

# Open Science Hardware & FlyPi workshop

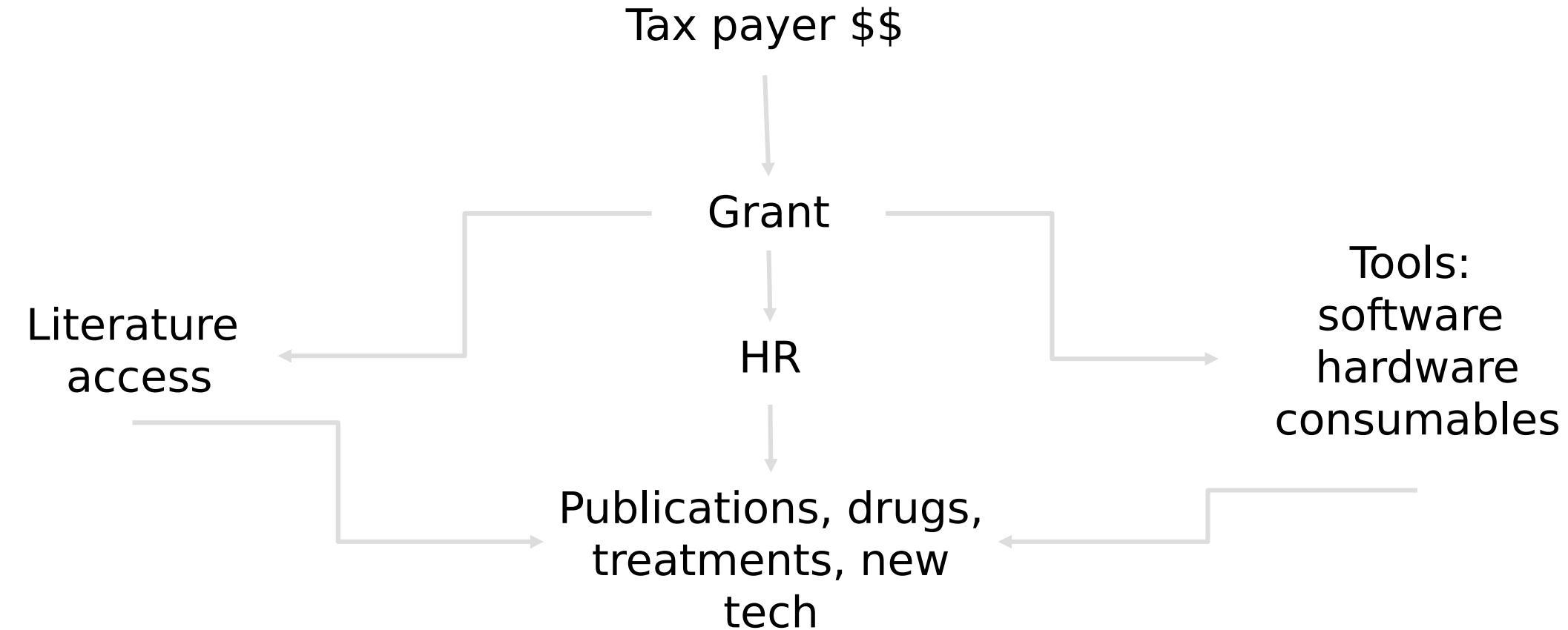
Khartoum 27/08 - 07/09/2018  
Andre Maia Chagas



# A bit about me & how we got together here...

- Open Source and benefits for science
  - Open Neuroscience
- Trend in Africa
  - Open Source Hardware for Science
- PLOS Channels
  - Open Source Toolkit
- Prometheus Science
  - Open Source scientific Instruments
  - Rotary donation & Cooperation with Uni Khartoum

# Funding research in Europe



# Funding research in Europe

Publications, drugs, treatments, new tech



Patent, copyright



Technology transfer



Distribution/production Oligopoly



High Costs

## 30 seconds to master open source

**Everything (code, hardware design, protocols, cake recipes) created is shared freely via licenses (GNU, 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.**

**How people share knowledge here?**

# Hardware: Bad deals at the car dealership

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## Fisherbrand™ 96-Well PCR Racks

Designed for preparing and storing 0.2mL thin-walled PCR tubes and strip tubes before or after PCR sample processing applications

**\$91.00 - \$101.00**

### Specifications

Dimensions (L x W x H)	5 x 3.5 x 1.375 in. (12.7 x 8.9 x 3.4cm)
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Material	Polypropylene
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Quantity	5/pack
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# Plastic tube holders: 100€

# Hardware: Bad deals at the car dealership



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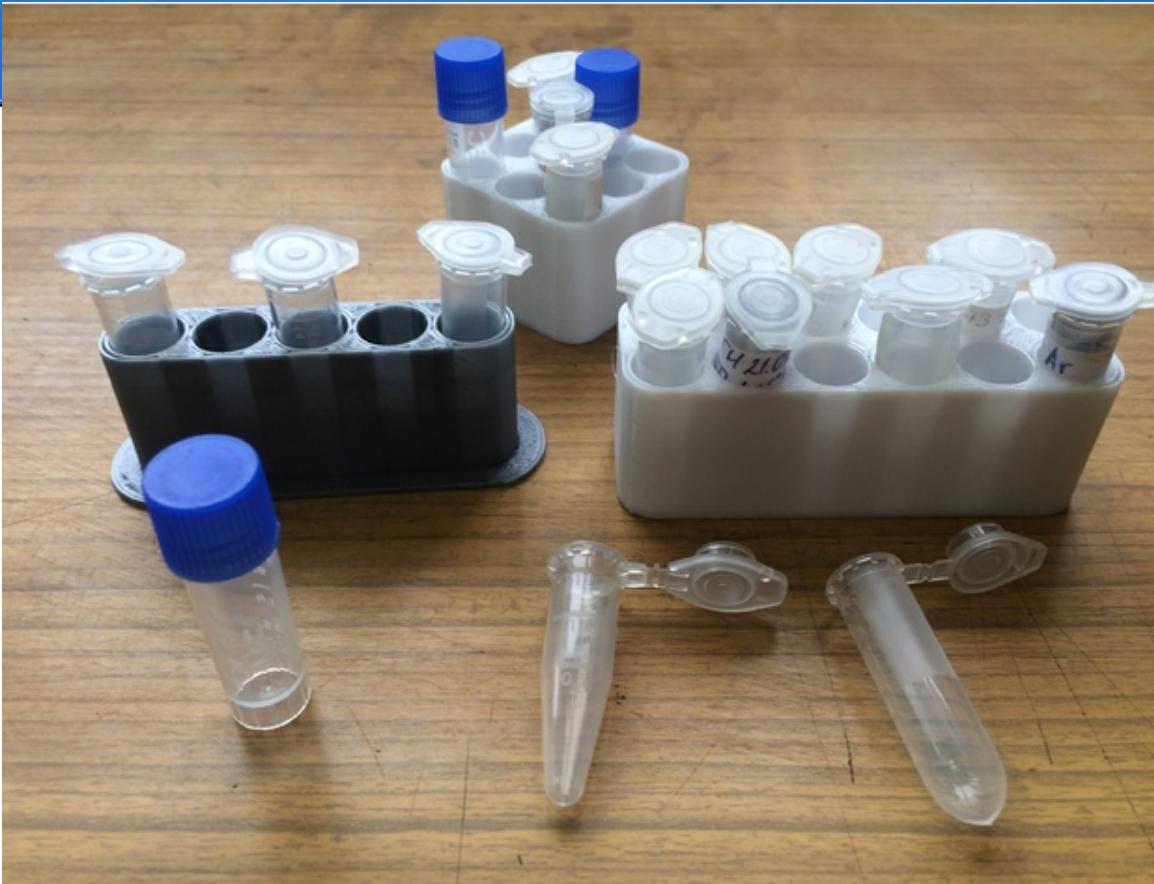
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1CR sample

THINKSTOCK

Plastic tube holders: 100€



1US\$



5000€ regular  
10000€ fluorescent

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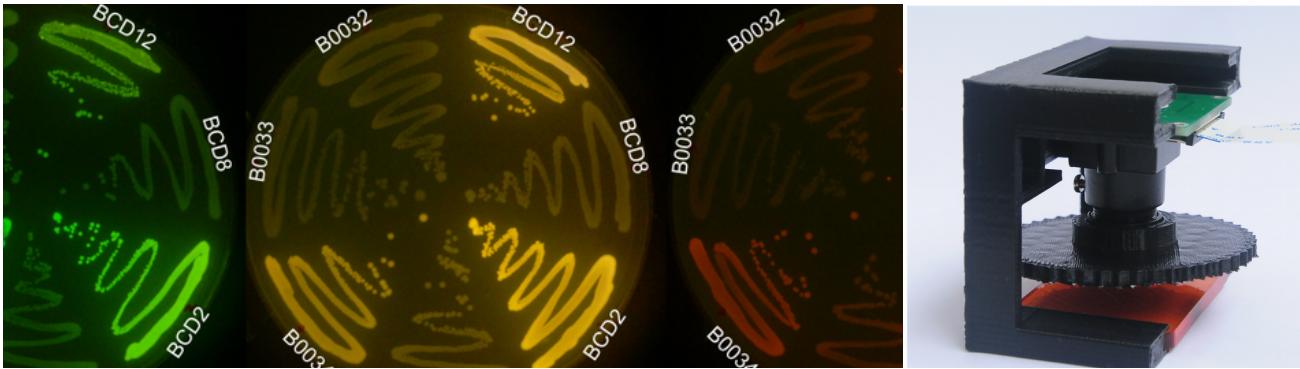
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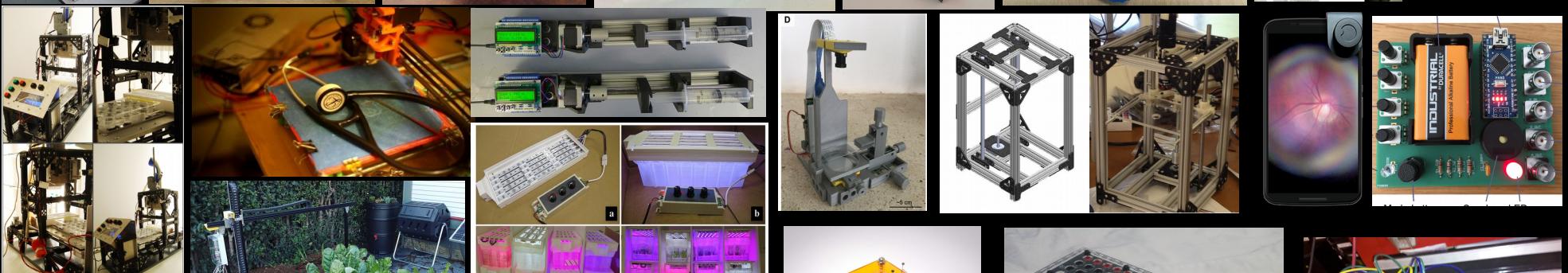
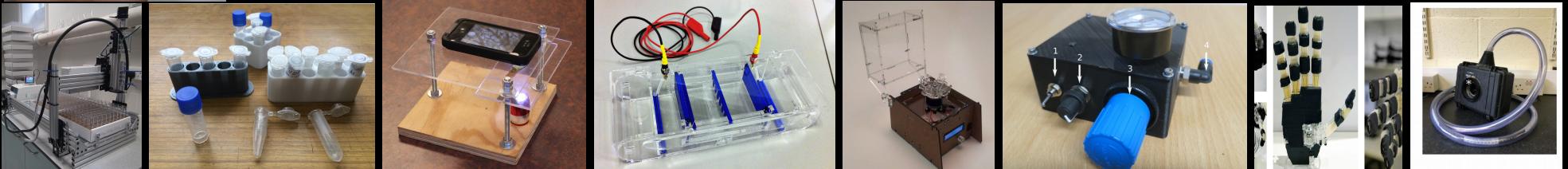
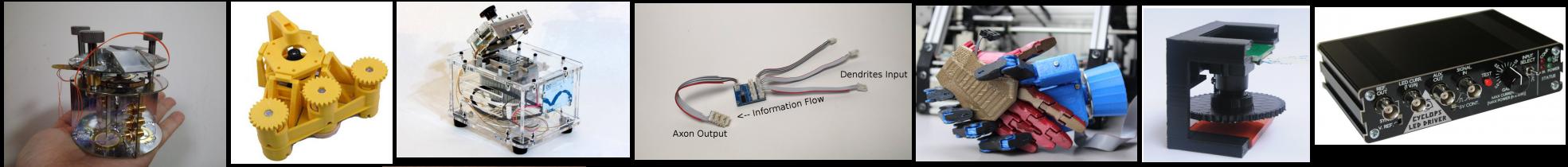
# Low cost and open source multi-fluorescence imaging system for teaching and research in biology and bioengineering

Isaac Nuñez , Tamara Matute , Roberto Herrera, Juan Keymer, Timothy Marzullo, Timothy Rudge , Fernán Federici 

Published: November 15, 2017 • <https://doi.org/10.1371/journal.pone.0187163>



We were inspired by the open source [IO Rodeo transilluminator](#), which images electrophoresis gels, and the [FlyPi microscope](#). We started to think how to evolve it to accomplish more sophisticated tasks for our daily research as well as for educational applications. So we combined the transilluminator with other existing advances such as long stokes shift fluorescent proteins, raspberry pi cameras and python programing resources.



# OS Hardware: Living in the “Cambrian explosion”

Wikipedia >70 projects (only commercial level/big projects)

In these slides at least another 36

Many, MANY more in repositories online

OS tools to create hardware are getting better and easier

Software

Fast prototyping

Lower price for manufacturing

Internet infrastructure

Sharing videos, tutorials, documentation

Some companies applying OS business models are >5 years old.

# Closed X Open Systems

## “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

# Companies/non-profits providing OS Hardware and services around them





Prometheus Science

# FlyPi as a way into OS Hardware

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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*

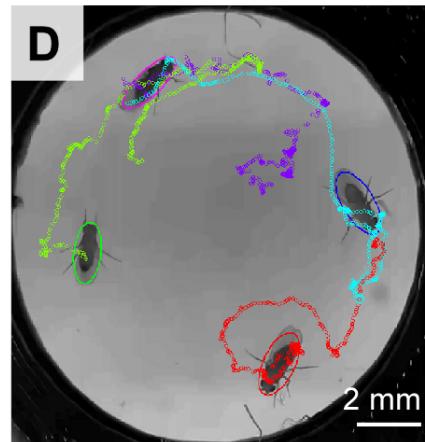
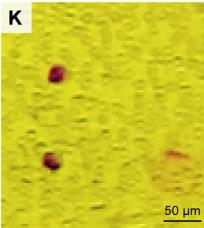
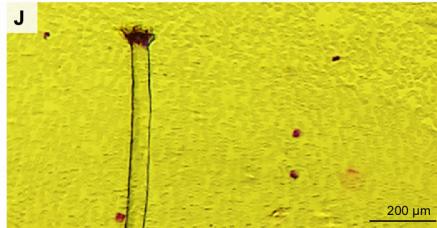
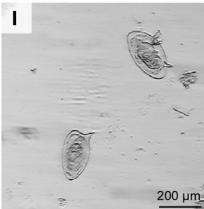
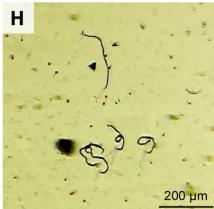
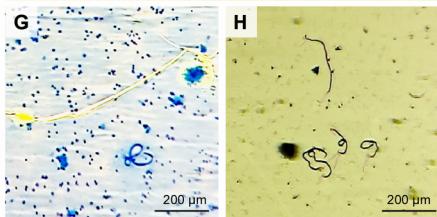
Andre Maia Chagas , Lucia L. Prieto-Godino, Aristides B. Arrenberg, Tom Baden 

Published: July 18, 2017 • <https://doi.org/10.1371/journal.pbio.2002702>

# FlyPi as a way into OS Hardware

- Project based learning
  - Practice from the beginning
  - End with a functioning piece of equipment
  - Get comfortable with electronics and online interactions

# FlyPi as a way into OS Hardware



# Online resources for FlyPi

- Publication: <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2002702>
- Github: [www.github.com/amchagas/flypi](https://www.github.com/amchagas/flypi)
- Forum: <https://www.forum.prometheus-science.com/home/categories/flypi-user-forum>
- Prometheus Website: [www.prometheus-science.com](http://www.prometheus-science.com)

# Online communities / repositories

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

# What questions do you have?

# Also good for career:

## A DIY Ultrasonic Signal Generator for Sound Experiments

Ihab F. Riad

*Physics Department, University of Khartoum, Khartoum, Sudan\**

(Dated: November 14, 2016)

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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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