Open Science Hardware in Microbiology

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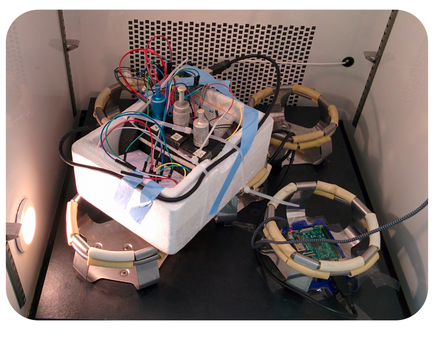
GLOBAL OPEN SCIENCE HARDWARE ROADMAP

Open Science Hardware?

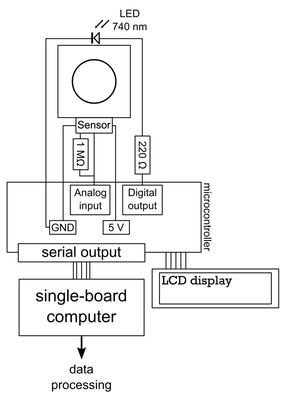
Hardware is a vital part of science: microscopes, sensors, reagents and instruments are all central to experimentation but the current supply chain limits access to many people and impedes creativity and customisation. Open Science Hardware addresses part of this problem through sharing open designs to expand the availability of customisable and often lower cost tools within academic research, citizen science and education. Technologies such as 3D printing and electronics platforms like Arduino and Raspberry Pi are making it ever easier to get started with designing hardware for your experiments.

Live cell density determination in test tubes?

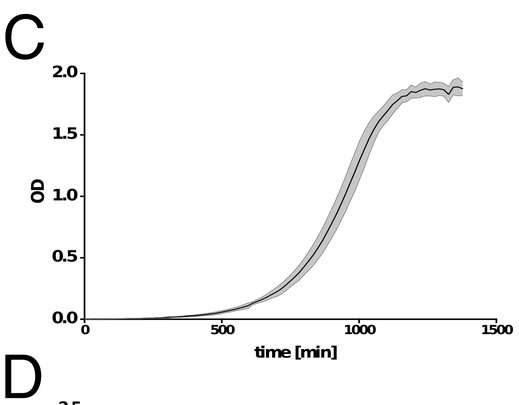
A



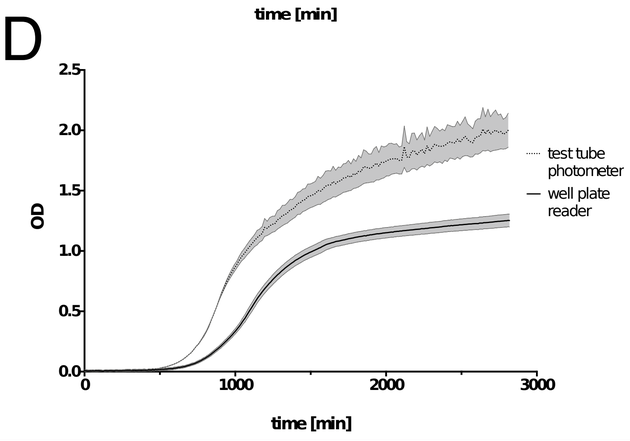
B



C



D



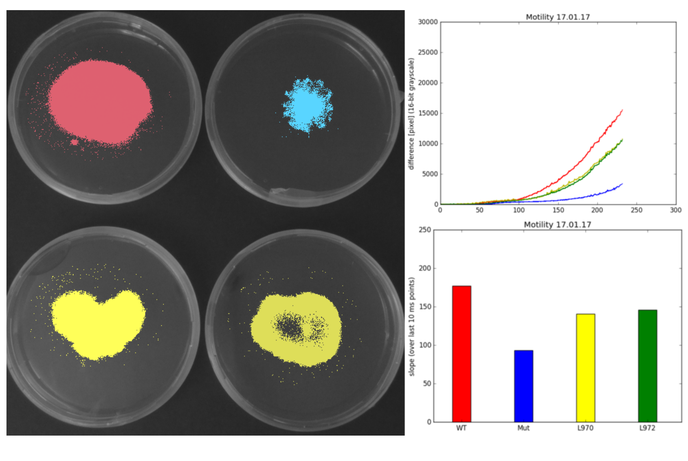
How about skipping the sample taking and transferring step and measure the culture density directly in the test tube? We developed a test tube photometer based on an LED, a highly sensitive photodiode and a microcontroller (**A**, **B**). The 3D-printed housing can be adjusted to fit any test tube size.

We validated the measurements of the test tube photometer and showed it accuracy is equal to a commercial table top photometer. We performed live monitoring of cell density with *Pseudomonas syringae* pv. *tomato* DC3000 (**C**), *Escherichia coli* and *Saccharomyces cerevisiae* and compared the results with reads from a commercial well plate reader (**D**). Notably the bacteria displayed a different growth kinetic in the test tube compared to the well plate.

Kutschera and Lamb (2018), *Current Microbiology*

Low-cost hardware setup and software for the analysis of microbe motility

A



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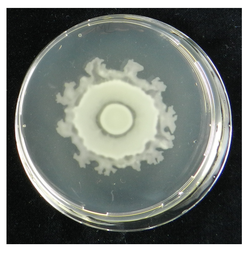

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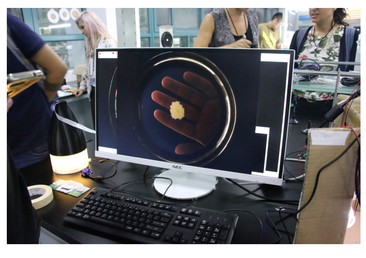
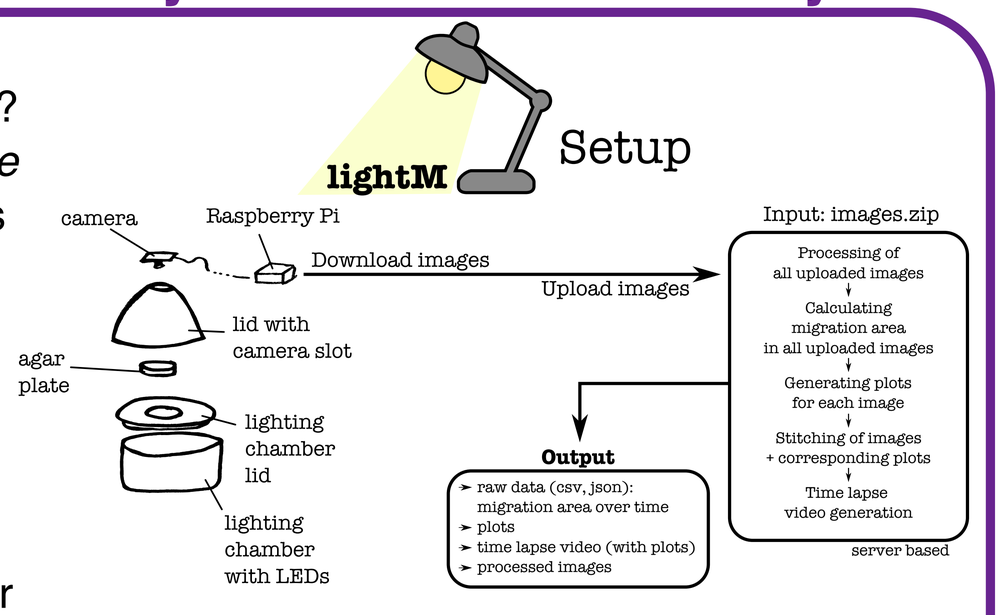


Ever wondered what your bacteria are doing when you are not looking? I wanted to see how e.g. *P. syringae* bacteria form their typical structures during swarming (**B**). I started monitoring bacterial motility on agarplates and calculated the covered area and spread over time and could correlate the results with phenotypes (**A**). We are now developing a lighting device for agar plates as well as software to analyse time series of images with swarming bacteria (**C**).



Hardware Setup
Lighting Chamber with Image Server

Software
Image Processing and Analysis Server based with Web Interface

In cooperation with Fernan Federici and many others

alexanderkutschera.com

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GOSH Roadmap

Test Tube Photometer

LightM Repository

GOSH Gathering for Open Science Hardware
openhardware.science

gig GLOBAL INNOVATION GATHERING
www.globalinnovationgathering.org

Join the movement and make Open Science Hardware ubiquitous by 2025!