One Image: Exploring Open Source Digital Imaging for Research

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Aims

- 1-year,
- cross-campus and cross-disciplinary,
- open research program
- to develop inexpensive, accessible, digital imaging research instrumentation built on the Raspberry Pi platform:
  - controllable, high quality, digital imaging of research targets and objects

Research Endowment Trust Fund (RETF)

Why?

- Need for low-cost high-throughput imaging of various subjects
- consumer digital cameras – can deliver great quality, but less controlled imaging conditions
- laboratory cameras - fully controlled to capture consistent, precise images but expensive (specialist research markets)

- Raspberry Pi is an easy-to-use single-board computer and cheap
- Raspberry Pi cameras can be high performance and are compatible with high-quality microscope lenses
- Compact system with small footprint in the lab or adapted to field work
- A large number of available tools/codes developed that can be easily adapted to the specific requirements

Local users

Research subjects (direct users):

***C. elegans* (Kevei lab)**

Zebrafish (Pollitt lab)

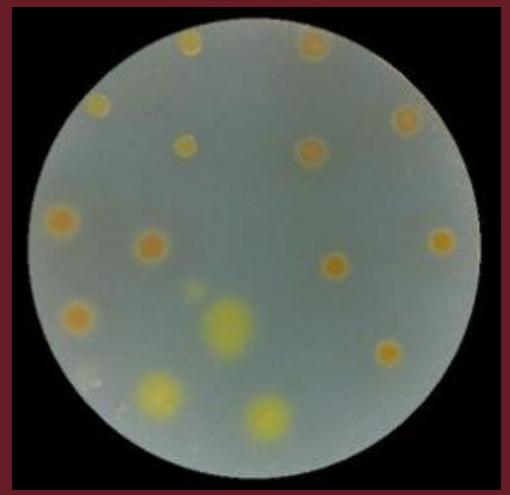
Bacteria (Barrett lab)

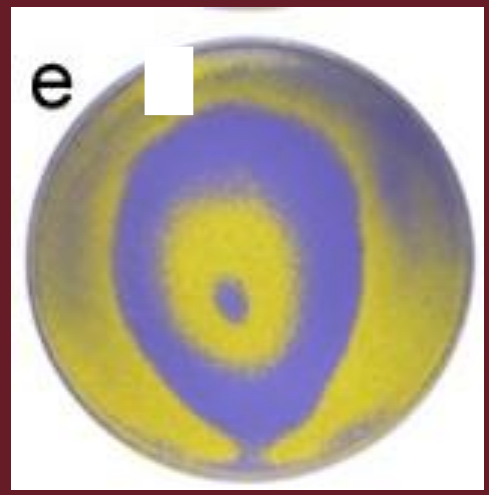
Mice (Vasudevan and Maiaru lab)

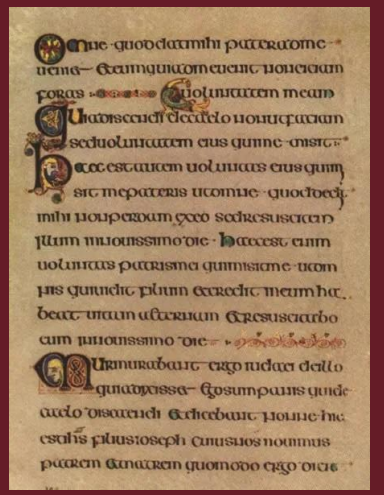
Platelet (Jones lab)

***In gel* chemical oscillations (Hayashi lab)**

Historical prints (Dr Lickiss)







Direct outcomes – affordable imaging system with design shared open source

- Easy to create
- Easy to use
- Affordable
- Multipurpose
- Modular
- For research, teaching and outreach
- Interdisciplinary collaborations across the campus

The team

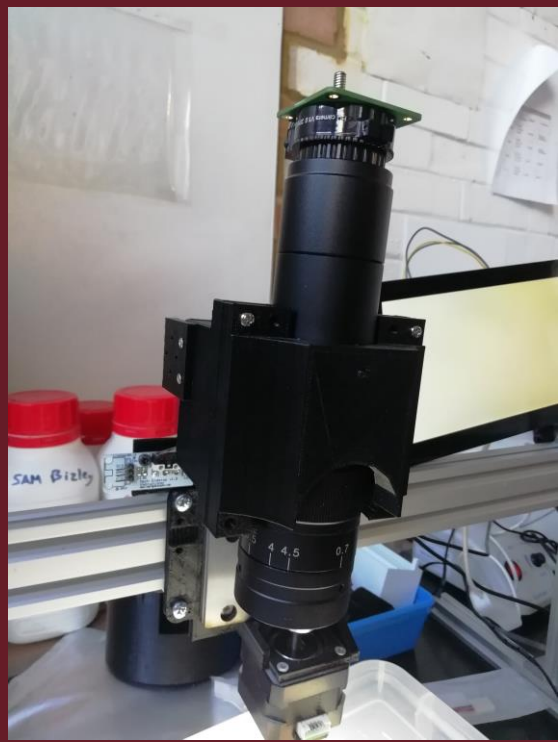
- Al Edwards
  - Sarah Needs
  - Ruya Meltem Sariyer
- Eva Kevei
  - Susanna Cogo
- Alice Pollitt
- Glyn Barrett
- And more…

Design
Test
Validate
Publish

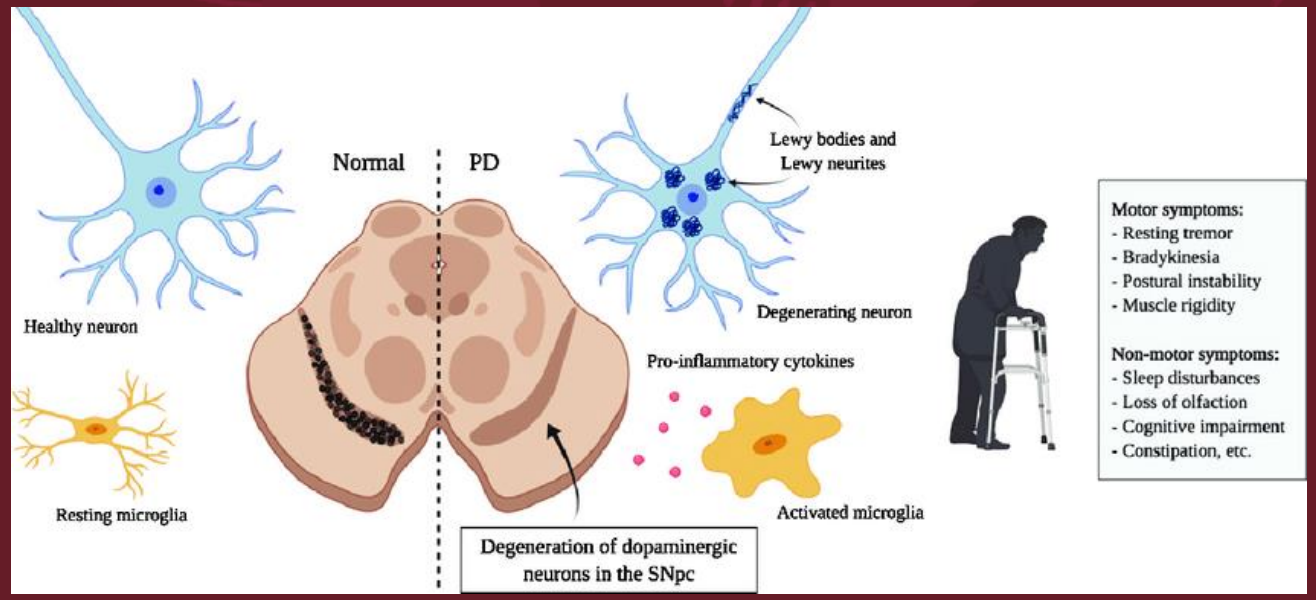
- Steven Wasko
- Ross Wilson

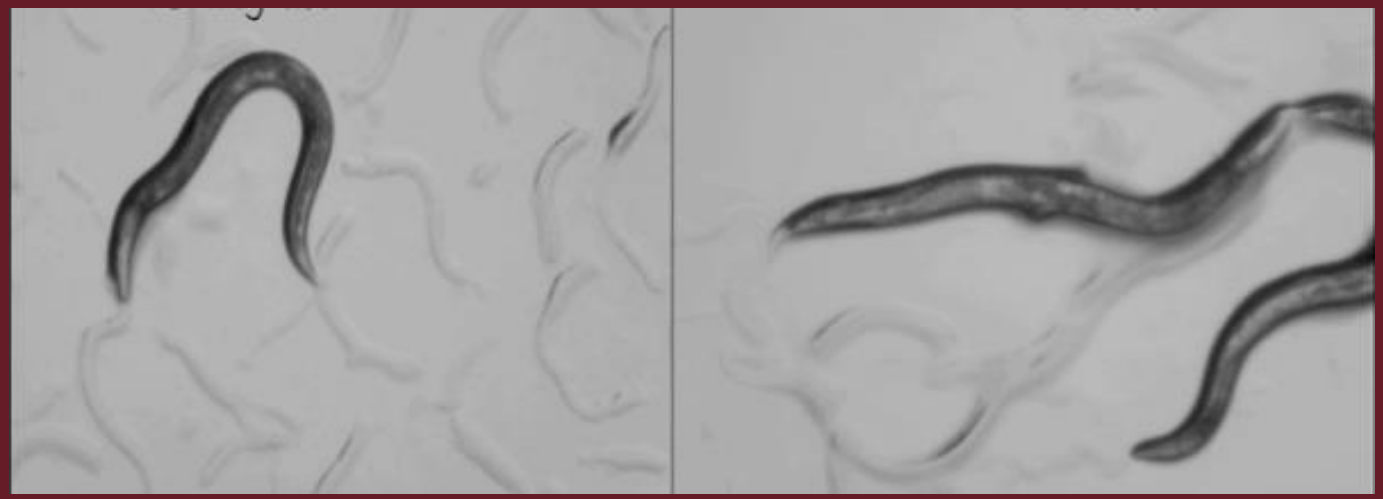
Technical support

- 3 PhD students part time - preliminary research studies for bigger grant applications



Research into genetics of Parkinson's disease





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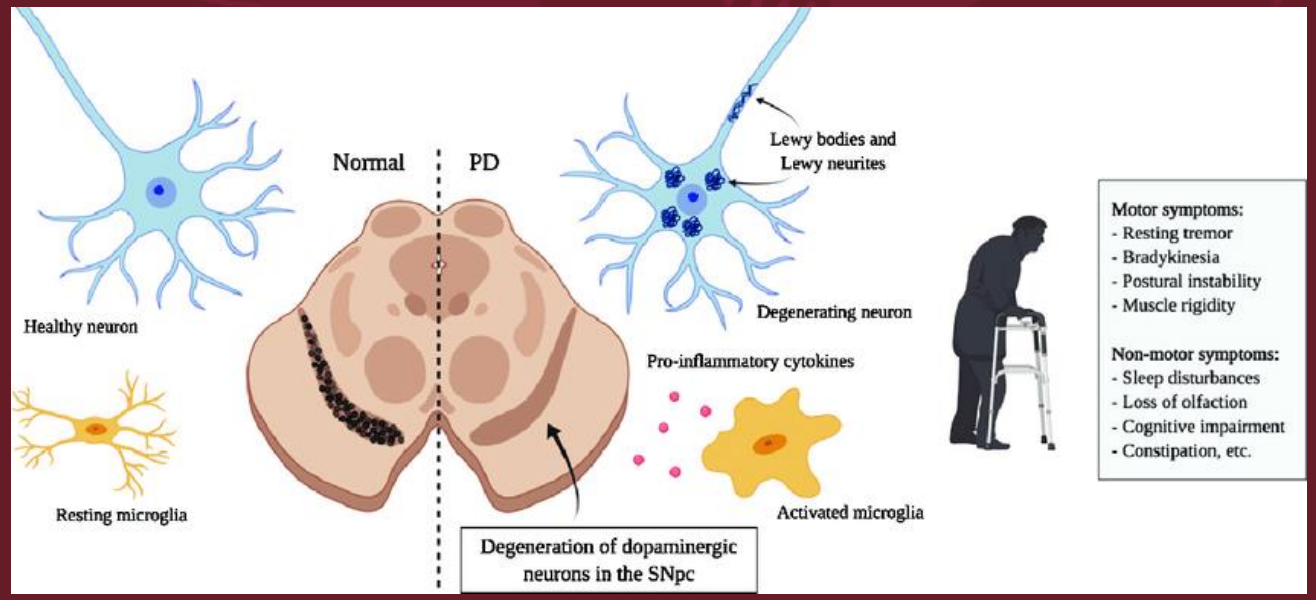
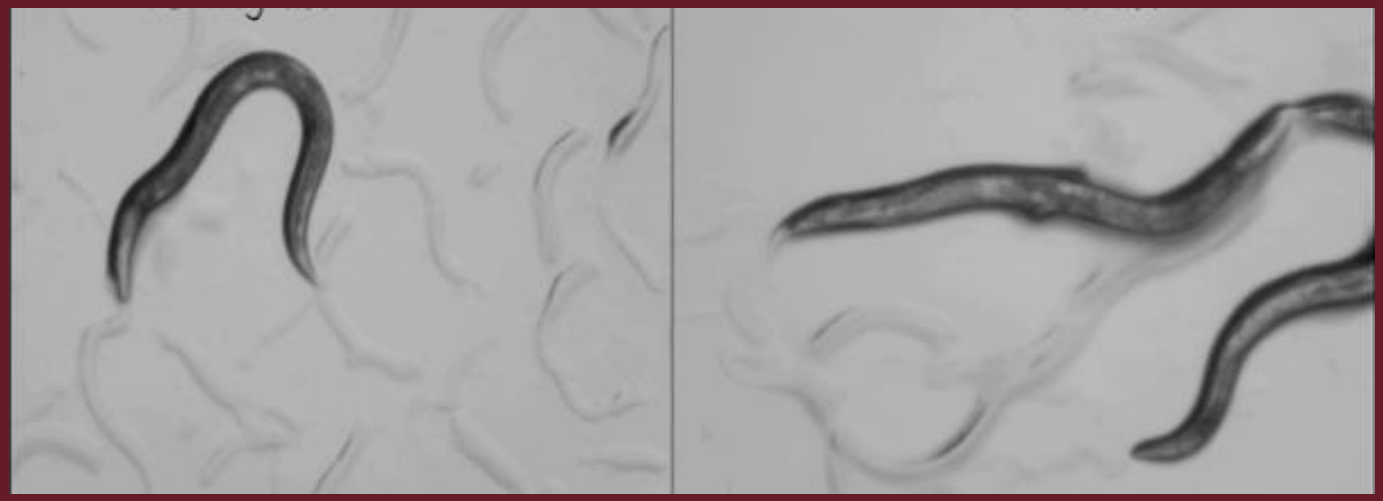




Build some multipurpose modular system

Multiple static camera (6-8) on a fixed frame with camera (lenses attached) being moved in vertical direction for manual focusing

One camera on frame moving above 6-10 samples/image positions, which are monitored over longer time; camera can be moved in vertical direction for manual focusing

IMAGES

- Images taken every 1-30 minutes for 1h up to 10 days
- Image quality: highest possible resolution with smallest (3-5 mm) to highest (35-100 mm) field of view

VIDEOS

Short videos 20sec

- 20 sec videos, manual/programme controlled start, automatic switch off when 20 sec done (having flexibility to set it for longer or shorter video length is essential)
- Possibility to take many (hundred?) videos without need to transfer data (USB stick with larger memory to save the videos on)
- Video quality: minimum ?? And FPS

Long videos 30 minutes

- 30 minutes videos, manual/programme controlled start, automatic switch off when 30 min done (having flexibility to set it for longer or shorter video length is essential)
- Possibility to take many (10-20?) videos without need to transfer data (USB stick with larger memory to save the videos on)
- Video quality: minimum ?? And FPS

IMAGES/SHORT VIDEOS

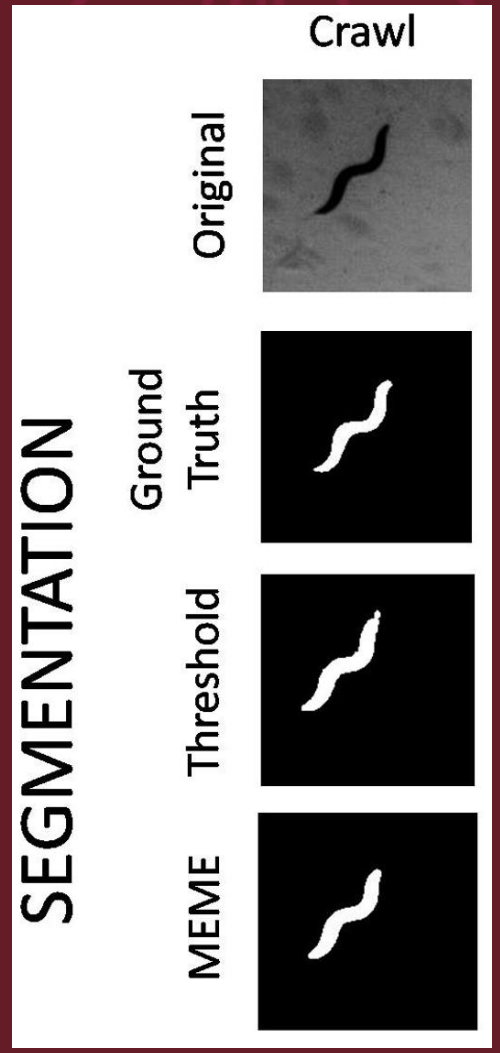
- One camera moves in X/Y (horizontally) over/between fixed image/sample positions
- Images taken every 5-60 minutes for 1h up to 10 days
- Alternatively, videos taken every 10-60 minutes for 4h up to 72h

- Image quality: highest possible resolution with smallest (3-5 mm) to highest (35-100 mm) field of view
- Video quality: minimum?? and FPS

Next steps

- AI for pattern recognition to automatize analysis and description of motility
  Modelling movement behaviour
- Zuowei Wang - Mathematics
- Hong Wei – Computer Science
- Nandini Vasudevan – SBS
- Xingchen Zhai

Impact of microplastics on social behaviours



Open Source

- Sharing open hardware design – Open source hardware journals
- Sharing code - GitHub or Google Code