Miranda Moss + Maya Minder + Ralf Schreiber

power harvest

DIY BIO-ELECTROCHEMICAL ART with anaerobic microbes + low power electronics

Refturing our imaginations when it comes to energy generation, electrical technologies, waste, and the power dynamics which permeate these narratives , is at the core of this ongoing project. Uncovering wild electricity - in this workshop in the form of Microbial Fuel Cells made from non-specialist and environmentally friendly materials - and seeing what and how we can power things with them.

Making our own electricity from scratch, the workshop aims to empower end users of electricity, while questioning the mainstream narratives of production, storage, transmission and consumption of this incredible force.

Working within the magical world of microbes, we can gain a deeper respect for these vital organisms, while investigating how electronics can work with such low power.

Aiming to demystify these disciplines, this workshop highlights aspects regarding DIY biotechnology, symbiosis, climate emergency, human-microbe relations, and the problematics in the history of the development of electricity and electronics.

Microbial Fuel Cell Ingredients

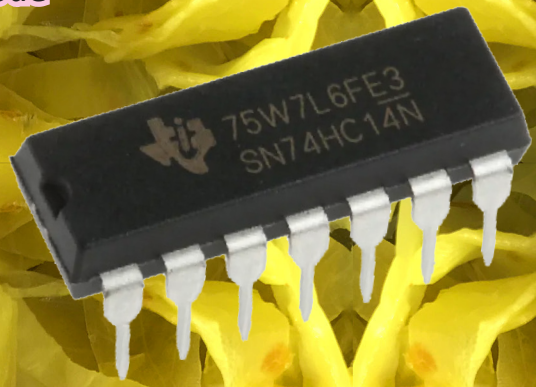
+ Ceramic Plant pot ~10cm diameter - 1 per fuel cell. Could also have some smaller ones too.
+ Gluten powderfor seitan (~ 6 spoons for 4 cells)
+ graphite powder - 1 tablespoon per cell
+ non-corrosive stainless steel wire - aprox. 50cm per participant OR thick solder also works (lead-free)
+ crocodile clips: 2 per cell
+ EITHER: buy activated charcoalpowder (6 spoons for 4)

OR we make our own: need a bag of fire wood, ,lemons, equipment: large sealable glass containers, stovetop, large metal cooking pot, food processor, sieve, surgical/dust mask.This is cheaper and more primal + hands-on, also to collect the ash which we could use later on to capture nitrogen if using urine, and neutralize the smell.
+ Oats - 1 spoon per cell

+ large elastic bands - 3 per participant
+ wooden stick, the same diameter as the ceramic pot's holes

Synthesizer Ingredients

Core Circuit:
+ Custom PCB or solder a flying circuit
+ 74HC14N Hex Inverter with Schmitt-Trigger Inputs (through-hole IC)
+ 2 x 100k resistor
+ 1000pF capacitor
+ 3 x 1uF capacitor
+ 1k resistor
+ 2 x 10M resistors
+ 2.7 K resistor
+ 4,7 K resistor
+3 x 1N4148 diode



+ Fun stuff / playing around / chaos
basically it's great to have a pile of random electronics to work with, doesn't have to be the same one per one participant, as the fun comes in the chaos and difference. E-waste is a good source for this.

piezo buzzers: small, a range.
Capacitors - a range between 1uF and 100uF
Resistors - a range between 10k and 100k
LDR (Light Dependant resistors), switches, potentiometers, random fruits and vegetables, plants, kombucha, any electronic components, pickles, more crocodile clips, whatever is lying around...

EQUIPMENT:

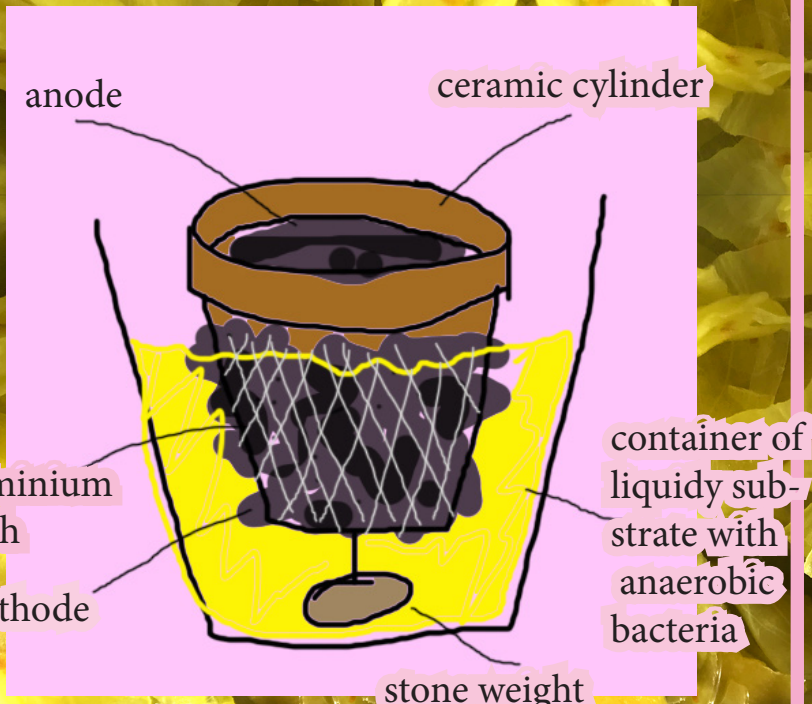
+ waterproof containers - 2 per participant: Anything that the clay pots can fit into will work. Transparent containers are nice visually, big jars, science flasks, buckets, large yoghurt containers, giant coconut shells, transparent heavy-duty plastic bags suspended from the ceiling?.... The larger they are, the more substrate we will need however, so sticking to a volume not too much bigger than the clay pots is easier.

+ Oven + Fan / time to dry in the sun and wind
+ funnel
+ Digital multimeters
+ box cutters, scissors
+ Soldering irons
+Speakers / sound systems, with standard 2.5mm aux cables - 1 per every 2 participants would be awesome, for testing the devices, and hearing them, altogether would be amazing.
+ hot glue / epoxy / putty / some bio-epoxy? Would be nicer to use an environmentally friendly option. Anyone know a recipe?
+ Fine, flexible Aluminium Mesh

<--- aluminium mesh

Other consumeables

+ Soldering tin ~1mm diameter, aprox. 1 metre per participant
+ coffee filters
+ sterile gloves
+ hot glue
+ cooking pots



Basic Diagram of MFC

Fuel Cell Recipe

001 Charcoal Cathode

+ Fill holes of pots with wood.

+ Make dry mixture of 50% gluten powder to 50% activated charcoal

+ Add +- 250ml of water, kneading well, until you have a kind of pastey-putty
+ Make a rectangle of the putty and Sculpt it onto the outside of the ceramic pot. Take care to not get it on the top lip of the pot (short circuit!), and to try have an even covering over the pot, including the base.

+ tightly wrap around some aluminium mesh. You can secure it with elastic bands.

+ Cook the charcoal-seitan either in an oven, or steam well, for about 20 minutes, or until set.

+ The longer it can dry out, the better.

002 Graphite Anode

+ Apply a blob of non-conductive, non-porous glue around the wood on the inside of the pot, to properly seal the inside from the outside.

+ Cook some oats with water, to make a glutinous paste.

+ Strain through a coffee filter

+ Eat the Lumpy bits: we will just use the strained mixture.

+ Add salt for extra conductivity.

+ Mix in about 50% graphite powder to 50% oat liquid, and stir well into a paste.

+ Smear or paint a thin, even layer onto the inside of the pot. If you for some reason have graphene ink you can use this instead of this mixture. Leave to dry well.

+ Make a half-moon shape from non corrosive wire and wedge it into the inside of the pot.

003 Where The Magic Happens

+ 3/4 Fill non-conductive containers with anaerobic substrate of choice - urine, old sauerkraut, mud,old yoghurt, sea water, chicken poo.... If your substrate is too solid (e.g. cow poo), mix some water with it.

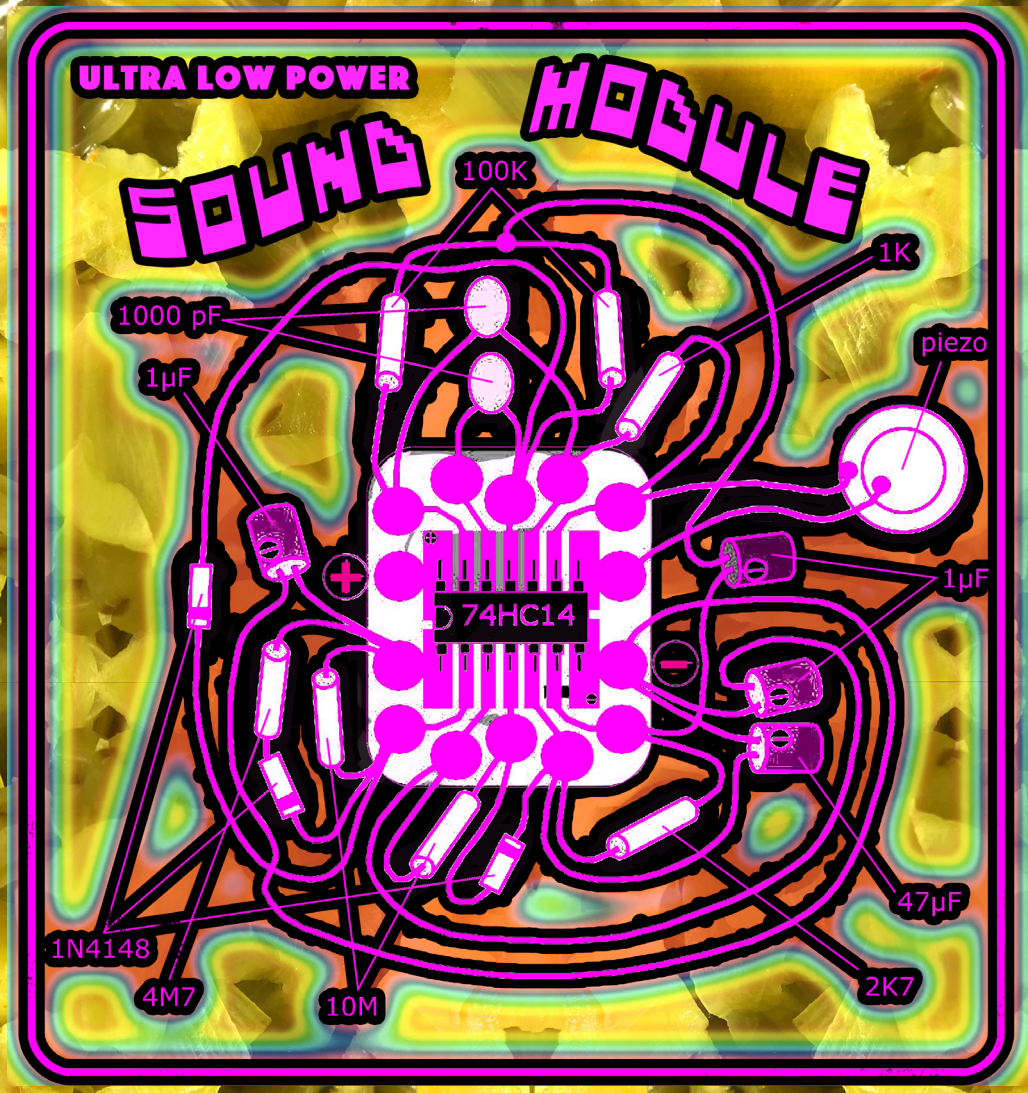
+Take care not to disrupt any ecosystems when collecting substrate, or wasting edible food - only use things that are going to "waste". healthy topoil, for instance, is in a state of global crisis, so we do not want to remove this from ecosystems.

+ Place the completed fuel cells into the container, taking care not to spill any inside (short circuit!)
+ Take out the multimeter, attach the cathode crocodile clip to the negative (-) terminal of the multimeter, and the anode to the positive (+).

+ TEST THE VOLTAGE!

004 Using the Cells

+ Depending on your application, you can play around with putting the cells in parallel and/or series - putting them in series (- to +, - to +...) will make a higher voltage, and putting them in parallel (+ to +, - to -), will create more current / amps.



+ Connect crocodile clips to the + and - terminals on the PCB (printed circuit board). You can also use old, "dead" batteries, or a small solar cell, if you don't have your fuel cell with you.

+ For sound, you can connect, with crocodile clips, the negative (-) of the PCB to the ground of an aux jack, as well as the signal, to one of the other parts of the jack. Once the speakers are on and working, you can take the other end of the signal crocodile clip, and look for a nice output. This you can move around, and even connect another one to make a stereo sound.

+You can play around with adding all sorts of components to find the "sweet spots" or to create mega chaos noise. Anything with capacitance and resistance properties can be added to the circuit (like plants, garlic, ...), and you can also make short circuits, or put the circuits under water. Go wild! These are Feral circuits, running on wild electricity.

+ By connecting a voltage-controlled oscillator to the fuel cells, we can use our sense of sound to understand what is going on in the microbiome. Not only will be able to hear what is happening with the electricity, but can become in tune with how the microbes are affected by environmental factors. Also, since a thriving microbiome, in certain substrates, can be indicitave of a healthy ecosystem. e.g. in soil, we could presume that if there is more electricity, we can determine the health of the substrate, without fancy and expensive sensors and tests.

More power will make a higher frequency, and low power will make a deeper sound - even a drum beat. In this way, the circuit acts as an audible voltmeter.

+ We can have a lot of fun creating chaotic noises with the ultra low power sound circuit, where the three oscillators inside the 74HC14 chip begin to fight each other over the small amount of available power.

Since we can power signals using a small sound circuit - or an LED - it can make us wonder - what else can we, and could we, power with such low and sustainable energy? What other types of wild energy are out there and how can we (re/un)design consumer electronics to run off of them, in pursuit of radically regenerative techno-futures?

Caring for Microorganisms = Caring for our Bodies = Caring for the Planet

Fermented food, soil, mud and water is alive, it poetically brings to mind an animistic world
where the air that we breath and the food that we eat is in constant movement.
If you listen and smell carefully, you could note how the activity in the Jars changes the sound and olfactory environment.

Even though they are super small, there are so many of them, and so many diferent types. They play a big role in aLL ecosystemS - including our own bodies. Caring for helpful micro-organisms means a healthy body and planet!

By conecting the electrical activity of the microbes found where there is no oxygen, and who give off electricity when they eat, to our synthesisers, we can get an idea, using our sense of sound, of how happy and healthy the MICRObiome is. We are only using old sauerkraut rescued from a sauerkraut factory for this experiment.

Mixing charcoal with our homemade seitan... mmmmmm

Sauerkraut Recipe

++ 500g cabage
++ 15g salt

+ grate the cabage very thinly
+ use a sauerkraut grater if you have, but an ordinary grater is fine
+ Mash up the Kraut with the salt in a larger bowl.
+ fill the jar air tight with your kraut to the very top of the jar border. close it and let it ferment sealed. for at least two weeks. its ready when it stops bobbeling.

Seitan Recipe (for our fuel cells we used pre-made gluten flour, but you can separate the gluten from scratch too!)

++ 500g Flour
++ 5 Dl of Water
++ cheese cloth
++ Bouillon // stock

Knead a dough as if you would usually bake a bread, wrap the dough inside a chees-cloth and let it sit over night in water. Next day take out the dough and part it in four pieces. Cook the four lumps in boullion Water. Finished Saitan can be fried as shreded (M)eat pieces, or barbecued with marinade.

Seitan, or wheat gluten, is a plant based protein, and is often used to make meat substitutes. Here you can make your own, for cheap, and help to save the planet by not eating factory-farmed animal meat.

Miranda Moss is an artist, outsider engineer, eco-geek and rogue educator from Cape Town, South Africa. Her transdisciplinary practice, which focusses on the problematics and hopeful possibilities of technology from a socio-ecological and anticolonial feminist perspective, has seen her exhibit, teach and perform research across the globe in various art, science, community, academic, public and hacker spaces. After completing a Masters degree in sustainable design, focussing on microbial fuel cells in conjuction with the politics of municipal water, electrical and sanitation grids in her home country, she is now working as part of a research project "Regenerative Energy Communities; artistic and collective energy experiments for resilient agriculture" funded by the Swedish Energy Agency's Program for Energy, People and Society. **<<mirandamoss.com>>**

„Cooking thus transforms us", is a framework **Maya Minder** weaves like strings through her work. Cooking serves her to reveal the metaphor of the human transformation of raw nature into cooked culture and she combines it to the evolutionary ideas of a symbiotic co-existence between plants, animals and humans. She creates entanglements between human commodities and animism of nature. A table of diversity, not yet digested. Following the Biohacker, Maker and Thirdspace movement she uses grassroots ideas, safe zones and citizen science into her field to enable collective story telling through food and cooking. **<<mayaminder.ch>>**

Ralf Schreiber studied sculpture art at the Art Academy Münster and media art at the Academy of Media Arts Cologne. He works with electronics, with motors, microphones and tiny loudspeakers. This creates kinetic sound and light installations as well as electronic music. His works have a playful and experimental approach. It's about minimal robotics, about random processes and self-sustaining systems. Small solar cells are often used for the power supply, with which he explores low-energy conversion processes from light to movement and sound. The output of his installations is usually minimal, meaning the sounds are very quiet, the movements sometimes on the edge of perception. In addition, he is involved in art and technology exchange and regularly offers workshops with circuit concepts and schematics of his works. **<< ralfschreiber.com>>**

This zine was made for the workshop "Kraut Source Energy", commissioned by House of Electronic Arts and Esch-sur-Alzette European Capital of Culture 2022. The workshop is aimed for children and happens in conjunction with the exhibition <<Earthbound - Im Dialog mit der Natur>>, curated by Sabine Himmelsbach + Boris Magrini.

DANS LE CADRE DE

ESCH-SUR-ALZETTE
EUROPEAN CAPITAL
OF CULTURE

House of Electronic Arts

HACKTERIA.ORG
Open Source Biological Art

SGMK

COMMUNITIES REGENERATIVE ENERGY