Graduation Magazine

February - April 2015

waag society

This publication is made by Waag Society, institute for art, science and technology. Waag Society develops creative technology for social innovation and cooperates with cultural, public and private partners.

Editor: Pieter van Boheemen
Contributors: listed on page 30 and 31

Waag Society - St Antoniesbreestr. 69 - 1011 HB Amsterdam - waag.org

Meet a new breed of hackers

Pieter van Boheemen

"in 10 weeks build, use and share your lab"

At the turn of the 21st century the Human Genome Project was declared complete. A new era began in which living material and life itself became a medium of design and technology.

However, the ever accelerating pace of research in the life sciences has created a divide between those who understand it and those who don't. Making it impossible for those outside the field to formulate useful and desirable applications and have opinions about it.

So now more than ever is the time to strip away scientific jargon and tear down those boundaries in order to start exchanging ideas, prototype products, formulate future visions, and establish a meaningful relationship between biotechnology and society.

This magazine summarizes the outcomes of the first BioHack Academy. An attempt to make biotechnology "hackable", meaning open, free, accessible, adjustable, playful, creative, collaborative, inclusive and simply better.

The challenge to the participants was to build their own lab in 10 weeks. Use it for what ever they felt was relevant and share it with the world.

Over 60 people on three continents simultaneously started setting up their projects. Mostly in partnerlabs in Barcelona, São Paulo, Rome and Amsterdam, some even on their own, but all connected via video stream.

The results exceed my wildest dreams. I witnessed research into environmental pollution, 3D bioprinting, longevity, typography, biomaterials, bio imaging and microbial intelligence whilst pushing the envelop of internet-mediated collaboration on rapid prototyping. Done by a group of now officialy graduated hackers, with close to zero prior experience in biology.

Congratulations, you deserve it!

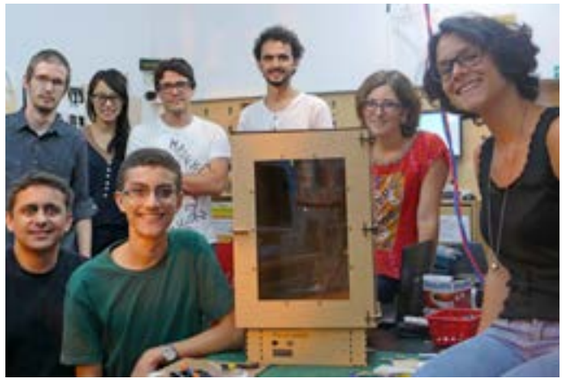
Partner Labs

DIYBio Barcelona

Barcelona, Spain

diybcn.org

Garagem FabLab



São Paulo, Brasil

garagemfablab.com

Roma Makers

Rome, Italy

romamakers.org

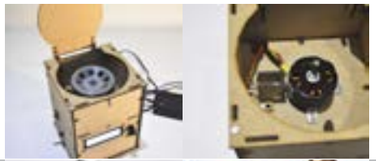
Waag Society's Open Wetlab

Amsterdam, The Netherlands

waag.org

The Challenge:

Build, use, hack and share this

1. Incubator	*February 17*	
2. Microscope	*February 24*	
3. 3D & 2D design	*March 3*	
4. Sterile Hood	*March 10*	
5. Centrifuge	*March 17*	
6. Magnetic Stirrer	*March 24*	
7. Spectroscope	*March 31*	
8. Pumps	*April 7*	
9. Bioreactor controller	*April 14*	
10. Graduation...	*April 21*	

Hack It Together

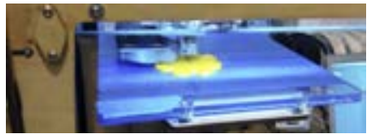




















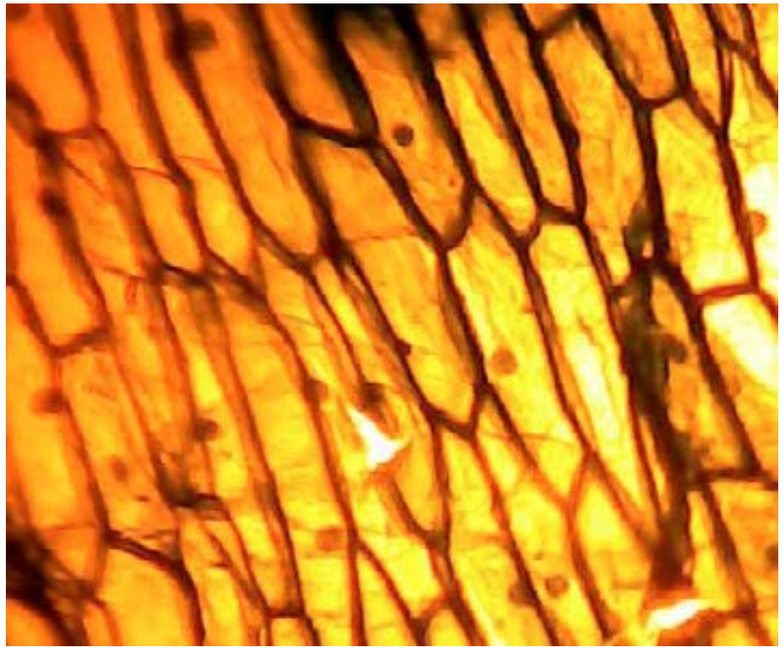

Introduction by

María Boto Ordoñez

More than half a year ago Pieter told me “we are going to organize the first Biohack Academy”. A couple of months later about 10 participants signed to be part of it. Working together with the participants has been a really nice experience: thanks to all of you to let me take part of your crazy ideas and projects.

During this period I have been fascinated with Tamara’s energy to experiment with everything that she found in the lab. Vittorio demonstrated us that no matter the inconveniences, if you want to do something you will get it done. Eline’s typography filled the lab with color bacteria letters (and her house too) and Toni was not only the master of worms, he was the most curious participant and the learning was mutual. The transition from architecture to a biolab was carried out by Giacomo and his growing (potato) structures. We found some real hackers like Martin and Dragoslav who modified the original prototypes and Claudia, who moved from the wetlab to the fablab. Soon we will also see Jamillah’s cellulose converted into a design table and Jurgen and Eiso slime molds races. And finally Alice, Yuan and Gerrit, that came for few but very efficient days.

Amplifying life



This is an image of onion cells under a microscope camera made during Biohack Academy. What is surprising is that the nuclei are evident even with only a few micrometers in length. The color comes from iodine solution used in the experiment. The cell walls are also visible and clear the borders of each cell. There is no doubt that the microscopic world is amazing and building my own simple way microscope made me see how beautiful is nature in all its aspects.

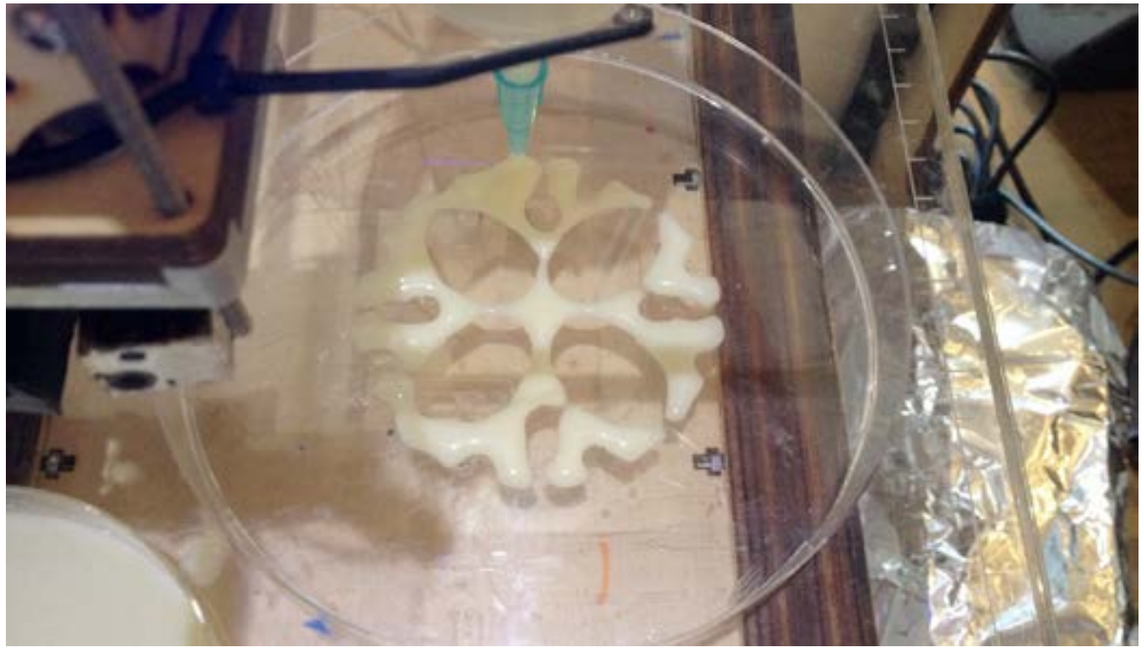
https://hackscientist.wordpress.com/

Eduardo Padilha Antonio

"I discovered an entire new world"

"After this intense ten weeks I have lots of impressions that I intend to keep in my memory forever. Attending to the Biohack Academy was certainly one of the most remarkable experiences I have ever had. Although it sounds like a cliché (and it probably is) it is the sincere truth. Since I was a little boy all I have ever dreamed was to build my own laboratory, perform my own experiments and make science by myself. No need to say that the Biohack Academy made it possible. More than that, I discovered an entire new world which is the world of the Fab Labs, of the maker and hacker cultures. During this weeks I met a group composed of an incredible variety of people from the most different fields such as teachers, students, designers and architects, all of them seeking for a chance to do things by themselves and to open their minds to what seems a very accurate example of the DIY universe. Coordinating the course was an opportunity of being in full contact with science, technology and smart people, all aiming to help this revolution that is bringing to Brazil what is newest in the area. Also it required me a lot of time, effort and patience even when something went wrong. However, after all this time all I want to do is get out and shout for the world how amazing it is to build your own devices, to cultivate your micros and grow something you never tought would be possible. And if someone said it has nothing to do with them I would say it concerns to everyone, each one, because knowledge is public, knowledge is power and is a new way of seeing and transforming the world. That is what Biohack meant to me."

RESONATING SPACES



Giacomo Garziano

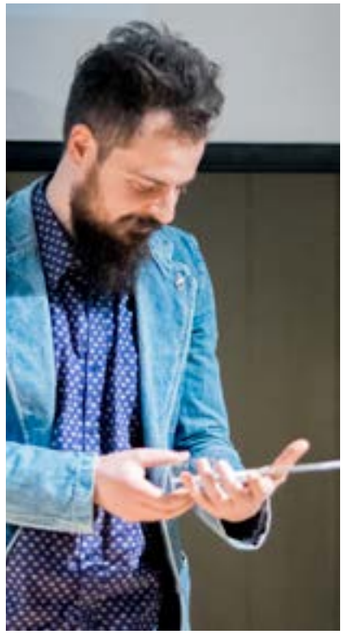
Through the study of the analogy between forms and patterns of sound and of nature, we are conducting experiments concerning a different mechanical way to stimulate matter. Petri dishes and flasks hosting different media for diverse kinds of bacteria, algae, kombucha or fungi are exposed to precise vibratory frequencies. Through the study of models in nature, prototypes of integrative, self-assembling, self-organizing architectonic structures are created. A 3D-printer is hacked to host this system and extrude agarbased or bioplastic structures as a bone system. This structures host colonies of bacteria, algae, kombucha or fungi to function as a membrane.

Sound as source of energy and matter on the smallest scale as vehicle of this energy can create harmonic structure propagating from atomic geometries to full scale living organisms.

Digital generative simulation together with 3D-printing prototyping can lead to three-dimensional harmonic architectural sequences.

gg-loop.github.io

“self-assembling, self-organizing architectonic structures”



DIYBio BCN

(left to right): Nuria Conde, Esteban Gimenez, Alvaro Jansà, Daniel Grajales, Óscar Gallardo

DIYBio BCN is a group established on Barcelona and formed by engineers and biologists. We want to involve citizens, researchers, designers and artists in biotechnology projects. In order to involve these players, we offer workshops and technical support. BHA01 has been a hard-as-fun course, and also has helped us to reach new members.

“citizens, researchers, designers and artists”

www.diybcn.org/

papertable

cellulose under water

Jamillah Sungkar

BIOHACK ACADEMY PROVIDED ME WITH AN INSPIRATIONAL SPACE AND LOTS OF KNOWLEDGE TO START MY MATERIAL RESEARCH ON BACTERIAL CELLULOSE THAT IS PRODUCED BY „ACETOBACTER XYLINUM".

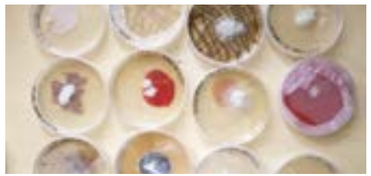
THIS BACTERIA CREATES AN ARCHITECTURAL STRUCTURE LEAVING BEHIND A STRONG LEATHERLIKE POLYMER.
THE TRANSLUCENCY AND STRENGTH OF THIS ORGANIC MATERIAL WILL BE THE BUILDING BLOCKS OF A TEMPORARY TABLE THAT I WILL DEVELOP FURTHER

"building blocks of a temporary table"

PAPERTABLE.GITHUB.IO
JAMILLAH.GITHUB.IO

Textilus Posterus

Tamara Hoogeweegen




I developed textiles for the world of tomorrow. In 2050 we have to deal with issues of overpopulation, food crisis, alternative resources and provide people with garments, and all of this in a sustainable way.

With this world in mind I see great opportunities for biotechnology to help us out. Therefor I'm working on growing textiles by using bacteria and mycelium.

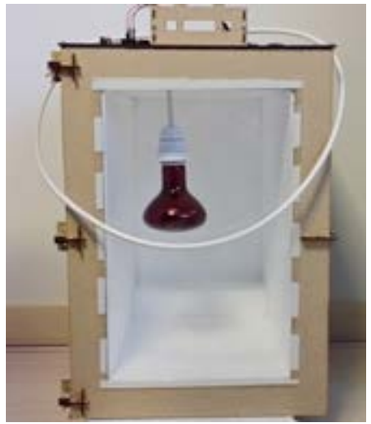
http://tamaratomoro.github.io/


"textiles for the world of tomorrow"




Claudia Marginean

http://claudiasbricks.github.io/



"I was a bit worried about this part"

I've been working on my meat barcoding experiment for a year now in the Wetlab, which is separated from the Fablab by just a door, but this was the first time that I've ventured into the Fablab. The purpose was using the laser cutter to cut the mdf wood based on the svg sketches provided by Pieter. After the initial moments while the software, the equipment, the instructions are not familiar, things start to make sense and one starts to agree with the shared opinion that using the laser cutter is like using a printer. "Just remember to turn this lever or the machine will catch fire!" And 2 to 3 hours later I had all the pieces needed to build the box for the incubator nicely cut, with a faint scent of burnt wood and ready to be assembled. This was my favourite part by the way - putting together the various panels - it was just like assembling a puzzle.

The incubator has to maintain a fixed temperature inside and to achieve this the first thing needed is a heat source. In my case the heat source is an infrared bulb connected to the 220 power supply plug and controlled via a relay by Arduino. I was bit worried about this part, so I had someone show me how it's done and I have to admit that now I find it pretty easy. The images on my wiki More than half a year ago Pieter told me "we are going to organize the first Biohack Academy". A couple of months later about 10 participants signed to be part of it. Working together with the participants has been a really nice experience: thanks to all of you to let me take part of your crazy ideas and projects.
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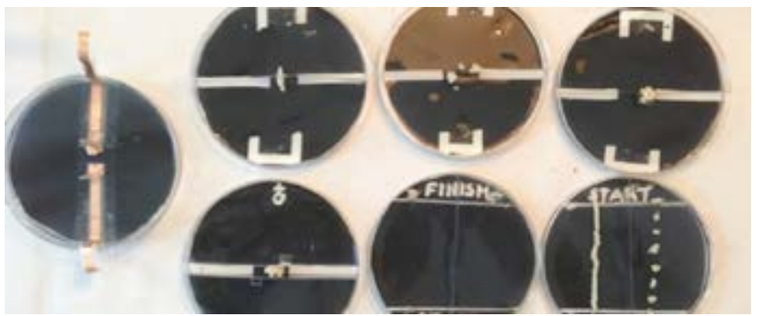
Jurjen Rolf & Eiso Vaandrager

http://jurminator.github.io/

The slime mold official name is: Physarym Polycephalum (PP). The PP is an amoeba. An amoeba does not have a clear cell wall so one could say that it consists of one large cell. The PP searches for its food (primarily starch based food like decaying wood) through growing 'tentacles'. Once it has found a food source the 'tentacle' that did not find any food retract. Between the food sources a 'tentacle' remains. The PP pulsates at a speed of 1:90 seconds. This allows the PP to 'communicate' and transport its food through its 'tentacles'. If it's too dry and there is too much light, the PP retract and will create spores.

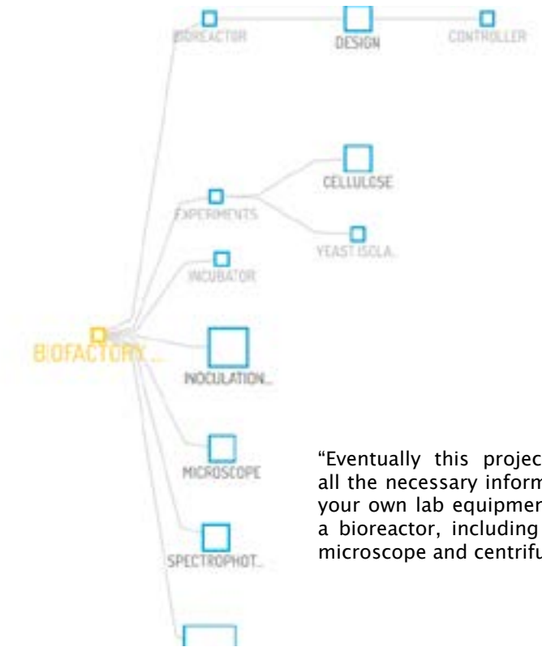
Our goal is to create a slime mold racetrack, allowing different slime mold cultures to compete against each other on a race track and meet the finish line or capture the flag. Possibly we will broadcast the races and allow designs of racetracks to be sent to us by the community.

"create a slime mold racetrack"

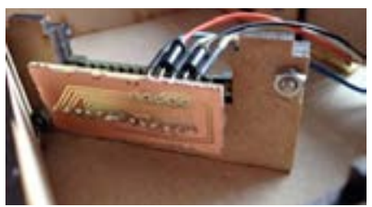


Gerrit Niezen

https://www.wevolver.com/gerrit.niezen/biofactory



"Eventually this project will contain all the necessary information to build your own lab equipment to construct a bioreactor, including an incubator, microscope and centrifuge."



Vittorio Milone

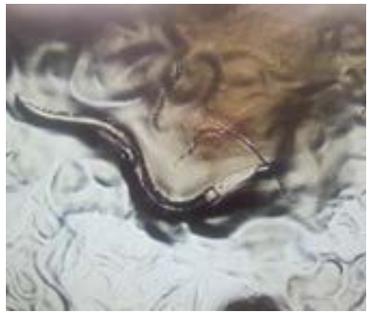
http://vittoriomilone.github.io/

"So far I tried to print the barrel for the microscope (and it went fine) and the rotor for the centrifuge: apart from the fact that for the centrifuge I could only find a different motor from the one suggested in the bill of material, before 3D printing the whole part I was also instructed to perform some preliminary tests of the part of the rotor critical for this design: the central hole in which the motor shaft should tightly fit in. The yellow rotor is nice to see, but it does not work as the hole for the shaft is a bit too big for the motor..."

Antonio Garcia

https://tg4259.github.io/

"recreating life extension"



Is aging a process that can be stopped, slowed down or even reversed? These were some of the questions that I wanted to see if I could answer by recreating life extension/longevity studies that I had read about in science publications where the life span of animal models was increased by 10–20% or more. These studies indicated that aging was a controllable process that could be hacked, by inhibiting mTor pathways. It is speculated that this pathways has evolved in animals to allow them to survive when they come under stress by lack of food, and helps them survive until food is more abundant. This process can be hacked by CR caloric restriction or the use of Rapamycin, both mTor inhibitors. Once I got comfortable in the lab I would use the skills learned at the BioHack Academy to see if the experiments could be duplicated and if the results would be convincing.

Eline van der Ploeg

http://elinevanderploeg.github.io/endexam/biohack.html

Living Systems

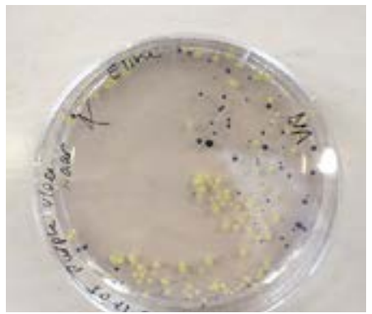
What is it? — Systems and tools to partially influence the growth process with room for unexpected outcome. A balance between completely random and fully controlled.

What does it do? – Research ways to use biological material that shape the design and skeleton of typography. This in which the shape isn't determined by me but by the material itself.

Why? – My graduation is about living systems that alter the skeleton or design of a letter and evolving it into type. In my work I'm always looking/ searching for rules and systems that can generate dynamic results. Our alphabet is an ancient system and we are conditioned with it. We are used to it, aware of it, and it is a familiar set of symbols for communication. In my project I'm trying to let the biological material engineer this system of fixed rules.

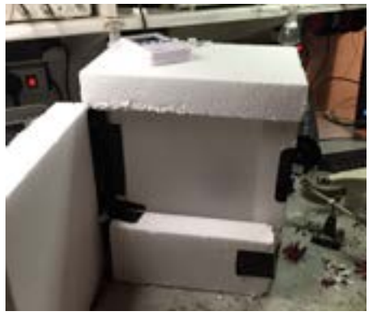
I see this as a undoing project, it will be a journey for the development of several experiments.

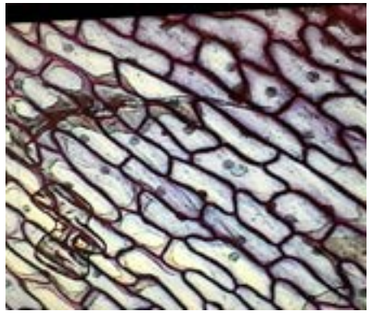
"rules and systems that can generate dynamic results"



Martin Havranek

https://github.com/MartiniMartin/Biohack-Academy

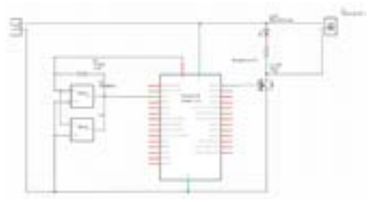




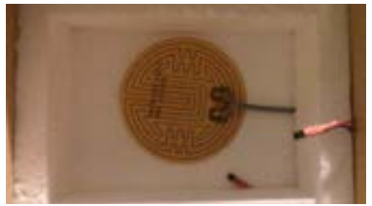
Dragoslav Pavkovic

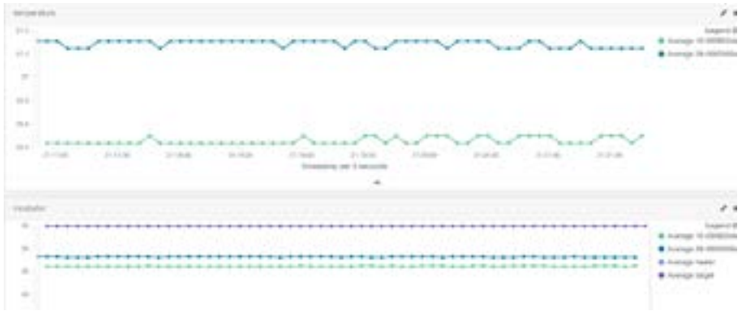
http://dragoslav.github.io/diy/

I have enrolled for BioHack Academy at Waag Society Amsterdam. Already completed few Coursera courses related to biology and genetics in general and now it is time to do some practical things. I expect to build Open Source hardware for my own biofactory and start growing biomaterials.



"time to do some practical things"





Creator of the living certificates:
Günter Seyfried







Grow your own yeastograms! The recipe can be found on http://pavillon35.polycinease.com

Many, many thanks to:

The Graduates

São Paulo

Roberto Stelzer
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Rodrigo Abreu
Paulina Achurra
Renato Ganzioli
Otto Heringer
Rita Wu

Rio de Janeiro

Ricardo Palmieri
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Gustavo Meira Chaves de Assis Pereira
Diogo Monteiro
Camila Coelho
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Irina Shaklova
Miguel Vilaplana
Natalie Alima
Nuria Pueyo
Oscar Gallardo
Oscar Suchill
Ronald Postma
Rosen Ivanov
Théo Lepage-Richer
Xavier Alegre

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Eiso Vaandrager
Jurjen Rolf
Antonio Garcia
Claudia Marginean
Eline van der Ploeg
Dragoslav Pavkovic
Tamara Hoogeweegen
Martin Havranek
Jamillah Sungkar
Vittorio Milone

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Andrea Polli (USA)

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Eugenio Battaglia

Barcelona:

Alvaro Jansà
Daniel Grajales

Amsterdam:

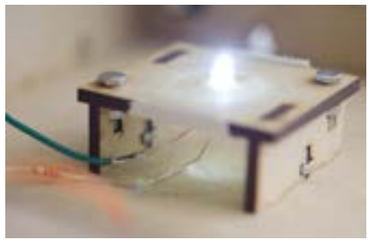
Pieter van Boheemen
María Boto Ordoñez
Veit Penzenstadler
Hany Saad
Zowi Mens
Lucas Evers
Marc Boonstra
Alex Schaub
Emma Pareschi
Tessel van Leeuwen
Jelmer Cnossen

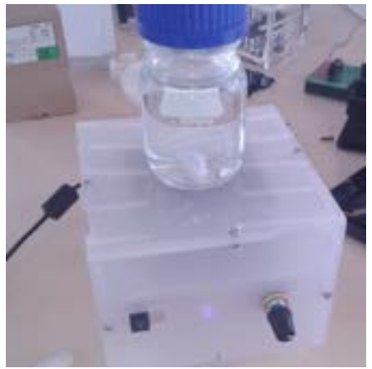
Guest speakers

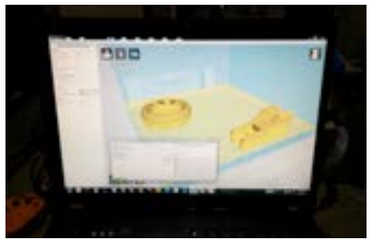
Adam Brown
Günter Seyfried
Rüdiger Trojok

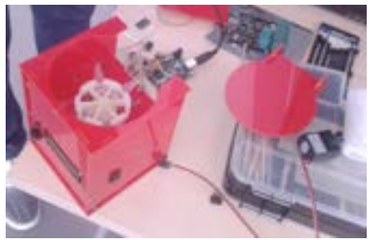

Garagem FabLab
BioHack Academy

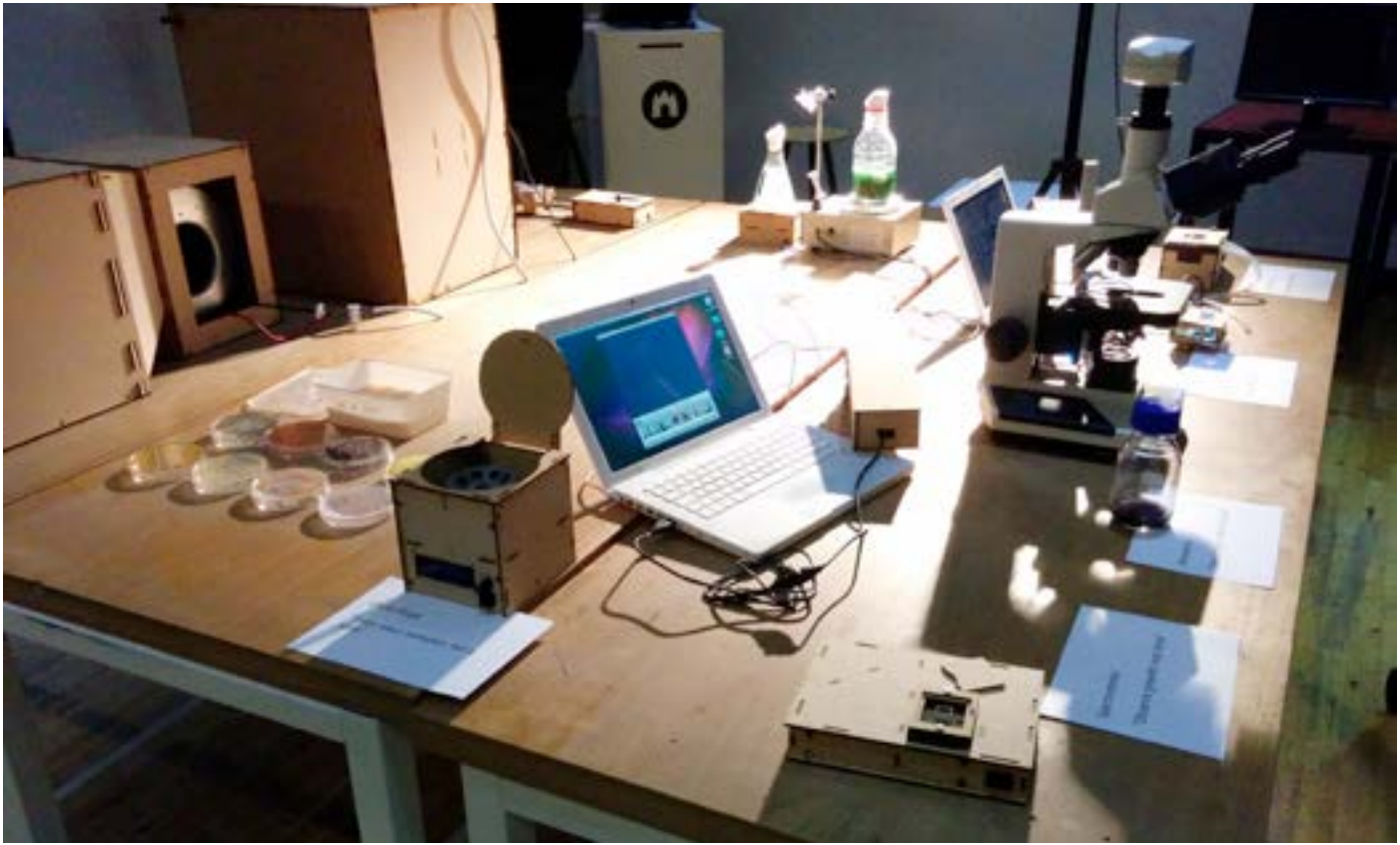

#biohacking











waag society

Do you want to build your own lab too? Sign up for
BioHack Academy 2, starting September 15:

www.waag.org/biohackacademy