pavillon_35 recipe #1

Yeast Printing

This recipe shows a method to cultivate baker's yeast and to shape the cultivation according to aesthetic and artistic decisions.

Parts of the recipe involve materials and devices, which have to be handled with care and responsibility. It is strongly recommended to ask for advice and supervision from a trained professional with experience in biology and biotechnological laboratory work.

Negligent handling of this equipment and/or ignorance of hazards and dangers may entail severe injuries.

The specifications of the recipe, made to the best of our knowledge and belief, do not constitute any liability for injuries and damages that may arise in connection with the procedures described. Furthermore, this recipe does not replace the user's sole responsibility for the use of its required ingredients and devices.

Ingredients of the cultivation medium

1. Sugar
2. Distilled Water
3. Yeast Extract
4. **Peptone** (Danger! Beware of fine particles, as they penetrate deeper into the lungs. Protect your respiratory system with a fine dust mask. Alternatively you can use bouillon de boeuf concentrate, instead of peptone or try a potato dextrose, or a raw milk agar. A lot of alternatives to peptone are possible.)
5. Bouillon de Boeuf
6. Agar Agar
7. Active Coal
8. Food Colors

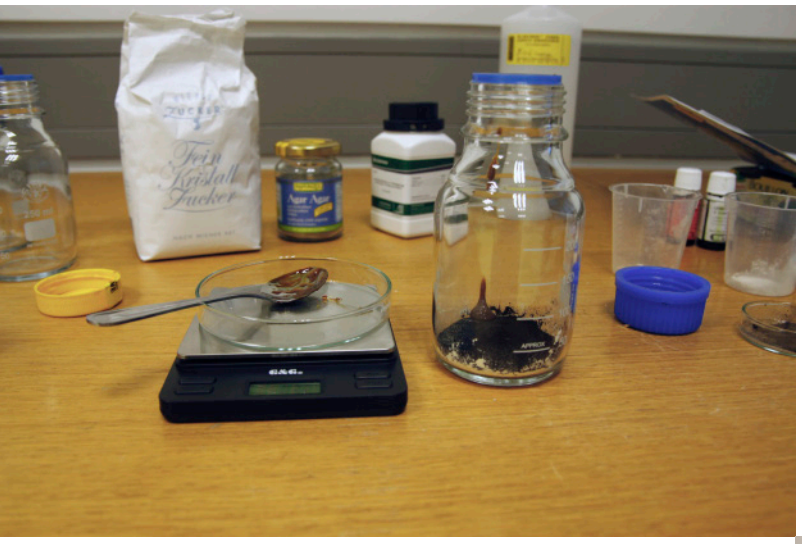
Equipment

Alternative equipments could be tryed out, e.g. using jam jars instead of laboratory bottles, but keep an eye on the requirements for quality and security.

1. Kitchen Roll
2. Microwave Oven
3. Kitchen Gloves
4. Fine Dust Mask
5. Pressure Cooker
6. Pot
7. Cooker Hotplates
8. Log Book (Establish a quality control scheme by using the power of protocols.)
9. Precision Scale
10. Petri Dishes, Measuring Cup, Laboratory Bottle, Funnel, Centrifuge Tube
11. Pipette, Spoon, Spatula, Drigalski-Spatula
12. Safety Goggles
13. Camping Gas Cooker (Beware of carbon monoxide and open fire, make sure that the room is sufficiently ventilated and that there is a fire extinguisher prepared!)
14. Rubbergloves

Cooking a suitable culture medium

The agars tested and used in this recipe are based on meat products, but there are also alternatives, e.g. based on potatoes (http://en.wikipedia.org/wiki/Potato_dextrose_agar).



1 litre culture medium requires

20g	Sugar
15g	Agar Agar
10g	Peptone
10g	Yeast Extract
0.45g	Active Coal (coloring the culture medium black, any other food color can be used, too)

Weigh in the ingredients into laboratory bottles (with autoclave capability) and fill it up with distilled water. The pictures show 250 ml laboratory bottles, which just fit into the depicted pressure cooker used here as an autoclave to get the agar medium sterile. The use of a pressure cooker as an autoclave bears a high risk of injuries, as an alternative a microwave oven can be used.

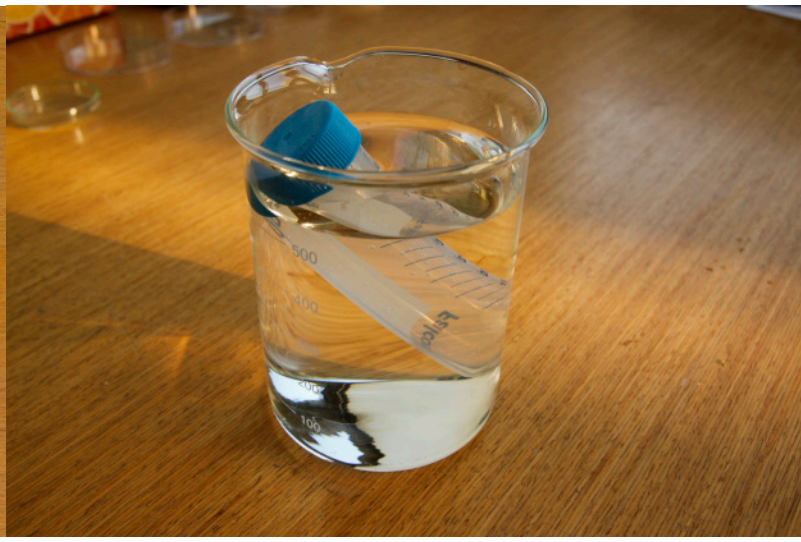
Shake the bottles well, until the ingredients have dissolved in the distilled water. The caps of the laboratory bottles must be slightly unscrewed so that the pressure can escape. Fill the pressure cooker a bit with water (about one third of the pots volume).

Close the lid and let it boil for about thirty minutes, turn off the heat and wait until the pressure escaped from the cooker.

Make sure that the pressure is released before opening the lid. Caution! The bottles are incredibly hot. After the bottles cooled down a bit the caps can be closed.

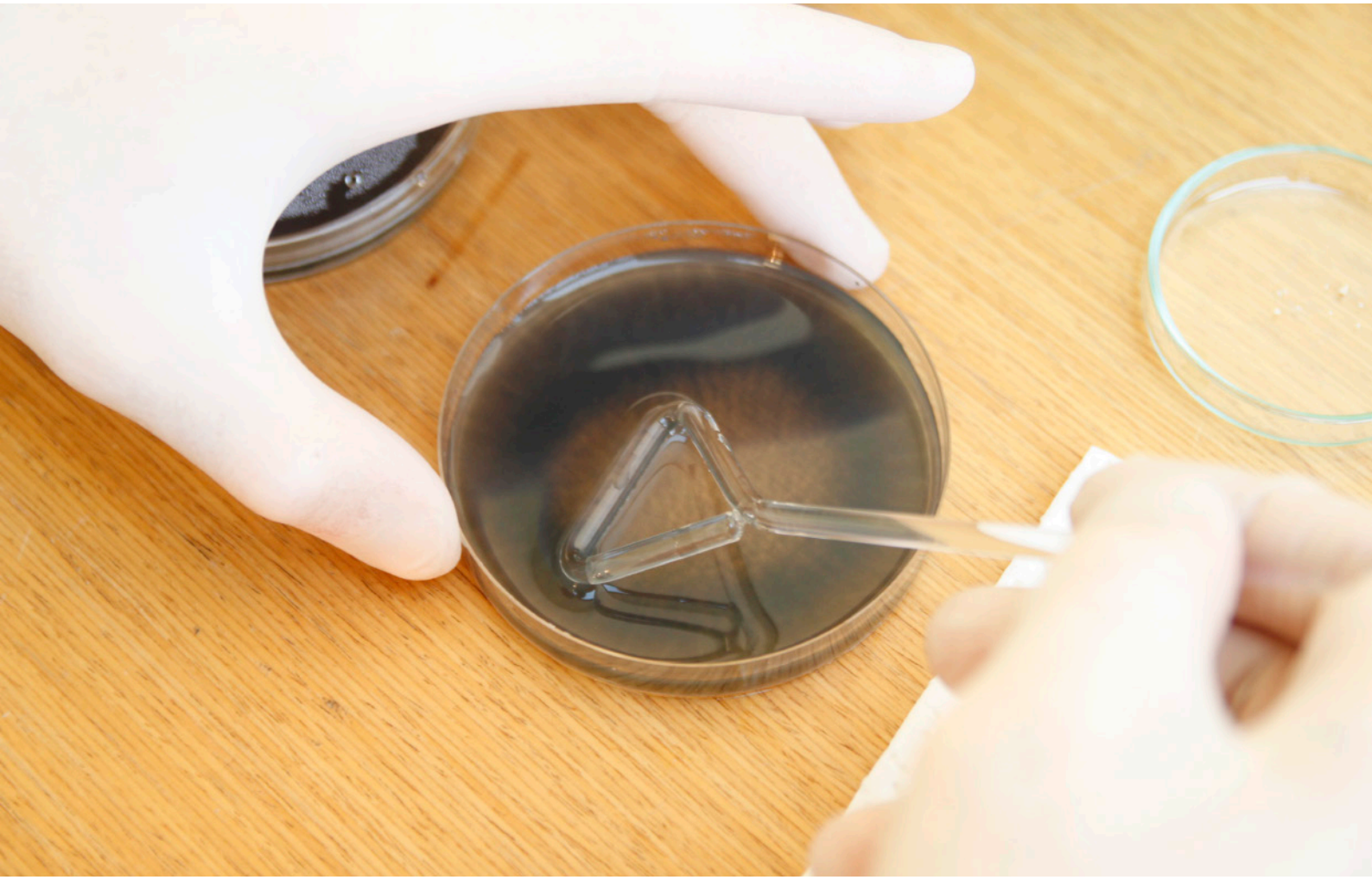
Let the bottles cool down to lukewarm and cast the agar medium into petridishes. The culture medium is stable at ambient temperature and can be stored quite some time in the bottles. Store the filled petridishes in a refrigerator.

Cultivating Yeast



Boil 45ml distilled water in a centrifuge tube for 5 minutes, thus making it sterile, then cool it down to lukewarm. Prepare a sterile workbench. Clean the surface with a 70% alcohol solution (1) and place a camping gas cooker (2) in the middle. Beware of carbon monoxide and open fire, make sure that the room is sufficiently ventilated and that there is a fire extinguisher prepared. The gasflame creates a sterile zone within a radius of approximately 50cm. The best results came from the agar plates that were kept in the refrigerator over night. Careful working, patience and changing the lids of the petridishes (5) can minimize the accumulation of condensed water, which has an effect on the quality of the results.

Put 0.23g baker's yeast (**3**) in 45ml sterile distilled water (**4**) and shake it well until the yeast is dissolved. Flood the petridish with the yeast solution and carefully massage the liquid into the cultivation medium. Pour out the yeast solution to the last drop and close the lid of the petridish. Again, try to minimize the occurence of condensed water inside the petridish.



Setting up the UV LEDs

The setup that worked includes

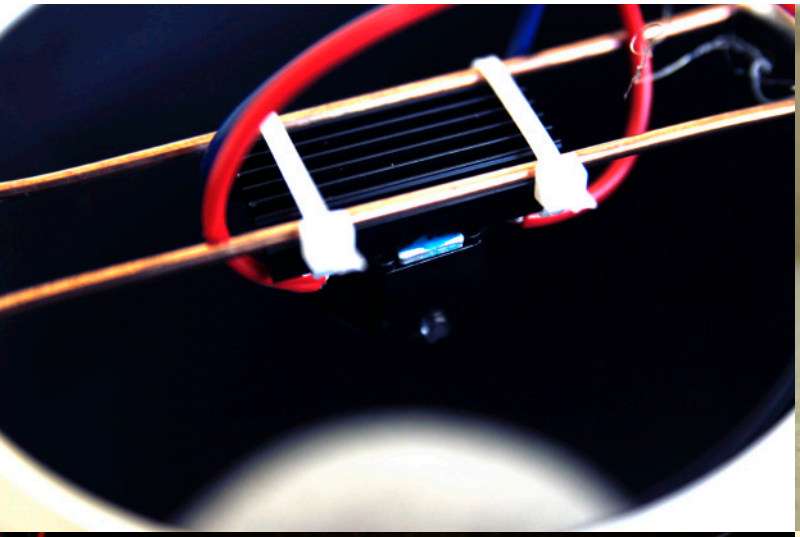
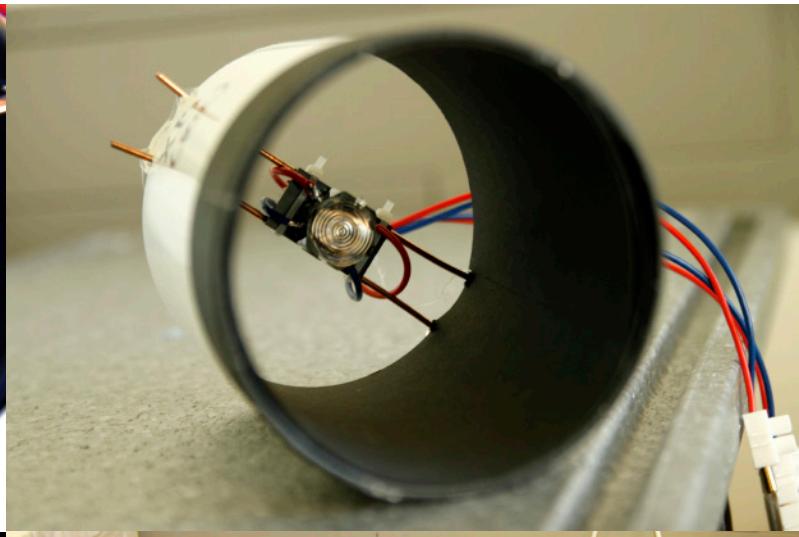
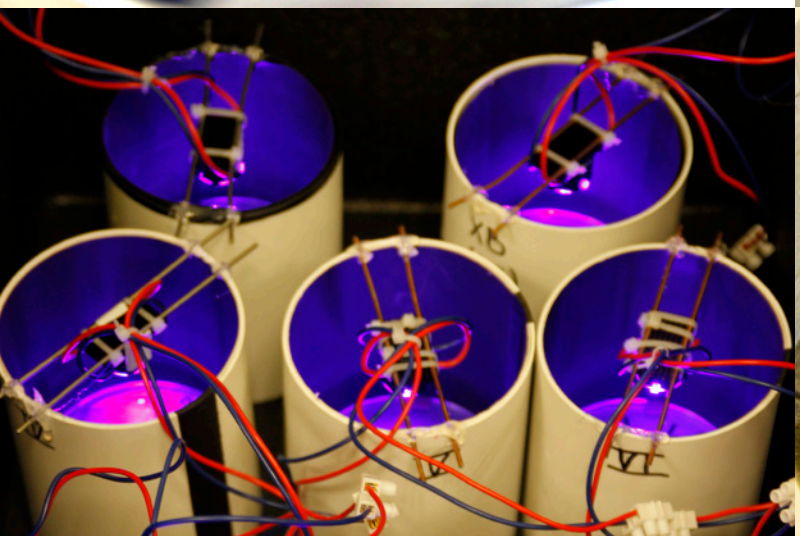
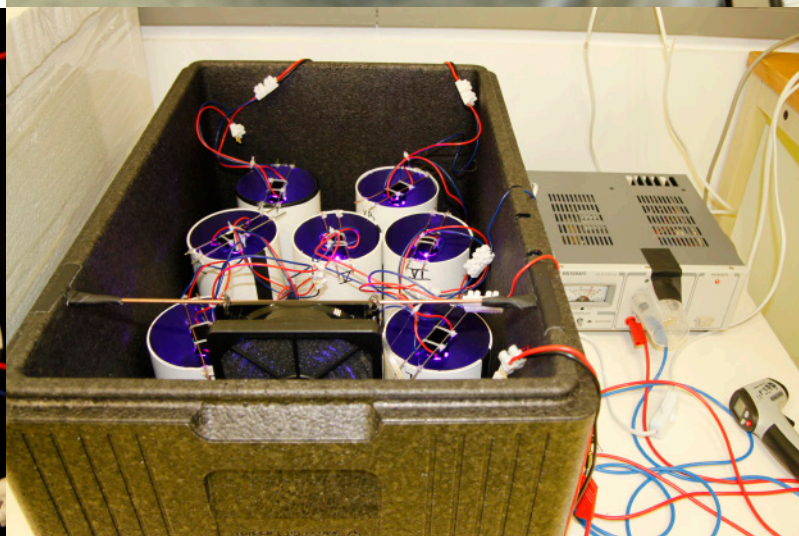
410nm Violet High Power Leds[1] (Danger! Never expose your eyes or your skin to the UV light emitted[2].)

Optic, 25 Degree Halfangle
Optic Holder[3]

Cooling Element (Use a thermally conductive adhesive to fix the LED board onto the cooling element.)

Laboratory Power Supply (3.65 V is required per LED at 350 mA. Visit the links in the footnote for the data-sheets and more detailed informations. Adapt the power supply to the number of LEDs you want to wire in series. No resistors were used in wiring, seek expert advice concerning technical aspects of wiring larger numbers of LEDs, which are electro static sensitive devices, therefore use a static free work station, while handling.

Rack (A distance of 6cm between the LED with a 25 degree optic and the lid of the petridish yields good results. Adapt this distance according to the optics used.)

1 H2A1-H410: http://www.roithner-laser.com/single/led_single_hexagonal.html
2 UV light is hazardous to skin and may cause cancer.Do not look directly into the light, use eye protection.
3 10003/25 and 10043 http://www.roithner-laser.com/led_highoptic.html

Design of the Stencils

Attach a stencil onto the lid of the petridish. There are different possibilities to create a stencil. Just print something on a translucent foil, or draw directly on the lid with a permanent marker. Everything that casts a shadow on the medium works (protecting the yeast from UV light). Rasterized images worked better than greyscaled. Further testing will reveal more possible ways and more parameters to raise the quality of the results. Now put the petridishes (with agar medium, stencil and yeast) under the UV LEDs and let it stay there for 24h.

Voilà, the results

Make sure that you understand the dangers and hazards that are involved in the described procedures. Feel free to contact us via our homepage **http://pavillon35.polycinease.com/contact/** ,if you have questions or concerns in regards to materials and techniques specified in this recipe. We strongly recommend to contact your local DIYBio group to use a safe laboratory space and to ask for assistance and supervision. Find out more on **http://www.diybio.eu/**. Community Biolab Saftey Guidelines can be found there, too.