



open wetlab  
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# Bio Paper and Ink

*Home grown books*

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wetlab  
workshops



Out of a simple seed a tree grows into beautiful and complex structure. Roots, veins, twigs and leafs all work together to turn the power of the sun into biomass. Nonetheless, we grow tons of these impressive biostructures that end up in a shredder to be reduced to flat sheets of paper. Likewise, the pigment industry is a huge environmental polluter.

In this workshop you will learn how to grow your own cellulose and pigments to make paper and ink. We will use natural micro-organisms. The equipment and ingredients are from everyday sources like grocery stores and pet shops.

All participants will be able to take home their own cultures and continue the experiment together.

**Duration:**

3-4 hours

**Number of participants:**

Max 30

**Subjects:**

Action potentials  
Neuro -signal transmission  
Electromyograms  
Electro-stimulation  
Open Source Hardware

All Open Wetlab workshops consist of an introduction into the subject and it's making, a concise biosafety training, the making itself, an optional artists presentation and a dialogue with the participants about the theme and background of the workshop.

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**Booking:** Open Wetlab Workshops can be booked by contacting [diensten@waag.org](mailto:diensten@waag.org)

# BioStrike

*Open antibiotics discovery*

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The European Centre for Disease Prevention and Control estimates that antimicrobial resistance (AMR) results each year in 25,000 deaths and related costs of over €1.5 billion expenses and losses. The pharma industry is not developing new antimicrobials.

This workshop is part of an ongoing open science initiative to develop antimicrobials in a collaborative and open way. The participants will isolate Actinomycetes from soil samples and screen them for potent antibiotic production. The methods and results will be shared with the global BioStrike community. This raises issues concerning intellectual property and material transfer, which will be discussed in the context of the BioCommons project.

The workshop can be completed in one week, or done over the course of a few weeks.

## Duration:

Day 1: 3-4 hours

Day 3: 3 hours

Day 5: 2 hours

## Number of participants:

Max 30

## Subjects:

Microbiology

Sterile cultivation

Antimicrobials

Collaborative open science

BioCommons

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*Pictures by Martin Malthe Borch*



# Biobatteries

*Electricity from mud microbes*

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Vast areas in the world are not connected to the power grid. When in need of electricity, the people who live there will need to use alternative energy sources. Solar, wind and hydro energy are probably the best known options, but only few people know that bacteria that live in the soil can generate electricity too.

During this workshop we will build our own biomud battery reactors. A series of quick experiments will give insight on how bacteria produce energy and how this can be put to use.

The workshop consists of two parts:

- 1) Setup of the bioreactors and online datalogger.
- 2) Analysing and interpreting the data (after one week).

**Duration:**

3 hours

**Number of participants:**

Max 30

**Subjects:**

Microbial fuel cells  
Metabolism  
Electricity / Conductivity  
Ohms Law  
Soil microbiology

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# Bioforensics

*Tracking down Ebola*

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DNA testing is a powerful measuring tool. It is often used to diagnose genetic diseases and infections. The same technique is used in court to compare biological samples of a crime scene to that of suspects.

During the workshop the participants will track down which of 5 patients is infected with Ebola using DNA fingerprinting technology. The participants will conduct the experiment on their own, using exclusively Open Source hardware. The workshop will include DNA isolation, digestion, electrophoresis, analysis and interpretation.

**Duration:**

3-4 hours

**Number of participants:**

Max 30

**Subjects:**

DNA isolation  
DNA digestion  
DNA electrophoresis  
Data interpretation  
Open Source Hardware

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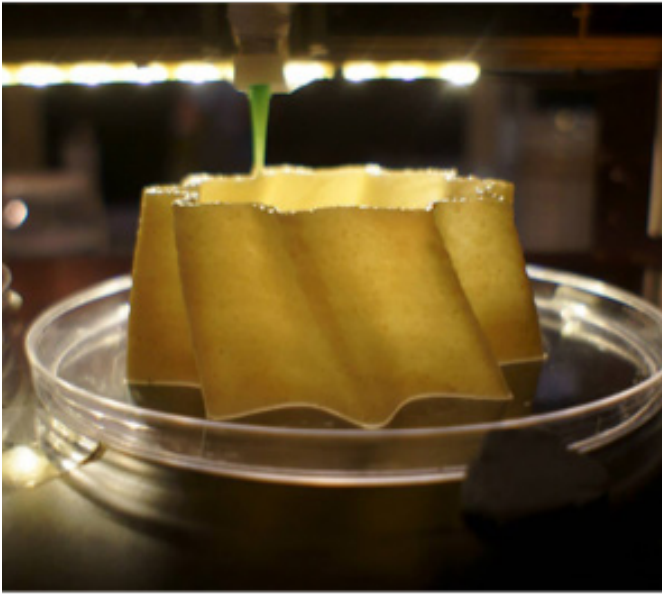


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# Bioprinting

*3D printing with living organisms*



3D printing allows you to transform digital designed objects into physical objects. By modifying a conventional plastic printer into a bioprinter, a whole new range of materials can be used. Glucose scaffolds or even bacterial and fungi mediums. Your designs will finally truly come to life!

During the workshop we will adapt an Ultimaker 3D printer into a syringe extruder printer, allowing you to print liquids (containing living microbes) in 3 dimensions. We will try out several mediums, for the participants to get an understanding of the required viscosity and material properties.

**Duration:**

1 day

**Subjects:**

3D printing  
Sketchup 3D modelling  
OpenSCAD 3D modelling  
Biomaterials  
Fluid dynamics  
Open Source Hardware

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*Pictures by Maurizio Montalti and Chiara Scarpitti*



# Making GMOs

*Exploring SynBio boundaries*

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When biotech is in the news it often concerns GMOs, how they are made and to what purpose. Sometimes controversial, sometimes not. But what are GMOs, how are they made and how do they look? More often than mammals, GMOs are micro-organisms such as bacteria, yeasts and fungi.

During this workshop we will learn how to build genetically modified micro organisms and learn about where bio safety regulation and legislation surrounding the production of such organisms.

The workshop will consist of preparing e.coli bacteria to become competent and culturing them.

**Duration:**

1-3 months

**Subjects:**

GMO  
Competent cells  
Micro organisms  
Bacteria  
Bio safety

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*The Making GMOs workshop is developed in collaboration with C-Lab, London, UK*



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# DIY In Vitro Meat

*Meat in a petri dish*

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The future of meat is a highly debated topic. Environmentalists are seeking alternatives to animal suffering and polluting in today's industrial farming. Perhaps bioreactor grown meat, so called In Vitro Meat, is the answer.

In this workshop the participants will grow their own In Vitro meat. For that we need to dissect fresh mice and extract live tissue. By feeding it with the right nutrients in the right conditions, the meat will grow. The participants will take home their own meat culture.

**Duration:**

3-4 hours

**Number of participants:**

Max 30

**Subjects:**

Meat culture

Mammalian anatomy

Mammalian cell cultivation

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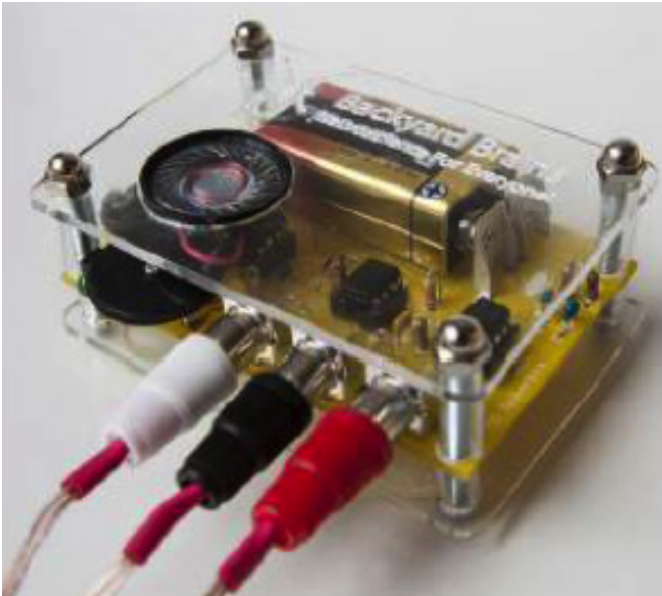


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# DIY Neurology

*Human to human interfacing*

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The nerves fibres are the internet of the human body. When something touches your toe, an electrical signal travels super fast through the nerves to the brain. People with neural disorders like spinal cord injuries may not experience that same feeling, which is why scientist develop new methods to interface computers with the nervous system.

During the workshop the participants will build their own Backyard Brains electromyogram (EMG) devices, and will tap into their own nerve system. We will investigate our response time and accuracy. Finally we will use a link between neural detection and stimulation to set up a human to human interface.

**Duration:**

3-4 hours

**Number of participants:**

Max 30

**Subjects:**

Action potentials  
Neuro signal transmission  
Electromyograms  
Electro-stimulation  
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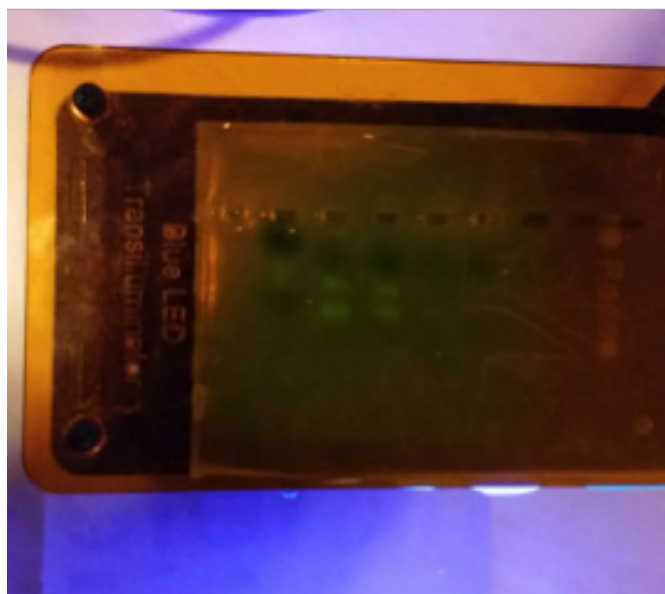
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# Mystery Meat PCR

*Diagnose your hamburger's DNA*

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Identify whether your favourite meat product contains chicken, beef, pork, horse, goat or sheep. We will extract DNA from the samples, add a blend of the DNA primers, added PCR mix, and then run each solution through the PCR process using only Open Source hardware equipment.

This experiment is based on a simplified version of DNA barcoding and teaches some of the most common and useful concepts in molecular biology, including DNA extraction, polymerase chain reaction (PCR), and gel electrophoresis.

Additionally the event can be extended with a "build-your-own open hardware" workshop that will be used during the experiment.

**Duration:**

5 hours

**Number of participants:**

Max 30

**Subjects:**

DNA extraction  
Polymerase Chain Reaction  
DNA gel electrophoresis  
Data analysis  
Open Source Hardware

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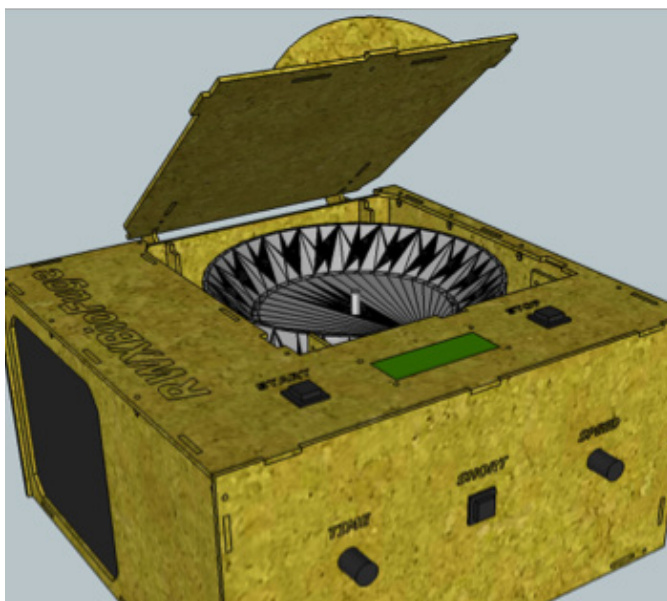
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*Pictures by Claudia Marginean; Protocol based on methodology of MadLab and La Paillasse*

# RWXBioFuge

*Build your own centrifuge*

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Centrifugation is a powerful method for isolation of compounds such as DNA, proteins, oil or membrane vesicles from a complex mixture. The RWXBioFuge was designed to bring this powerful tool into the hands of lab technicians, scientists, hackers, makers, DIYbio-ers and those who cannot afford to procure A-label equipment in low-resource settings.

This workshop is an educational project to teach fundamental principles of physics, chemistry, biology and electronics hands-on. Apart from an assembly guide, there will be 7 demonstration experiments and science classes.

## **Duration:**

3-4 hours

## **Number of participants:**

Max 30

## **Subjects:**

Centrifugation  
Arduino microprocessing  
Sketchup 3D modelling  
OpenSCAD 3D modelling  
Fritzing circuit design  
Digital fabrication  
Open Source hardware

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# Spirulina

*Grow your own superfood*

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Superfoods are the latest trends in modern cuisine. Special berries, nuts and other otherwise uncommon ingredients are added to diets, because it is believed by some that it may benefit your health.

Spirulina is a green algae and regarded as a superfood. It has high protein and vitamin content. It can be easily grown at home, as it only requires sunlight to produce.

The workshop will consist of setting up our own Spirulina reactors and trying out different recipes for tasting this green algae. The participants will take home their own cultures.

**Duration:**

3-4 hours

**Number of participants:**

Max 30

**Subjects:**

Bioreactor control

Algae

Photosynthesis

Nutrition

Smoothie recipes

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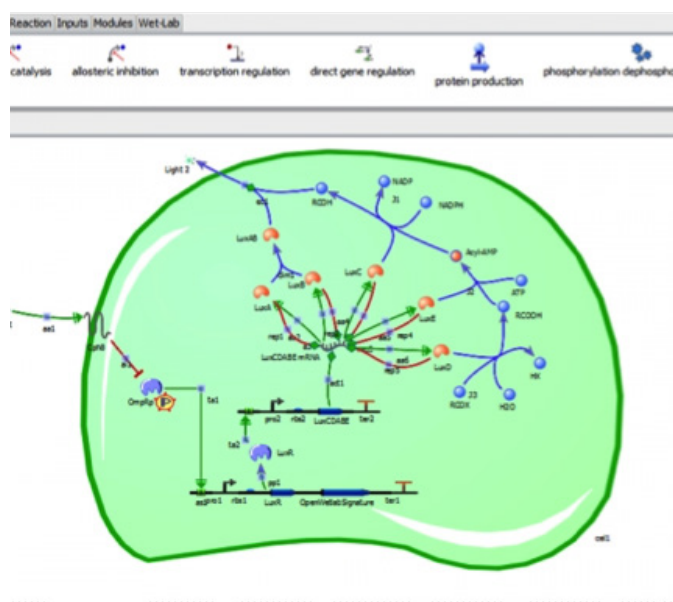
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# Tinkercell

*SynBio on your computer*

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Biotechnology regards biological organisms as living machines. DNA is code, and cells are processors. As reading and writing of DNA has dramatically reduced in cost over the past few years, new tools have been developed to quickly design new DNA sequences.

Tinkercell is such a program. Open source and freely available. During the workshop we will design a genetic circuit that, once put into a cell, causes it to produce light. Tinkercell also allows us to model how much light we may expect.

For this workshop no prior knowledge of Synthetic Biology is required. Participants do need to bring their own computer.

## Duration:

3 hours

## Number of participants:

max 30

## Subjects:

Synthetic Biology  
Metabolomics  
Genetic pathways  
Gene regulation  
Tinkercell

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# Open a Wetlab

*Starting a citizen biolab*

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A wetlab is a biotechnology lab where citizens, scientists, designers, artists and hackers collaboratively conduct creative bio research. A lab where the transformations, both technical and social, caused by biotechnology can be investigated, debated and exhibited.

The setup of a dedicated space for practical and self initiated research can be achieved in 1 to 3 months. A series of workshops will ensure that a community of local stakeholders get acquainted with your new facility, and establish a sustainable basis for future activities.

If you wish, permits for genetic modification can be arranged, allowing synthetic biology to take place in the lab.

**Duration:**

1-3 months

**Subjects:**

Starting a community  
Do It Together Bio sessions  
Selecting lab space  
Acquiring machines  
Open Source hardware  
Setting up stock and supplier relationships  
European legislation

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