Slides available online:
bit.ly/osmend1

Open Science Hardware in the Biomedical Field

- A proxy for other fields

André Maia Chagas

12.04.18 Abril 2018

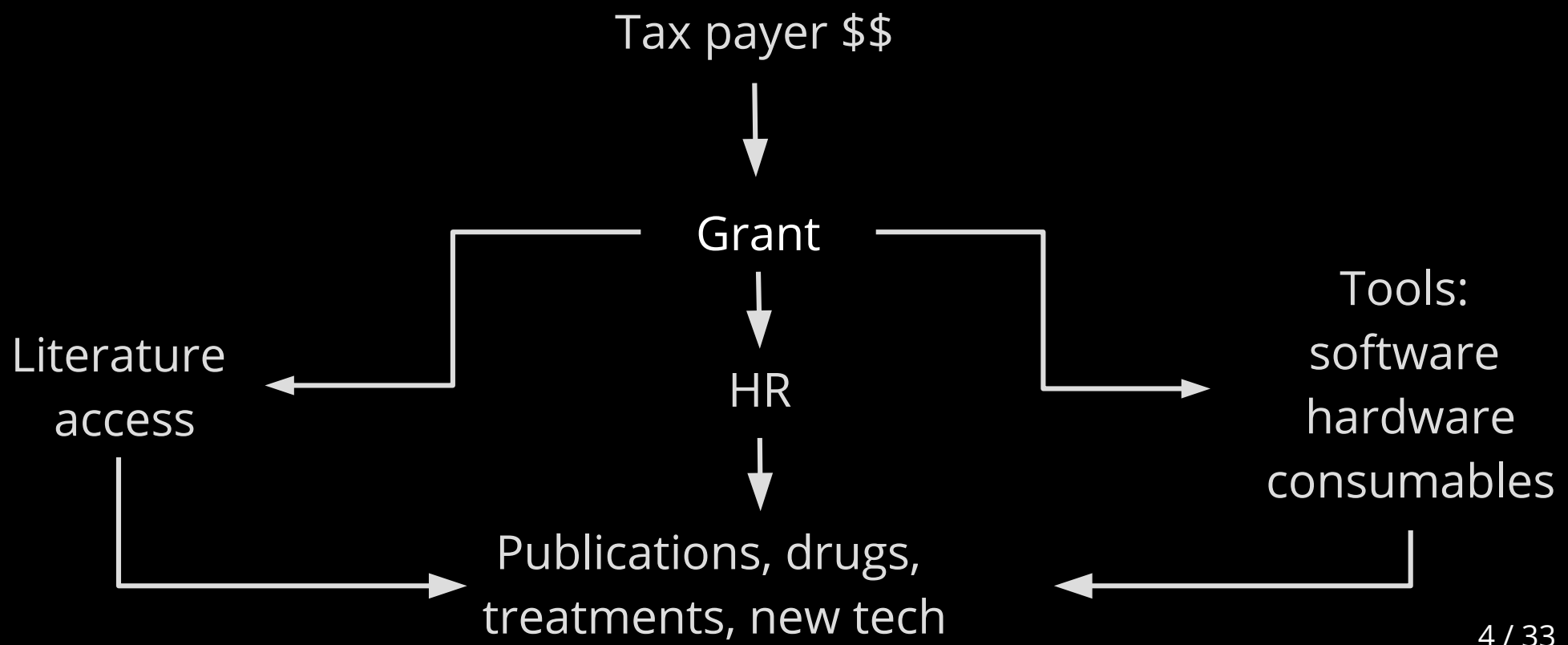
UC Chile

Brief Intro (open source related projects)

- 2013/1 → openeuroscience.com started
  - Open source projects related to Neuroscience
- 2013/2 → Open source adviser @ Trendinafrica.org
  - Organization of open labware workshops
  - development of open source tools
- 2015 → Editor of PLoS channel: Open source toolkit
  - Collection open source projects for science
    - Send your projects!

andre@prometheus-science.com

Public hospitals, Research centers, Universities



Public hospitals, Research centers, Universities

Publications, drugs, treatments, new tech

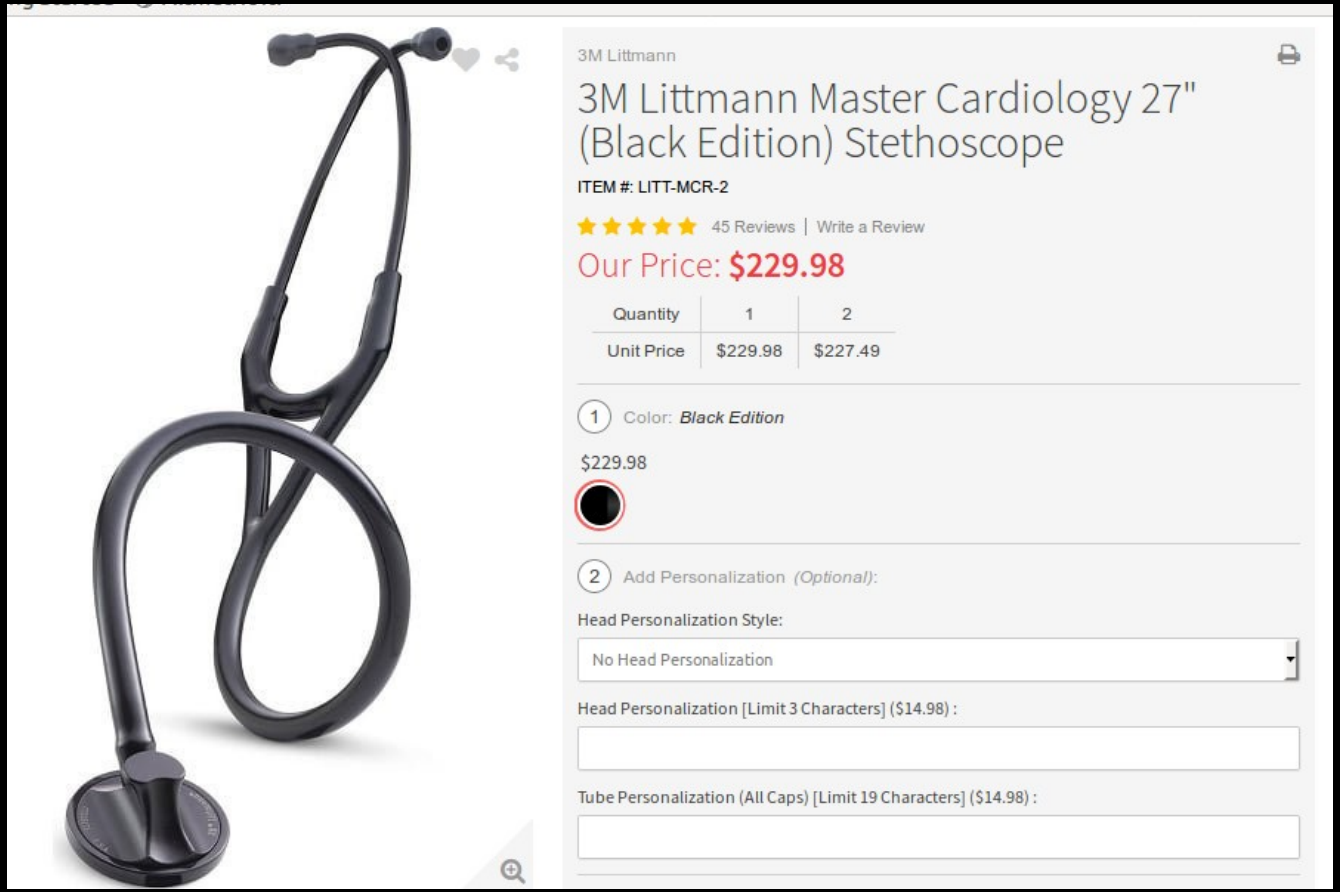
Patent, copyright

Technology transfer

Distribution/production Oligopoly

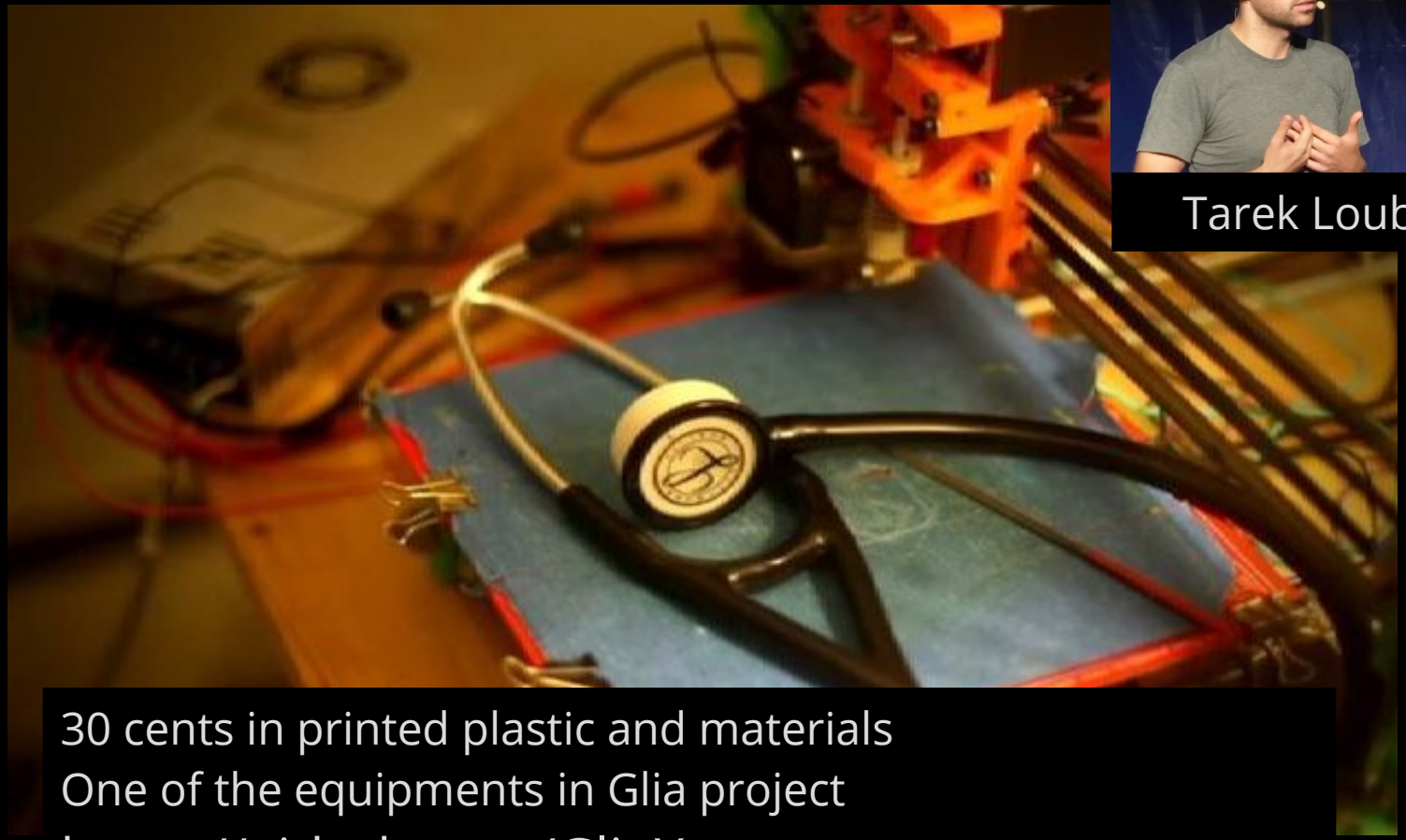
High Costs

Case study: Stethoscope



Case study: Stethoscope

Tarek Loubani



30 cents in printed plastic and materials
One of the equipments in Glia project
https://github.com/GliaX

Case study: Stethoscope

PLOS ONE

RESEARCH ARTICLE

Validation of an effective, low cost, Free/open access 3D-printed stethoscope

Alexander Pavlosky[1], Jennifer Glauche[2], Spencer Chambers[1], Mahmoud Al-Alawi[3], Kliment Yanev[2], Tarek Loubani[1,3,4,5,6]*

1 Faculty of Medicine, University of Western Ontario, London, Ontario, Canada, **2** No institutional affiliation (Independent contractors), Cologne, Germany, **3** Glia, Inc., London, Canada, **4** Division of Emergency Medicine, Department of Medicine, University of Western Ontario, London, Ontario, Canada, **5** Division of Emergency Medicine, London Health Sciences Centre, London, Ontario, Canada, **6** Division of Emergency Medicine, Al-Shifa Hospital, Gaza City, Occupied Palestinian Territories

Data shows the performance is better than Littmann stethoscopes!

https://github.com/GliaX

Open Source / Open Access

- Culture/philosophy “started” in the ~60s
  - Mainly computer software/drivers
- all blueprints are shared
  - Information is free (LIBRE)

Open Source Hardware / Free Hardware

- No intellectual property or patents (or at least permissive)
  - Existing companies sell service, leads to fairer prices & access
- Hardware
  - Also around for some years
  - Gained power with:
    - Price drop in electronics
    - DIY manufacturing tools (3D printers, laser cutters, etc)
    - Online repositories

Case study: PCR machines

ThermoFisher SCIENTIFIC

Order Support | Sign In | Quick Order | 0

SimpliAmp™ Thermal Cycler

Katalognummer: A24811

Applied Biosystems™ **Verwandte Anwendungen** PCR

	Katalognummer	Packungsgröße	Listenpreis (EUR)	Menge
☆	A24811	1 instrument	4.990,00	

Mein Preis & Verfügbarkeit ›

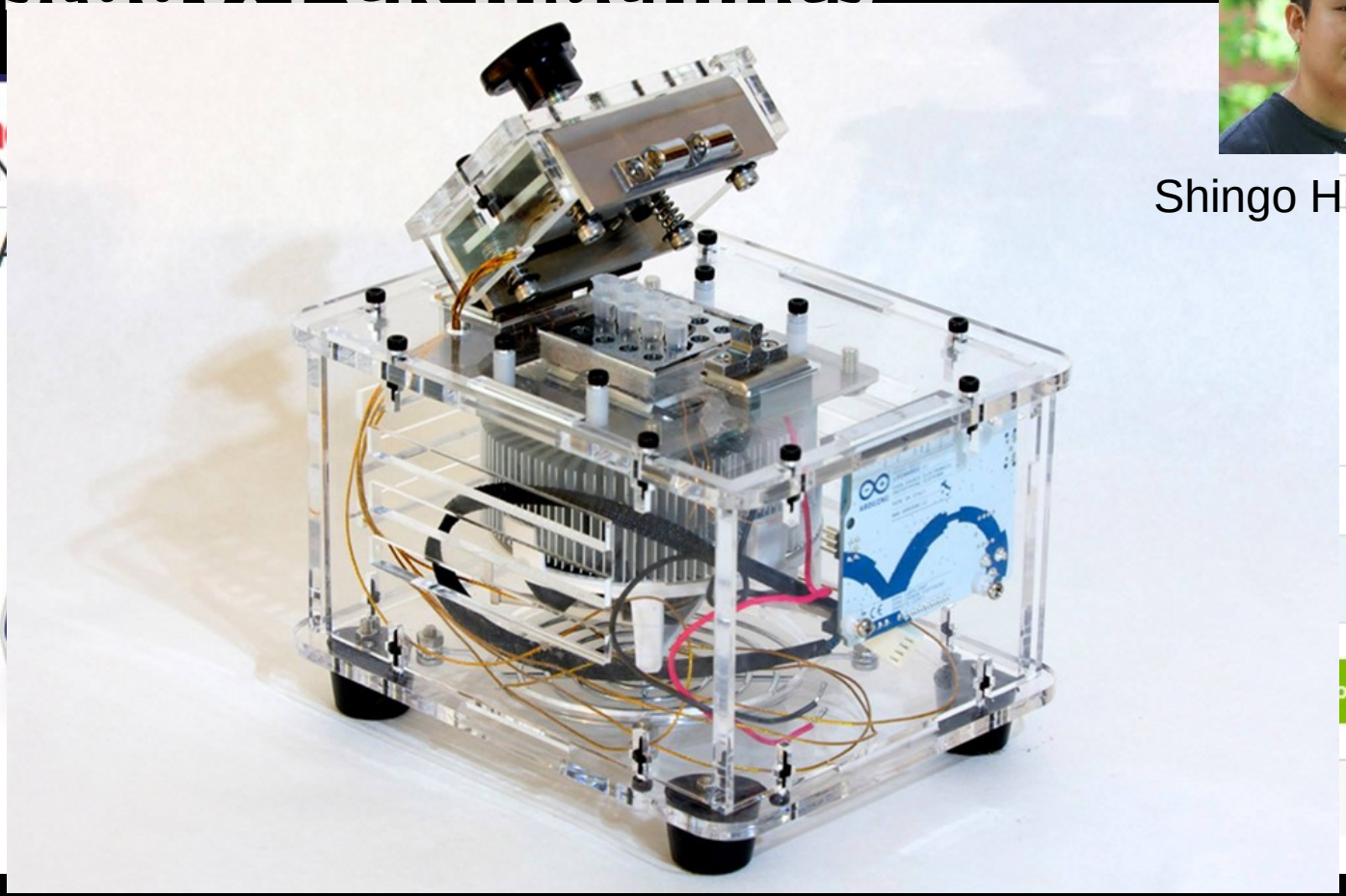
Zum Warenkorb hinzufügen

Benötigen Sie ein Webangebot? ›

Case study: PCR machines

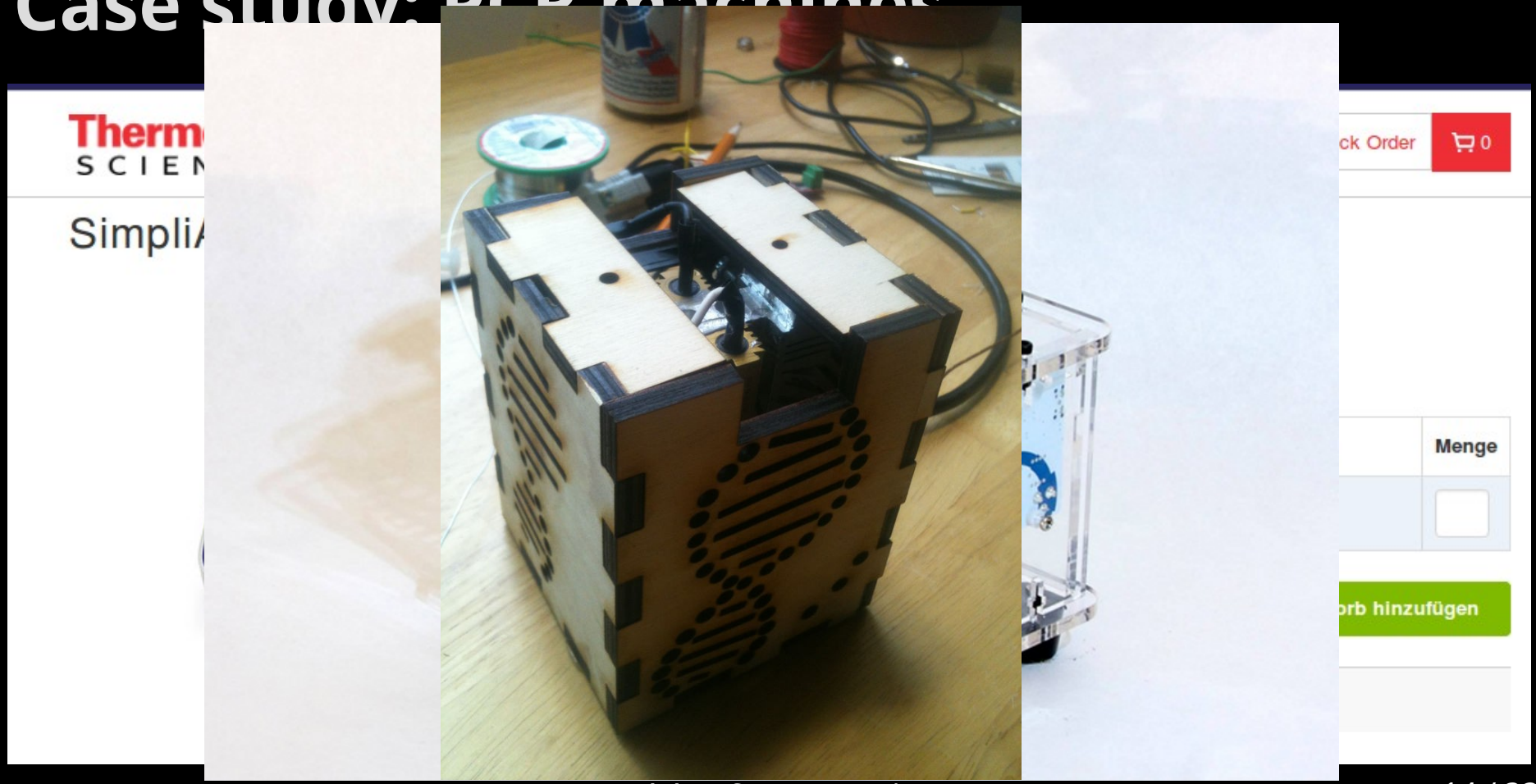
Buy for 650US$ or build it yourself

Case study: PCR machines



Shingo Hisakawa

Case study: PCR machines



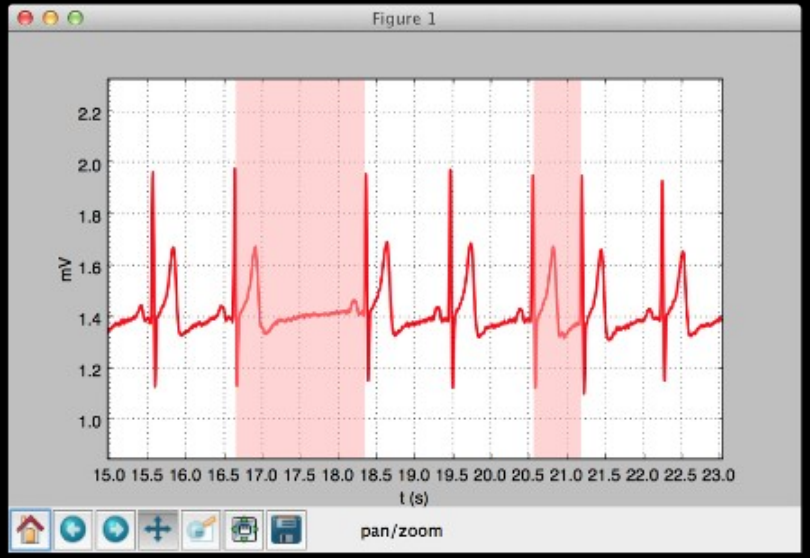
Build it for 65US$

The use of open source hardware

- Open source hardware → defined by OSHWA:
  - Hardware needs to be released with documentation
  - Software for the hardware must be open (or easy to make open)
  - Redistribution agnostic (derivation,businesses, hobbyists, etc)
  - Attribution
  - No discrimination (persons and endeavor)

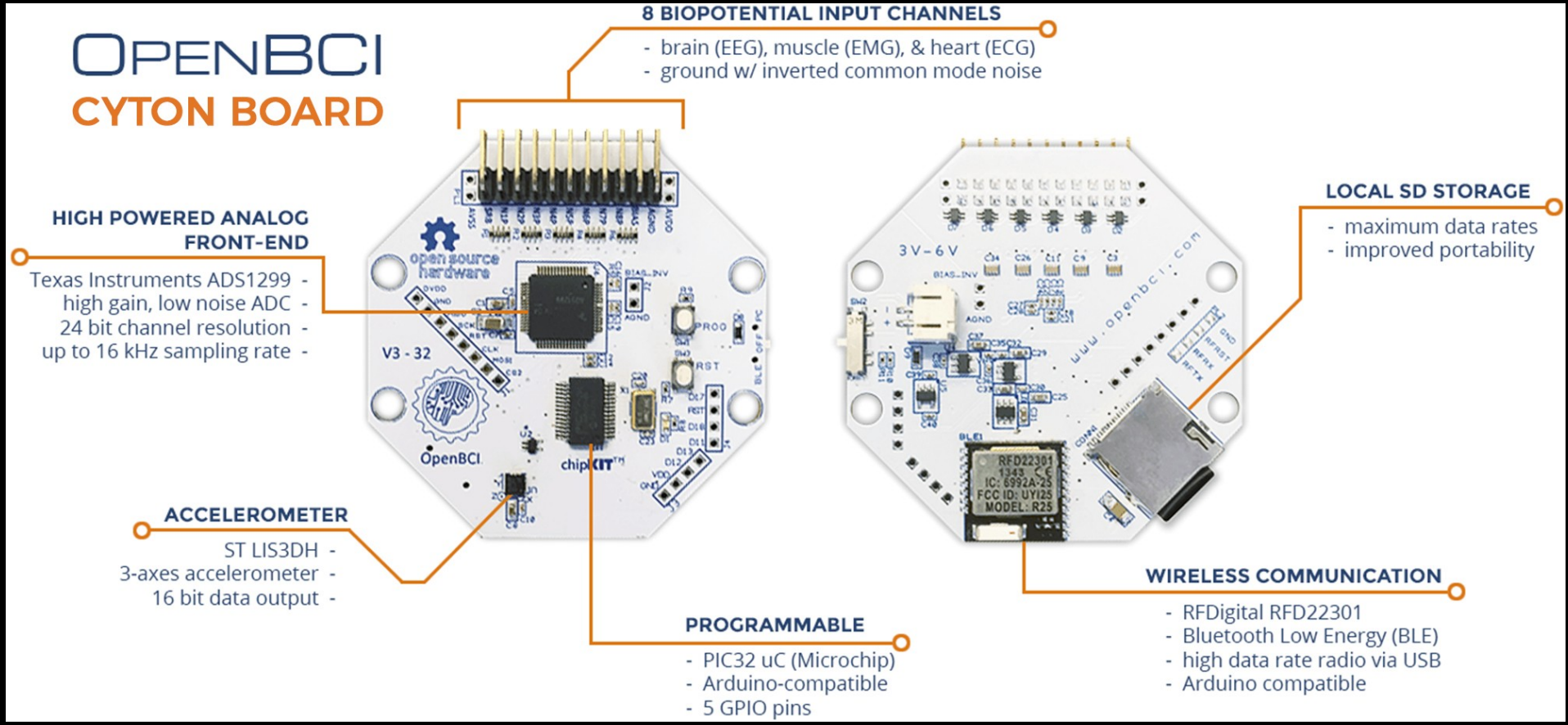
“Why my doctor prescribed me OS Hardware”

Hugo Silva

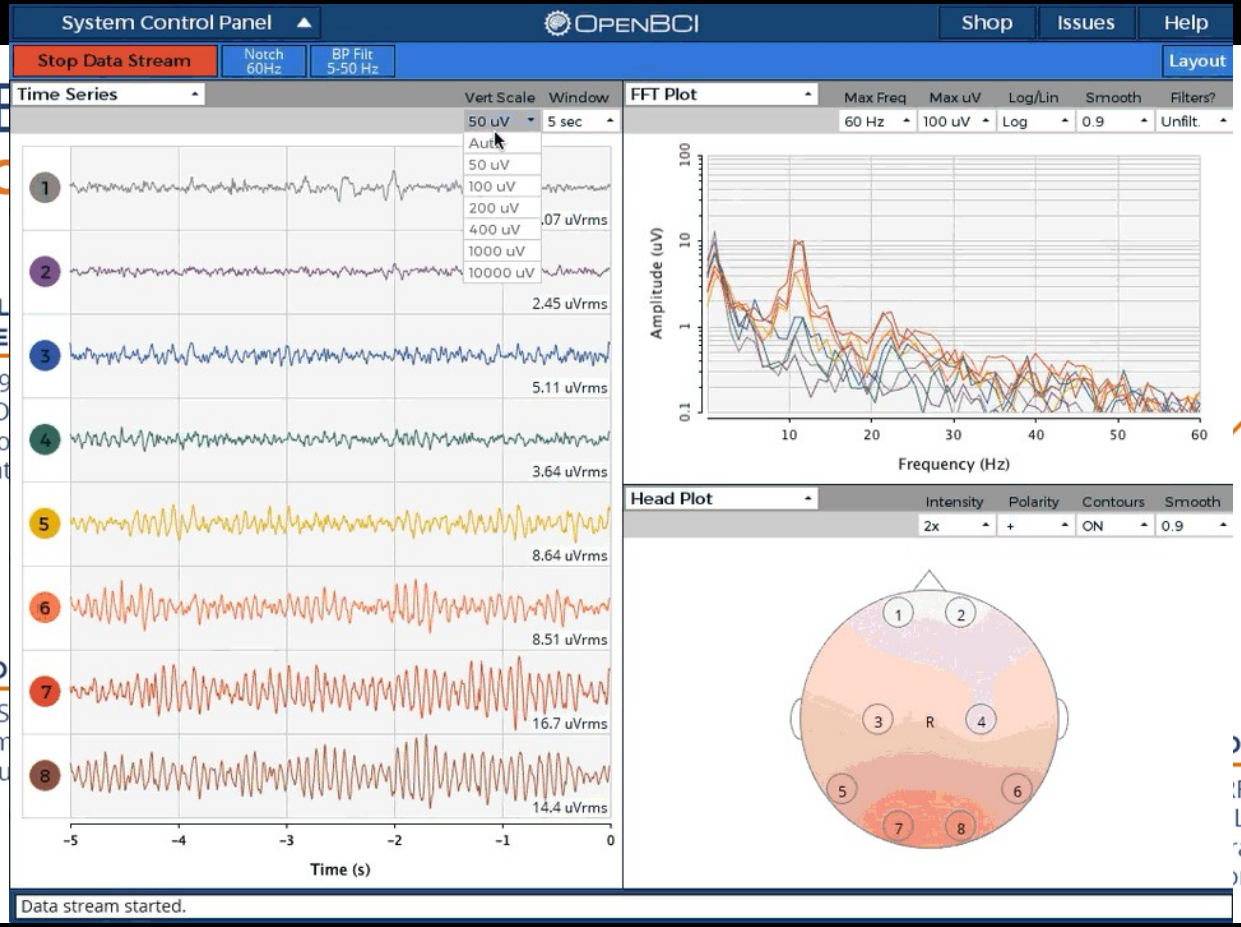


https://opensource.com/health/15/6/monitoring-health-with-open-hardware

Open BCI


OPENBCI
CYTON BOARD
8 BIOPOTENTIAL INPUT CHANNELS
- brain (EEG), muscle (EMG), & heart (ECG)
- ground w/ inverted common mode noise
HIGH POWERED ANALOG FRONT-END
Texas Instruments ADS1299 -
high gain, low noise ADC -
24 bit channel resolution -
up to 16 kHz sampling rate -
LOCAL SD STORAGE
- maximum data rates
- improved portability
ACCELEROMETER
ST LIS3DH -
3-axes accelerometer -
16 bit data output -
PROGRAMMABLE
- PIC32 uC (Microchip)
- Arduino-compatible
- 5 GPIO pins
WIRELESS COMMUNICATION
- RFDigital RFD22301
- Bluetooth Low Energy (BLE)
- high data rate radio via USB
- Arduino compatible
V3 - 32
OpenBCI
chipKIT
3V-6V
www.openbci.com
RFD22301
FCC ID: UYI25
MODEL: R25

Open BCI



OPENB

CYTON BC

HIGH POWERED ANAL
FRONT-E

Texas Instruments ADS129
high gain, low noise AD
24 bit channel resolutio
up to 16 kHz sampling rat

ACCELERO

ST LIS
3-axes accelerom
16 bit data ou

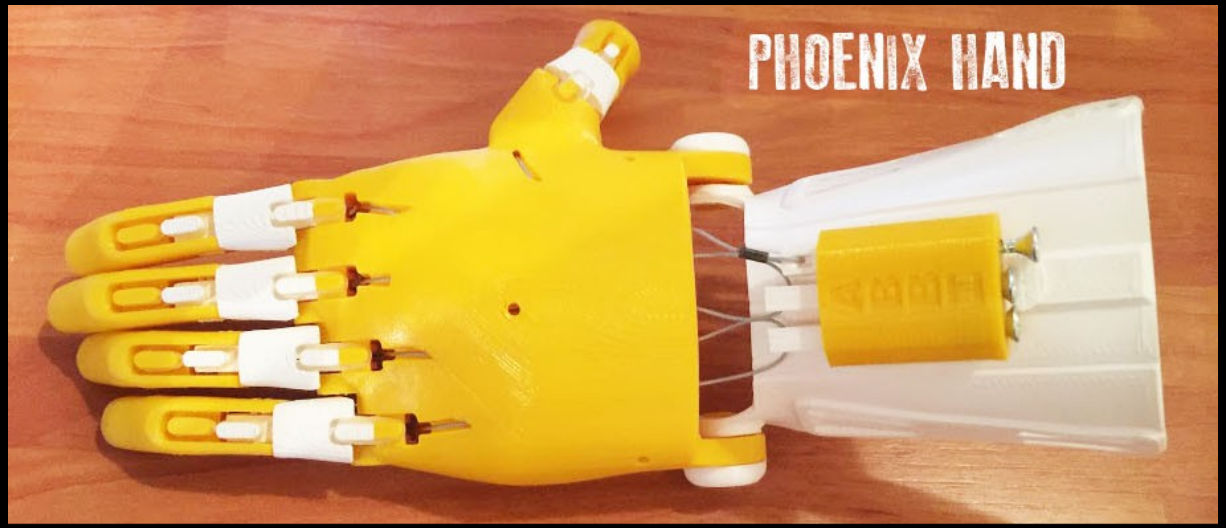
LOCAL SD STORAGE

- maximum data rates
- improved portability

OMMUNICATION

FD22301
Low Energy (BLE)
ate radio via USB
mpatible

Enabling the Future



Printed parts
Customizable
3-15€ in materials

Case study: OS Hardware as a teaching tool

“Open Labware” Schools
2015 – Durban
2015 – Addis Ababa
2017 – Ibadan
2018 – April Cape Town

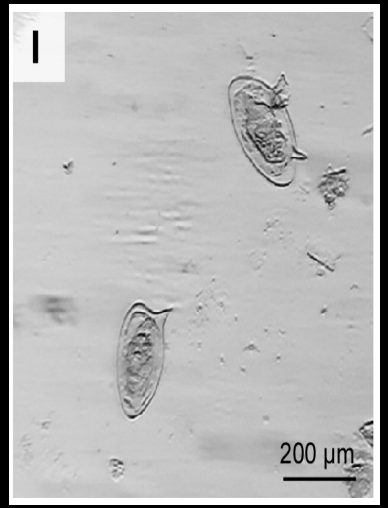
In the Menu:
“Sharing how to build fishing rods”
AKA
Share basic electronics and 3D printing knowledge

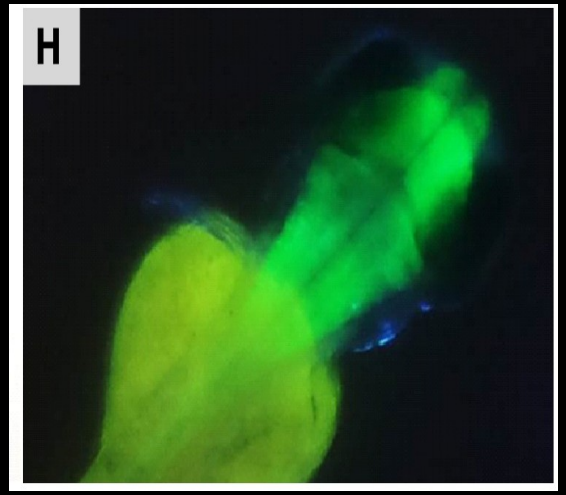
Test

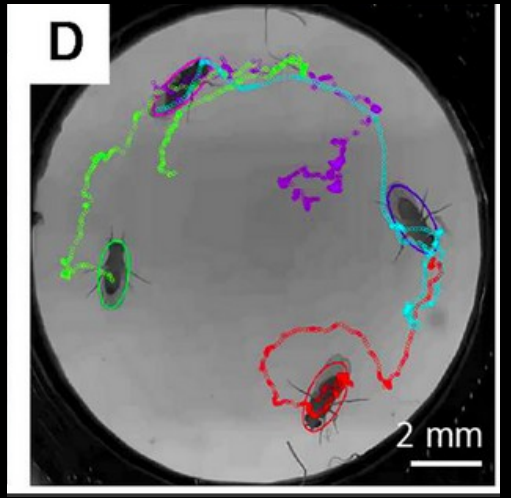
Case study: OS Hardware as a teaching tool

Dr. Odunayo Azeez video

FlyPi: Affordable modular lab







OpenNeuroscience

FlyPi: Affordable modular 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*

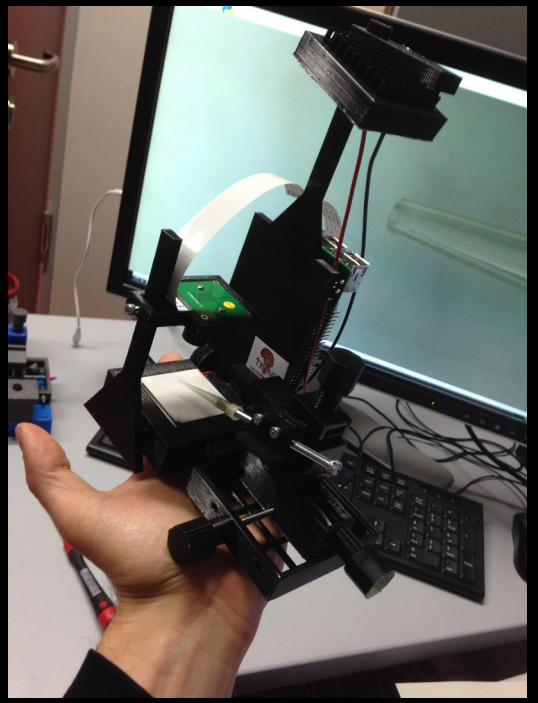
Andre Maia Chagas[1,2,3,4]*, **Lucia L. Prieto-Godino**[3,5], **Aristides B. Arrenberg**[1,6], **Tom Baden**[1,3,4,7]*

1 Werner Reichardt Centre for Integrative Neuroscience, University of Tübingen, Tübingen, Germany, **2** Graduate school for Neural and Behavioural Neuroscience, University of Tübingen, Tübingen, Germany, **3** TReND in Africa gUG, Bonn, Germany, **4** Institute of Ophthalmic Research, University of Tübingen, Tübingen, Germany, **5** Center of Integrative Genomics, University of Lausanne, Lausanne, Switzerland, **6** Institute of Neurobiology, University of Tübingen, Tübingen, Germany, **7** School of Life Sciences, University of Sussex, Brighton, United Kingdom

* andremaia.chagas@gmail.com (AMC); t.baden@sussex.ac.uk (TB)

Check for updates

OPEN ACCESS



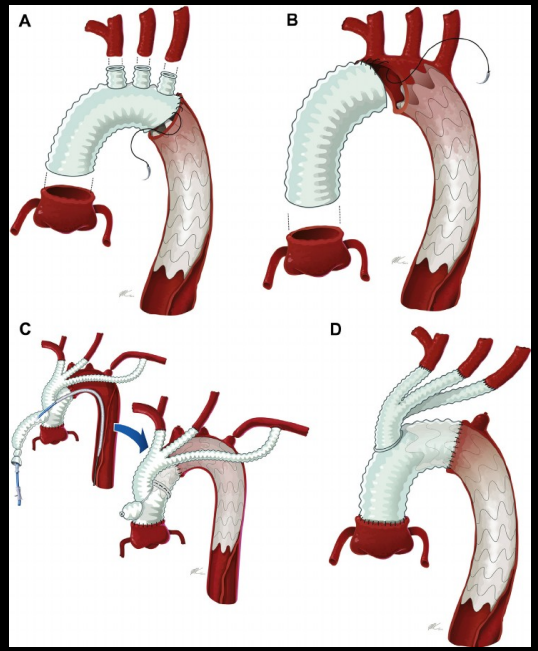
Paper published, then what?

- Once papers are published development “stops”
- Researchers don’t have time/interest to mass produce
- What happens to all these tested/benchmarked/peer-reviewed designs?
  - Can we improve access by doing the boring jobs?

Paper published, then what?

- Looking for early adopters!
  - www.prometheus-science.com/flypi

Treatments – Next step?!



Open Stent

HEALTH

THESE BIOHACKERS ARE CREATING OPEN-SOURCE INSULIN

TO MAKE THE DRUG AFFORDABLE FOR MILLIONS OF DIABETICS WORLDWIDE

By Alexandra Ossola Posted November 18, 2015

Open Insulin

Repositories and online communities

- 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)
- 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)

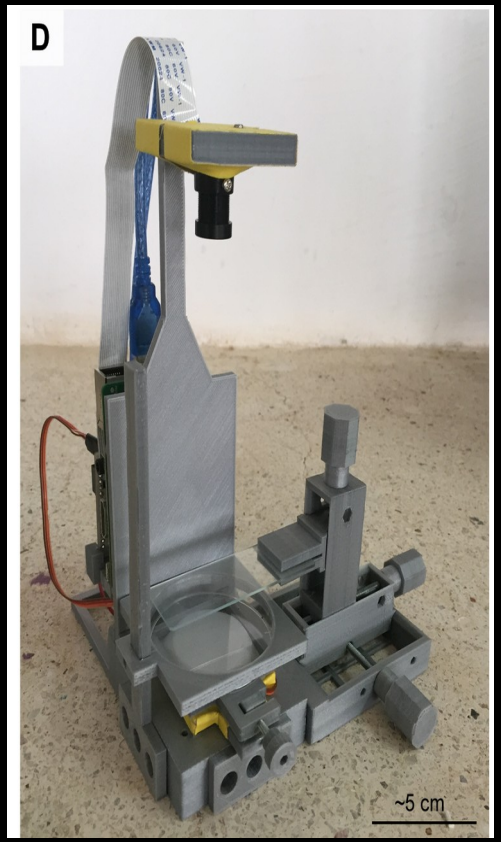
Thank you for your attention!

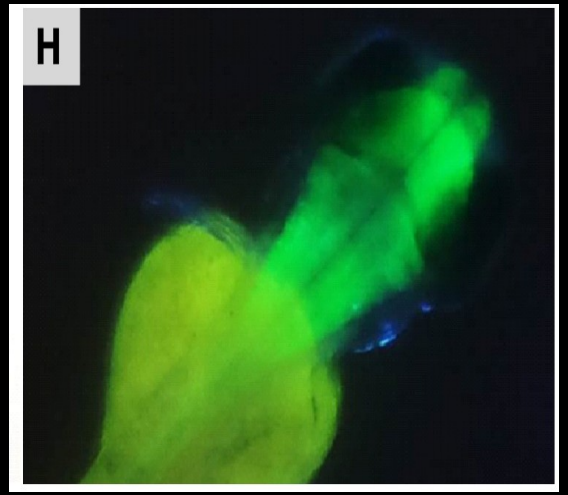
- Questions?

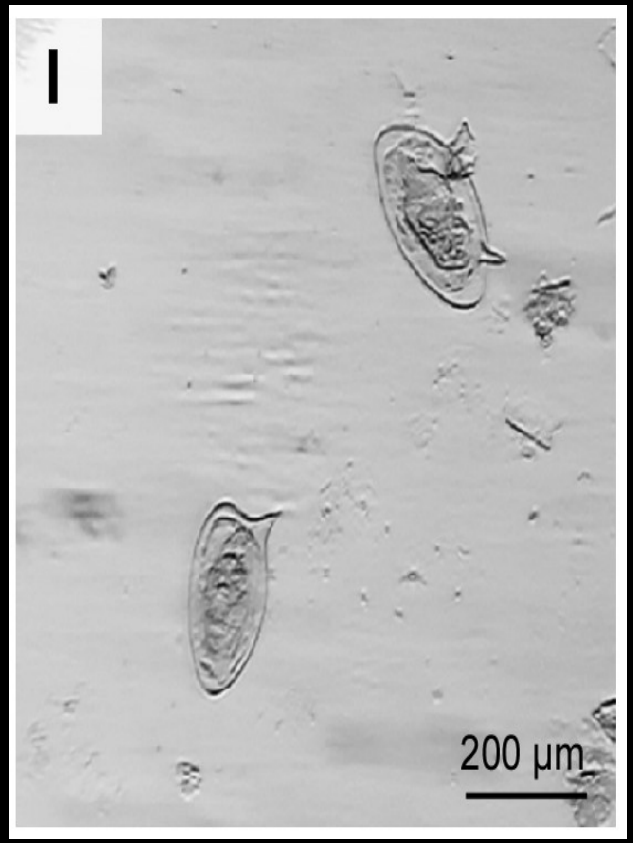
  - Slides available oniine:
    - **bit.ly/osmend1**

  - **Contact: andre@prometheus-science.com**

Microscopes







communities

- Wevolver
- GOSH
- Hackaday.io
-

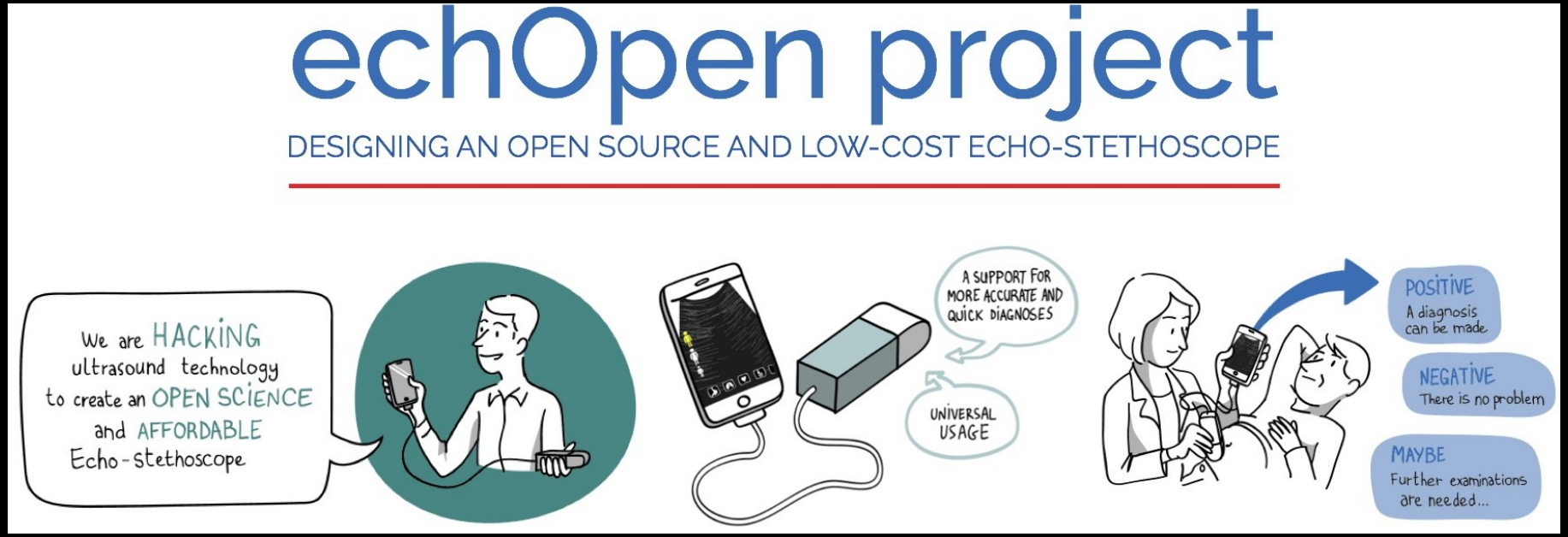
Open and profitable

- Company examples

Hurdles of the biomedical field and why open is better

- Certifications, legal requirements, etc

echOpen



Right here in your backyard!