

<http://bit.ly/stemamb1>

Setting up a science lab with Open Source Hardware

STEM ambassadors

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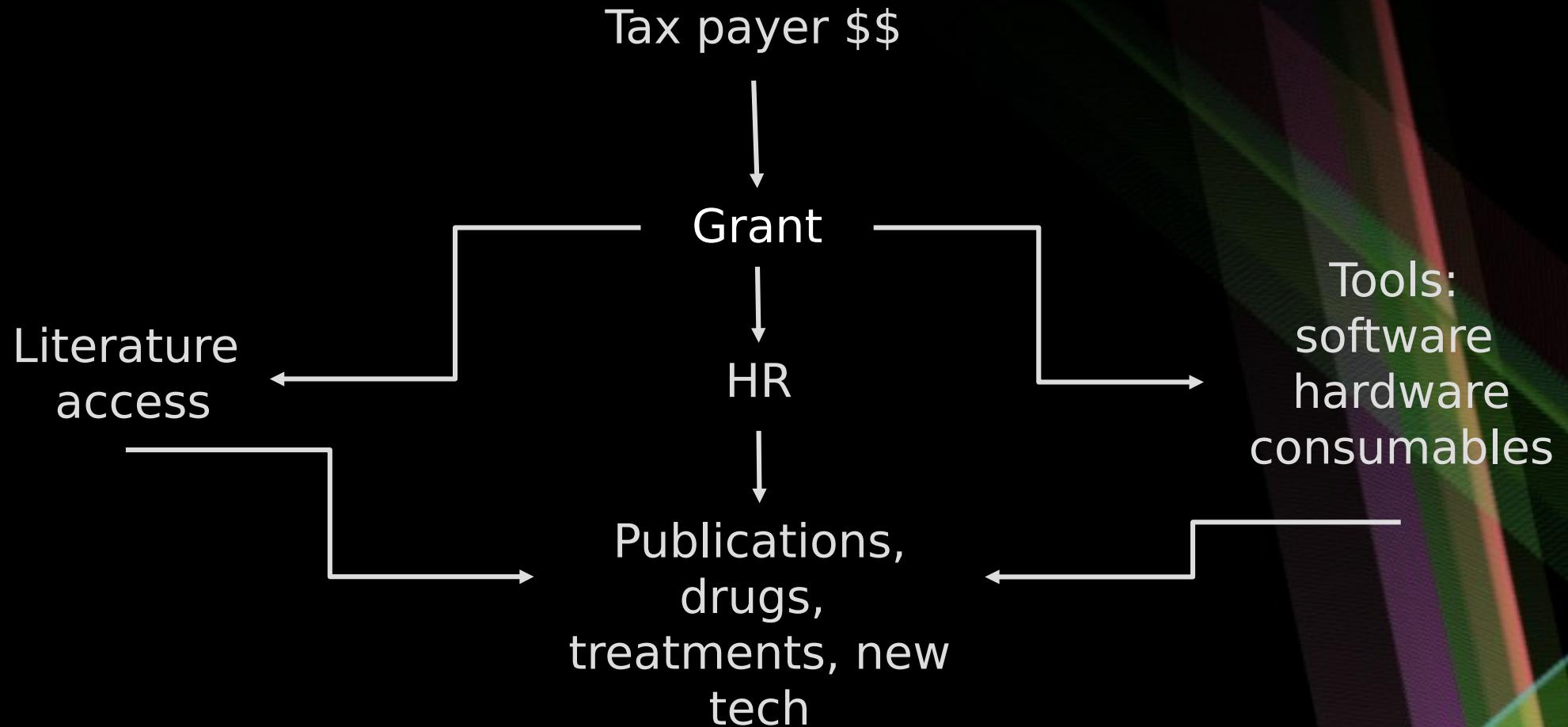
Overview

- About me/us
- Research funding
- Science equipment
- Open source
- Open Source science equipment
- Teaching the teachers
- The tools you want
- Repositories and more information
- Questions

About me/us

- Biology / Neuroscience
- Advocating Open Science:
 - [Open Neuroscience](#) (since 2012)
 - Mozilla & FreiesWissen Fellow (since 2018)
- [BadenLab](#)(since 2018) & [TReND in Africa](#) (since 2013)
 - Building open source tools for science:
 - FlyPi, Spikeling, OpenSpritzer, Micropipettes, etc..
 - “Teaching the teachers”
 - Showing researchers and educators how to build tools themselves

Research funding



Research funding

Publications, drugs, treatments,
new tech



Patent, copyright



Technology transfer



Distribution/production Oligopoly



High Costs

Science equipment

- Microscopes:
 - ~17th century
 - Scientific grade ~5000€
 - Fluorescence +~5000€
 - No patents
 - Hard to repair
 - Hard to customize
 - Designed for european/US markets



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Science equipment

- Microscopes:
 - ~17th century
 - Scientific grade ~100€
 - Fluorescence ~5000€
 - No path
 - Hard air
 - ' ' customize
- Can we do better?
Designed for european/US markets

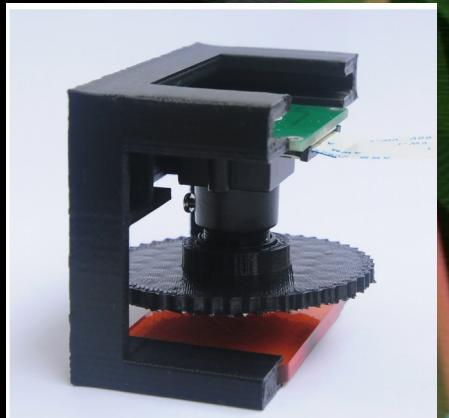
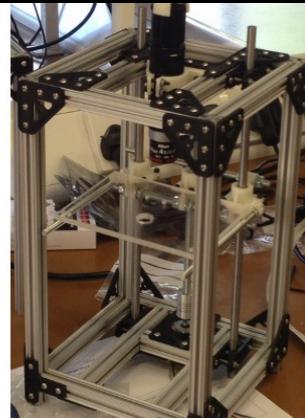
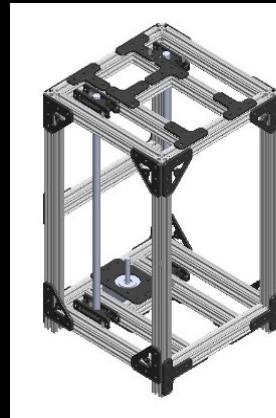


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Open Source science equipment

- Open Source Microscopes:
 - Different capabilities
 - Published in peer reviewed journals
 - Affordable (Cheapest 50£. Most expensive 1000£)
 - Portable, battery driven, easy to customize



FlyPi an affordable all in one lab



PLOS | BIOLOGY

COMMUNITY PAGE

The €100 lab: A 3D-printable open-source platform for fluorescence microscopy, optogenetics, and accurate temperature control during behaviour of zebrafish, *Drosophila*, and *Caenorhabditis elegans*

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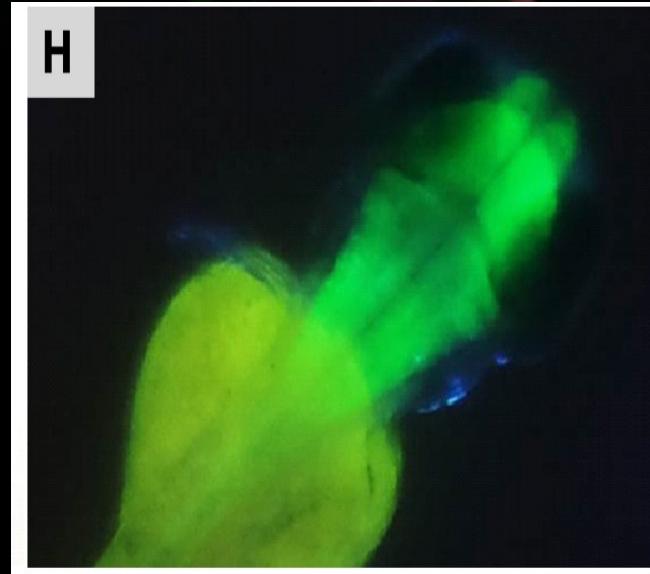
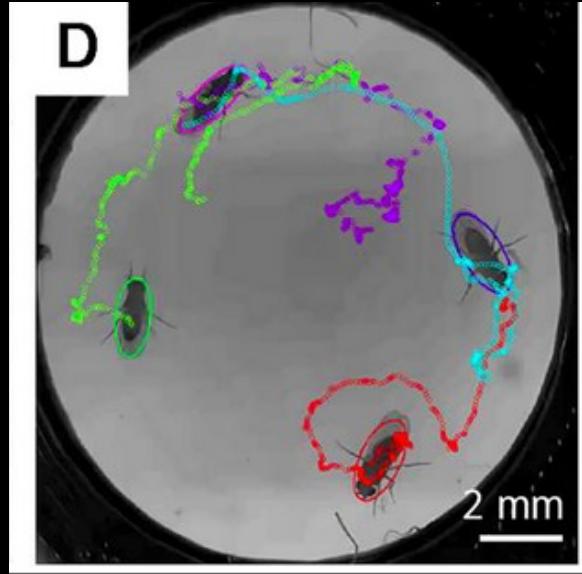
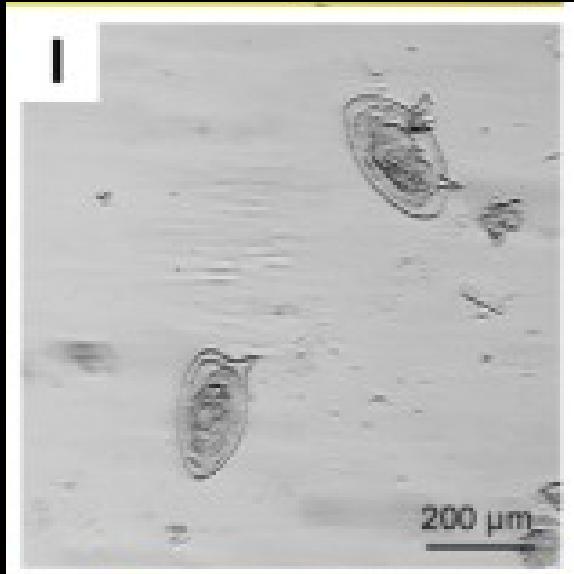
<http://bit.ly/flypios>



Open Source Science Equipment



Open Source Science Equipment



Tracking using C-Trax

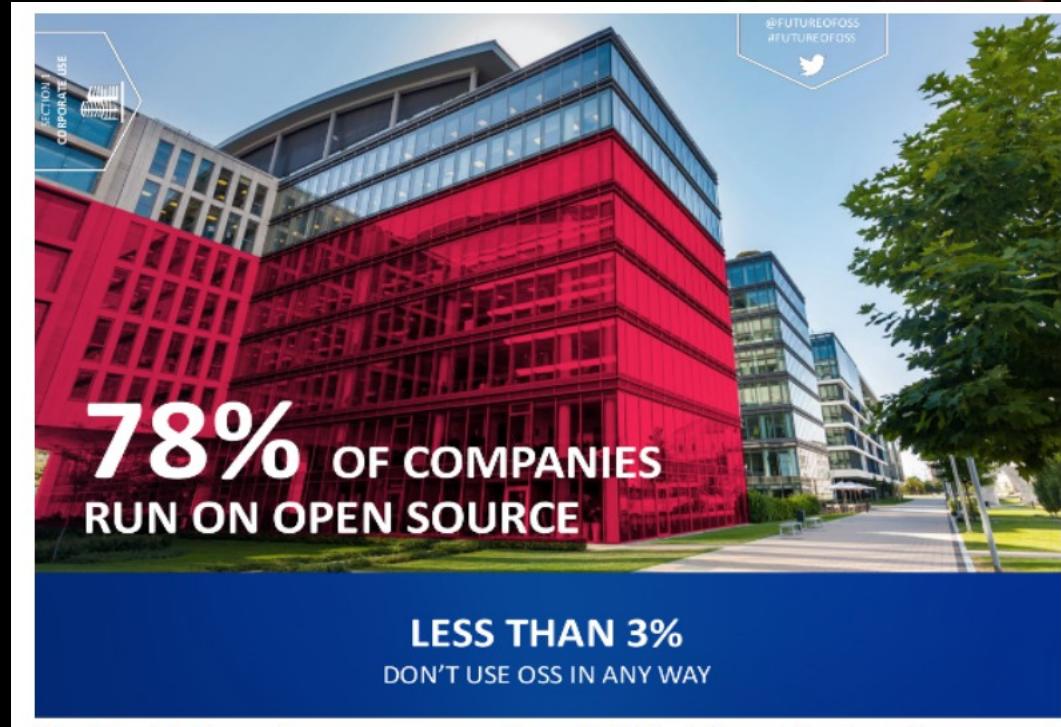
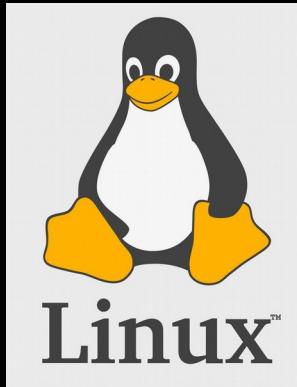
FlyPi paper: <http://bit.ly/flypios>

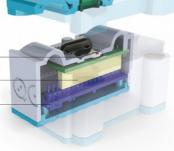
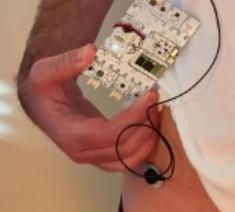
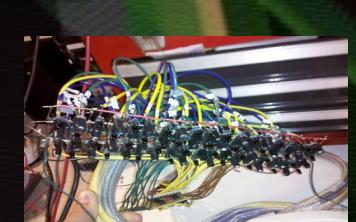
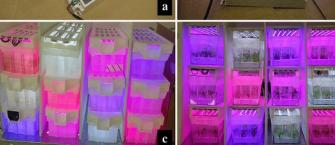
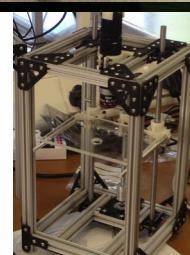
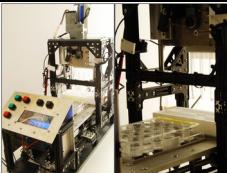
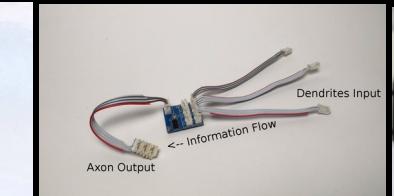
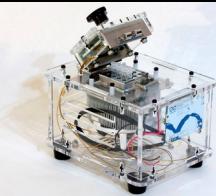
Open Source

- Everything created (code, hardware design, protocols, cake recipes) is shared freely via licenses (GNU GPL, Creative Commons, OSHWA, and many other), using any means at hand (internet, usb sticks, recipe notebook)
- We've always done it. Now we just have a fancy name for it and metrics so that all projects follow a certain standard.

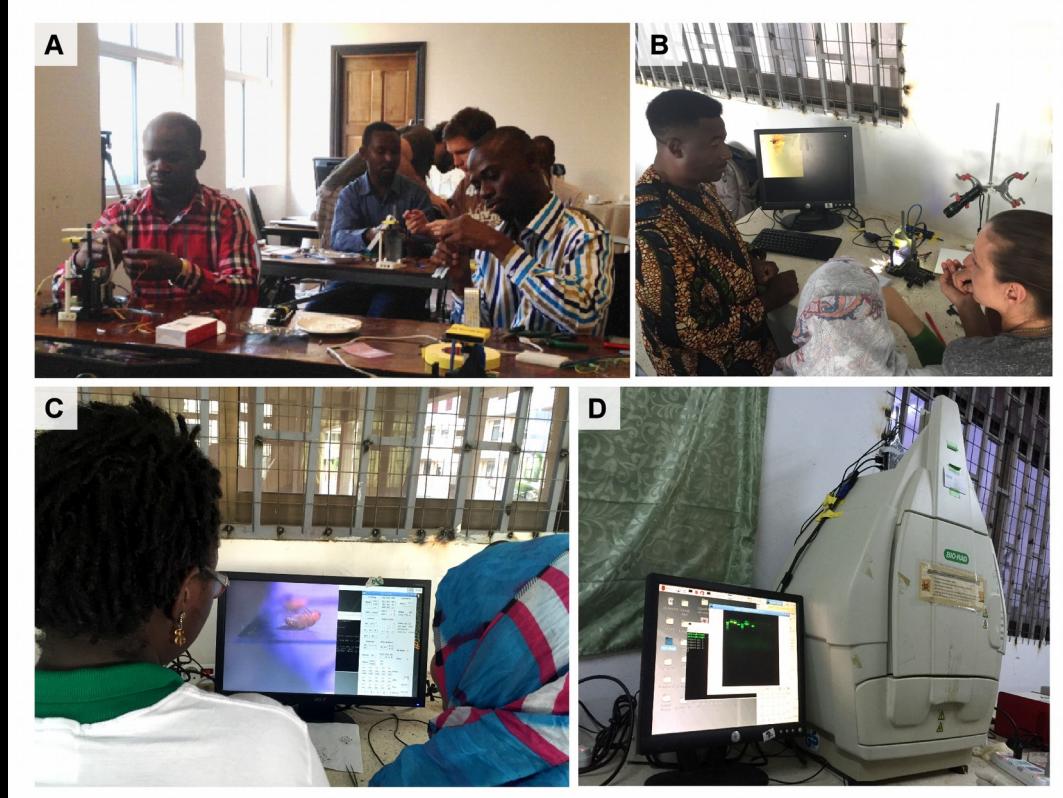
Open Source

- Powers your smartphones, data centers, airplanes, super computers

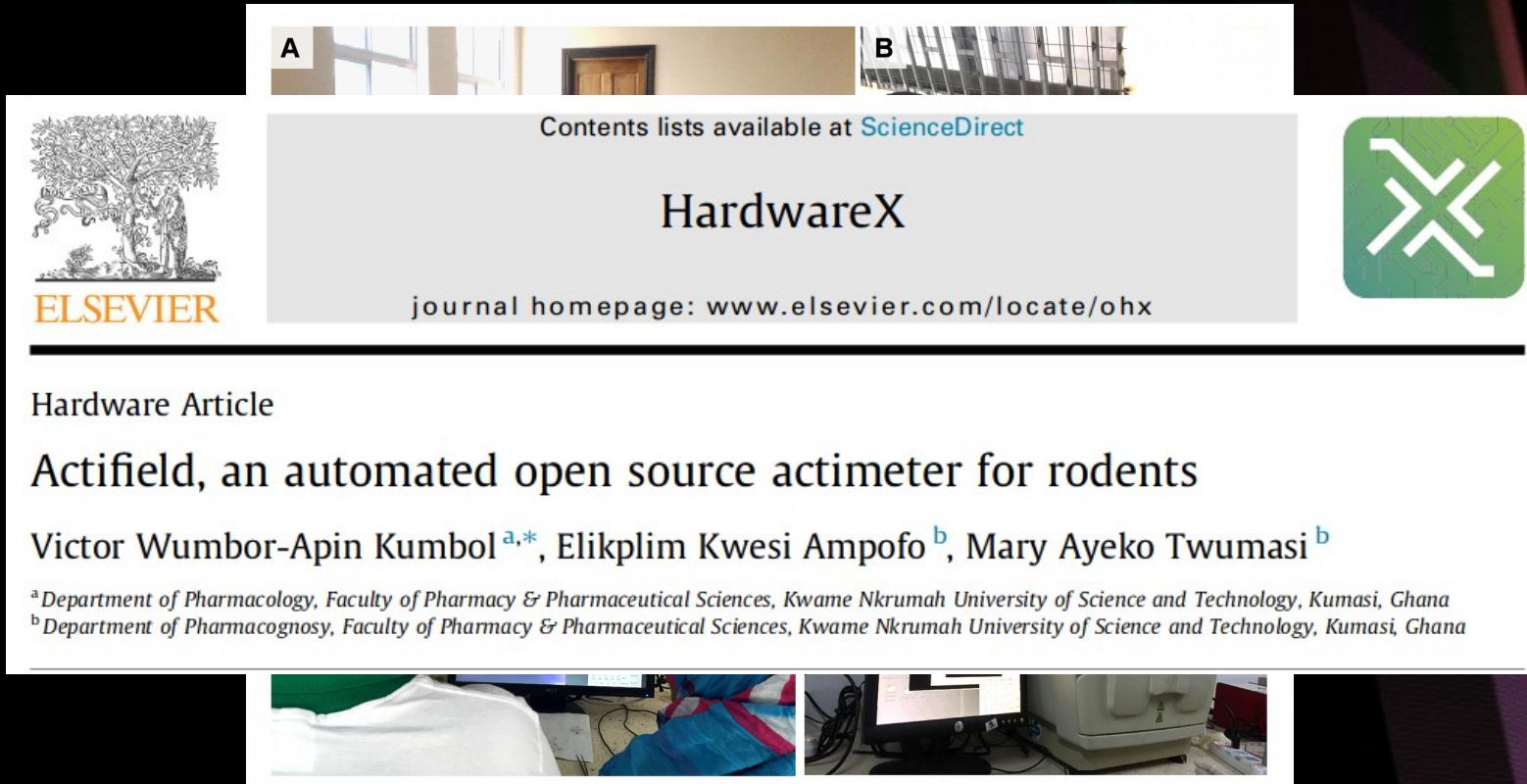




Teaching the teachers



Teaching the teachers



The tools you want

- Google search with participants

OS science equipment

- “Traditional systems:
 - Expensive (fluoresc. Scope >5000€)
 - One supplier commitment
 - Hard to fix/customize/upgrade
 - One per lab/classroom
 - Costly calibrations
 - Bugs hard to spot
 - Fixed, one size (has to) fit all
- OS systems:
 - Affordable (fluoresc. Scope <250€)
 - Buy parts from anywhere
 - Know your tools from inside out
 - Many per lab/classroom
 - Calibrate before every experiment
 - Bugs are easier to spot
 - Adaptable to local realities

Repositories and more information

- GOSH (<http://openhardware.science/>)
- PLOS Channel (<https://channels.plos.org/open-source-toolkit>)
- Open Neuroscience (openeuroscience.com)
- Open Plant Science (<http://openplant.science/>)
- Hackaday.io (hackaday.io)
- CTA - UFGRS (<http://cta.if.ufrgs.br/capa/>)
- Instructables (instructables.com)
- Thingiverse(thingiverse.com)
- Journal of open Hardware (<https://openhardware.metajnl.com/>)
- HardwareX (<https://www.journals.elsevier.com/hardwarex>)
- Appropedia (http://www.appropedia.org/Welcome_to_Appropedia)
- Hackteria (hackteria.org)
- Open Behaviour (<http://openbehavior.com/>)

- Is there any interest in bringing these concepts to schools
 - Think of a problem/scientific question
 - Decide what tools are necessary
 - Leverage open source projects and join the maker community
 - And if so, how do we do it?

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Thank you for your attention!

- Is there any interest in bringing these concepts to schools
 - Think of a problem/scientific question
 - Decide what tools are necessary
 - Leverage open source projects and join the maker community
 - And if so, how do we do it?
- Let's open for questions/comments

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