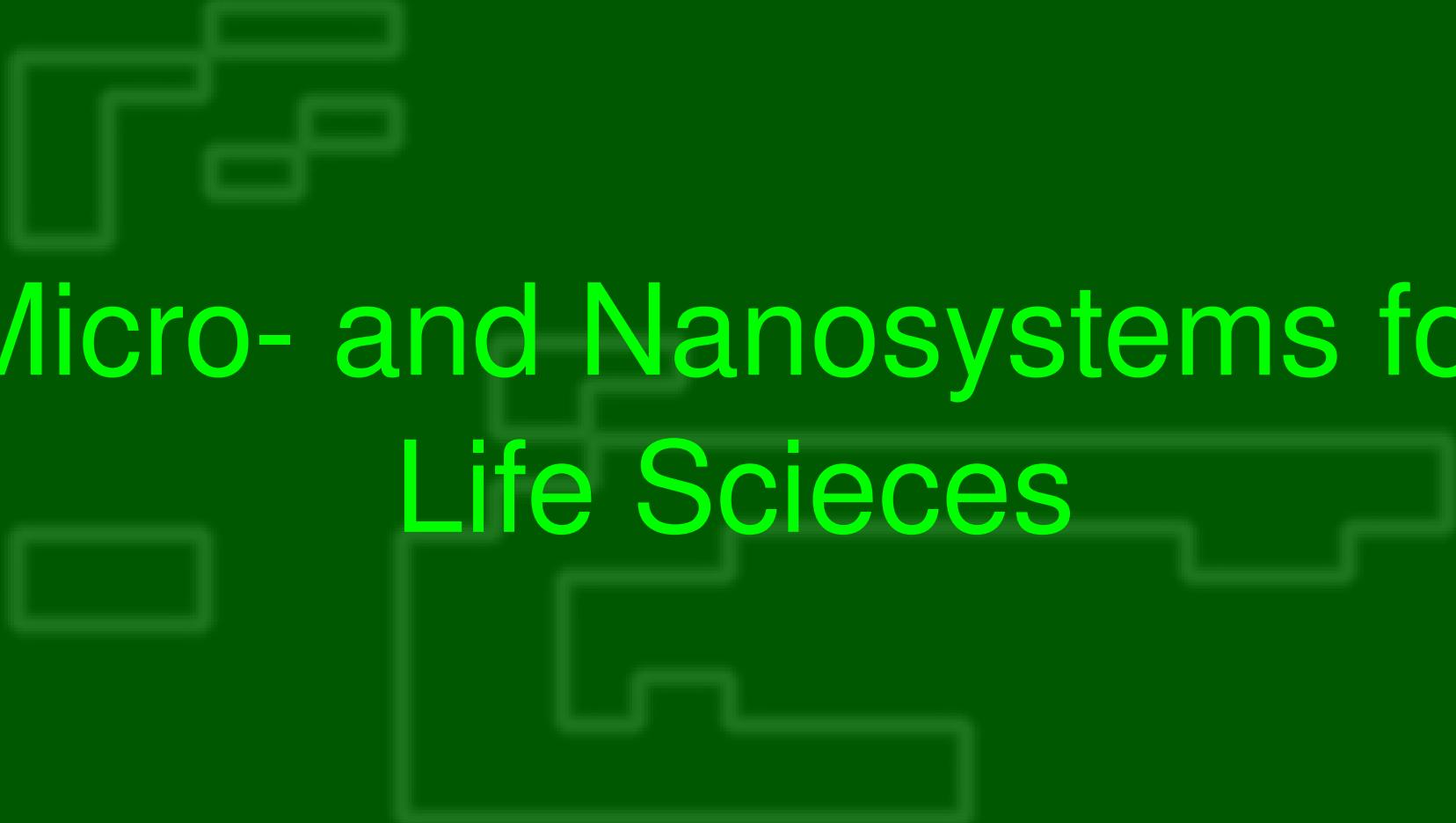
Typical AFM setup. A microfabricated cantilever with a sharp tip is deflected by features on a sample surface, much like in a phonograph but on a much smaller scale.

from Wikipedia

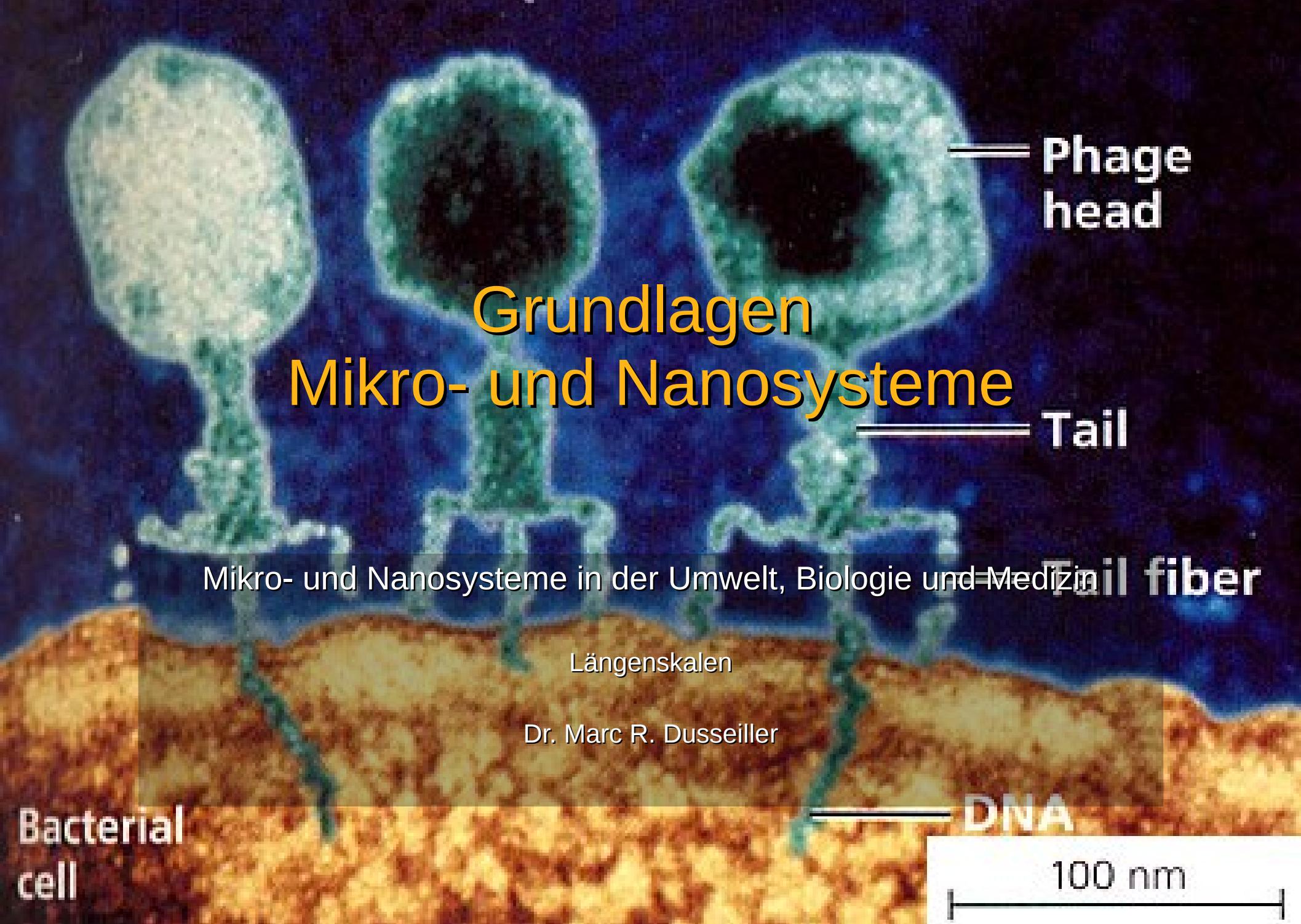
NanoŠmano Turntable



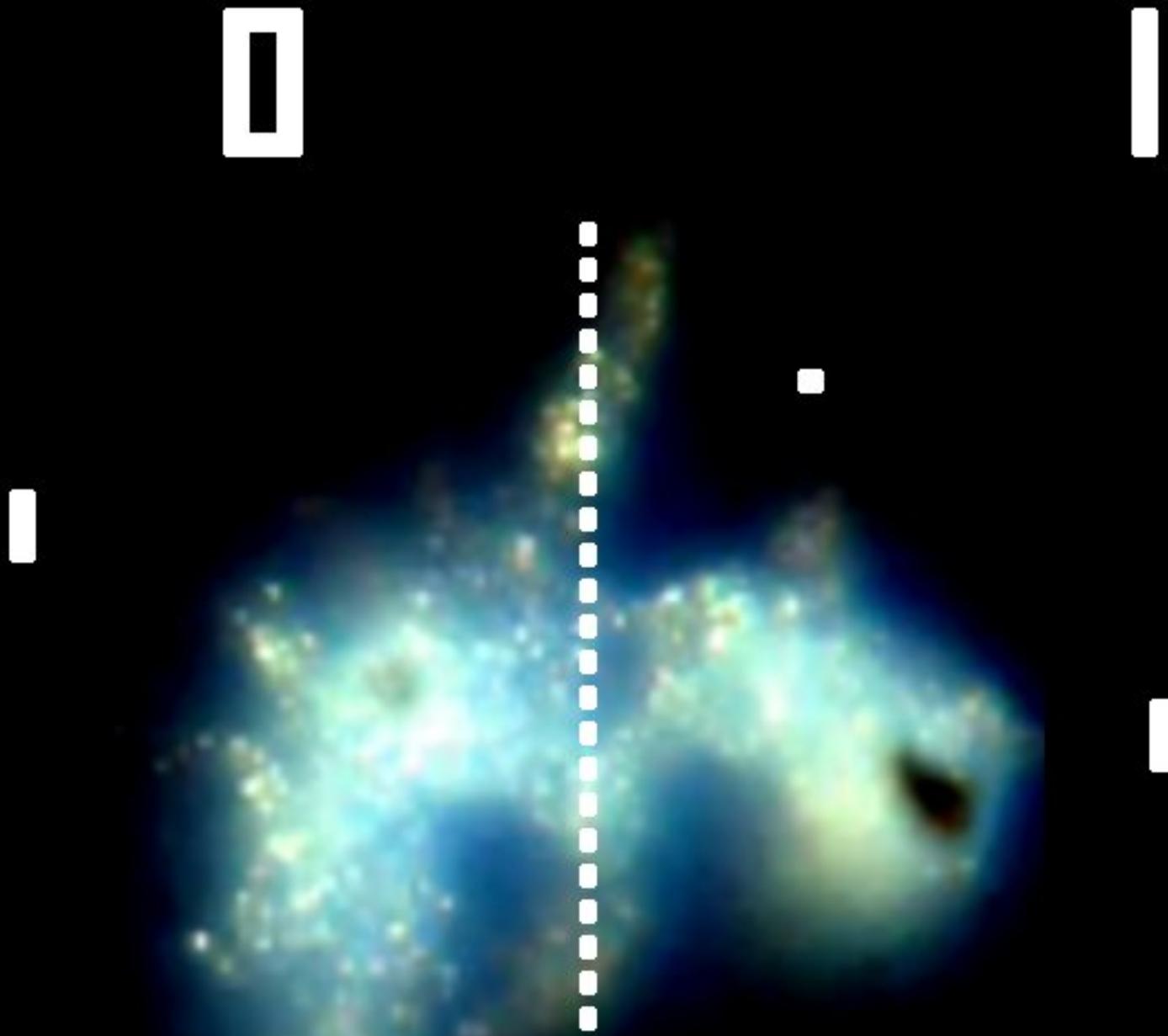
Accoustic Fuck Microscope (AFM)
Bostjan Leškovsek



Micro- and Nanosystems for Life Sciences



LabCourses for MedTech Students



wetPONG

A creativity approach to project based learning in microfluidics

Marc R. Dusseiller *#

Fabienne Amacher *, Boris Budesa *, Niki Chantziaras *, Fabian Fässler *, Gregor Imboden *, Corinne Keller *,
Matthias Näf *, Daniel Pasku *, Robert Uehlinger *, Benjamin Wyss *

* School for Life Sciences, University of Applied Science Northwestern Switzerland FHNW, Switzerland

Swiss Mechatronic Art Society, SGMK, Postfach 2161, CH-8004 Zürich, Switzerland



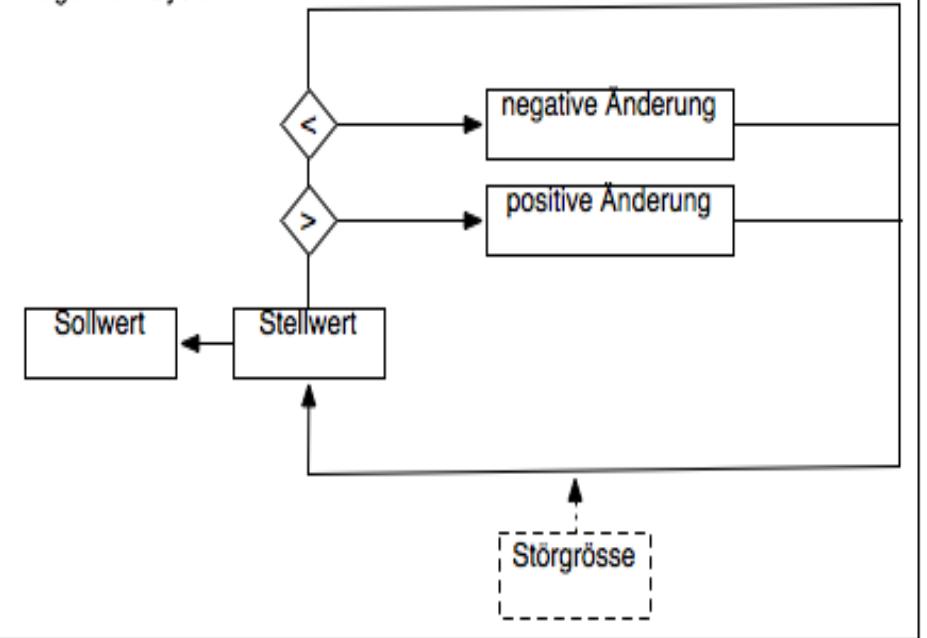
HomeMade Microfluidics



Slow Games

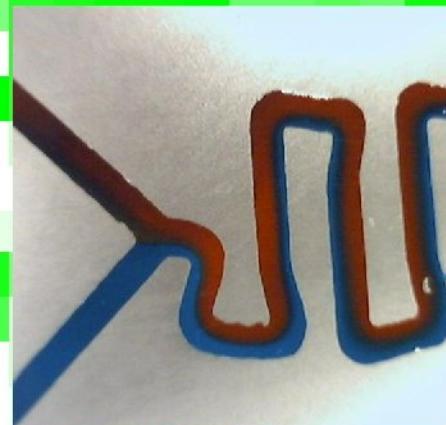
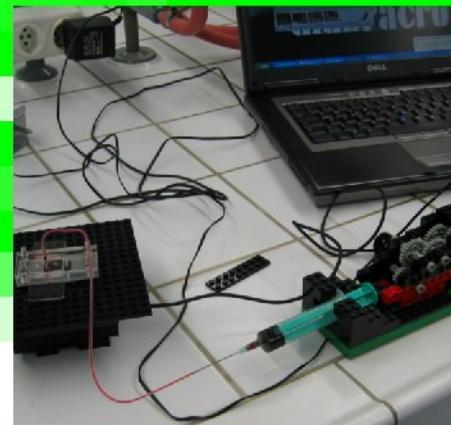


Regelwerk/System:



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.

Open Questions

- How can we teach creativity?
- How can designers profit from collaborations with the sciences?
- Is a transdisciplinary education crucial for innovation?

Thanks for listening



