The NeuroML ecosystem for standardised multi-scale modelling in neuroscience

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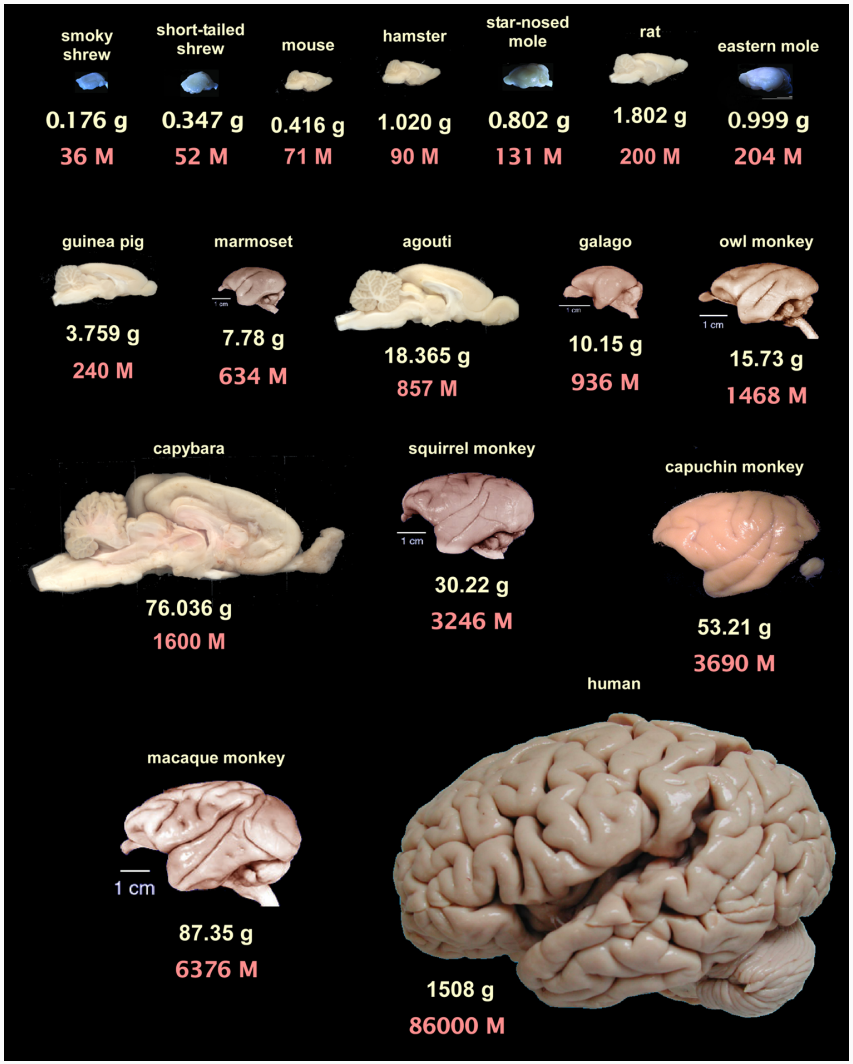
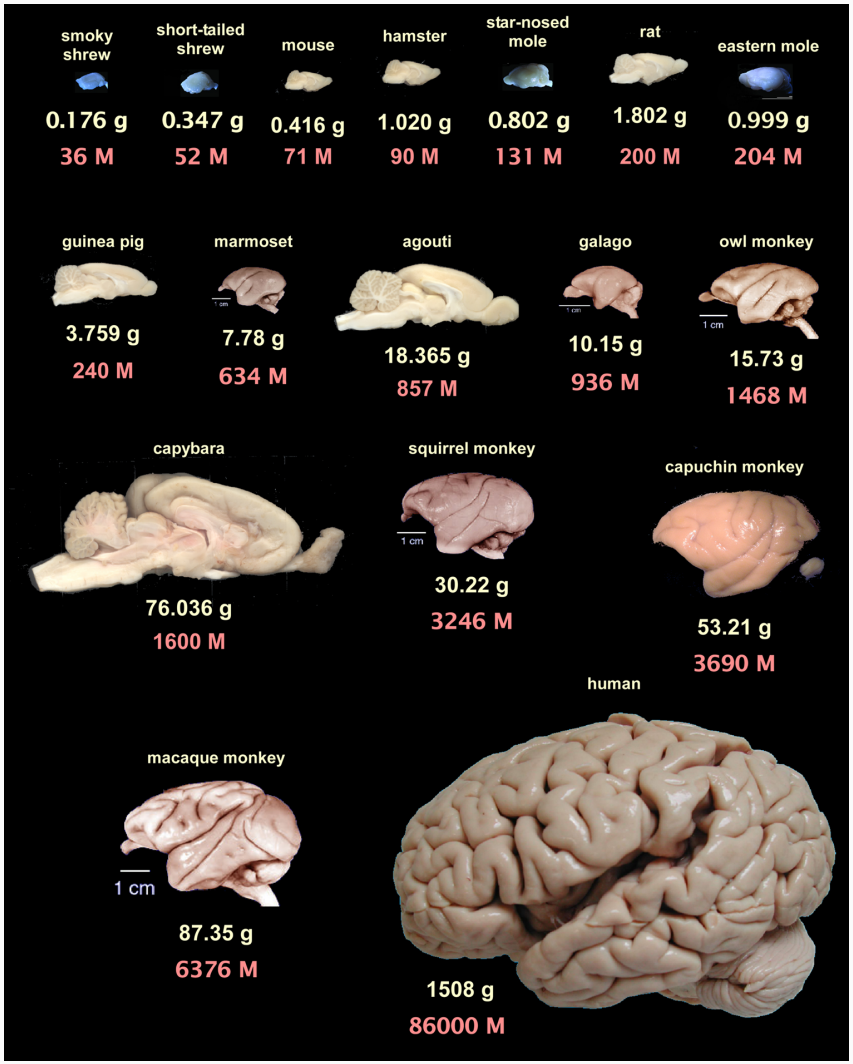
An understanding of the brain



- 86B neurons
- also similar number of glia

[1] Herculano-Houzel, S. **The human brain in numbers: a linearly scaled-up primate brain.** *Frontiers in human neuroscience* **3,** 31 (2009)

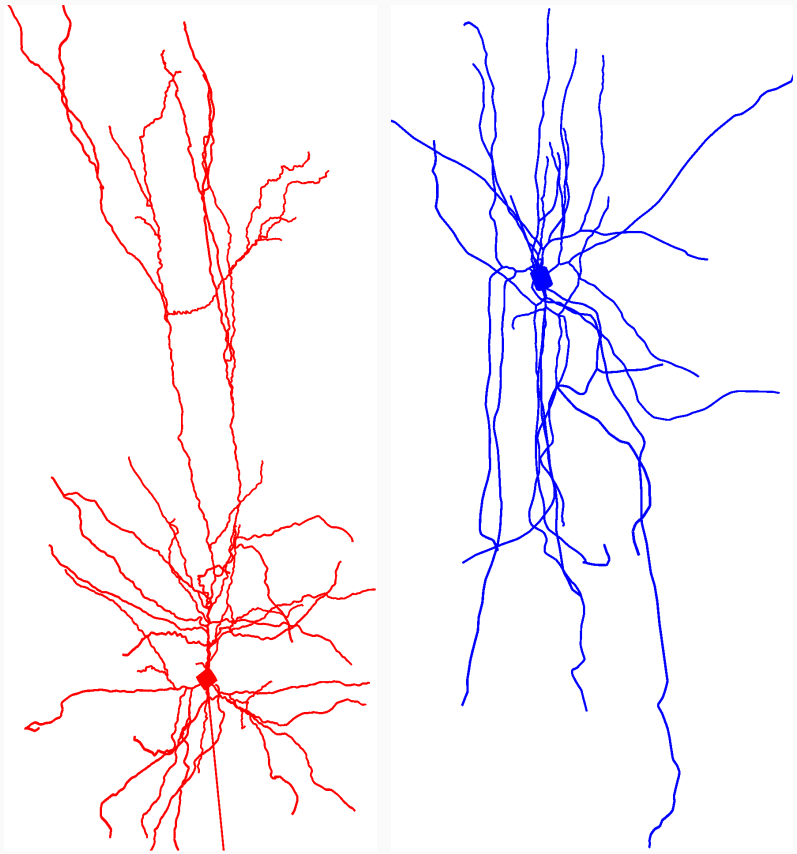
An understanding of the brain



- sensing
- cognition
- action

[1] Herculano-Houzel, S. **The human brain in numbers: a linearly scaled-up primate brain.** *Frontiers in human neuroscience* **3,** 31 (2009)

The brain: diversity of neurons



[1] Yao, H. K. *et al.* **Reduced inhibition in depression impairs stimulus processing in human cortical microcircuits.** *Cell Reports* **38.** ISSN: 2211-1247. https://doi.org/10.1016/j.celrep.2021.110232 (Jan. 2022)

Experiments provide a window into the brain

Multiple scales of experiments goes here

A *mechanistic* understanding of the brain

Figure showing multiple scales of modelling goes here.

The model life cycle

- tweaked version of life cycle figure from paper goes here.
- remove NeuroML, add data

Standards enable FAIR neuroscience

- NWB/BIDS for data
- NeuroML/SBML etc. for modelling
- Add logos

But, too many standards?

- XKCD here.

NeuroML

- Introduction to NeuroML.

NeuroML: scope

- Figure 2 from paper

NeuroML: software ecosystem

- Figure 3

NeuroML: software ecosystem: core tools

- Figure 4

NeuroML: create models

- Figure 5
- Code example

NeuroML: validate models

- Figure 6

NeuroML: visualise models

- Figure 7
- Figure 8
- Figure 9

NeuroML: simulate models

- Example simulation: neuron/netpyne

NeuroML: fit models

- Figure from docs
- Mention inspyred

NeuroML: share and re-use models

- GitHub, OSBv1, OSBv2, NeuroML-DB

NeuroML: the standard

- Schema, component types

NeuroML: the APIs

- Python API

NeuroML: LEMS

- LEMS, advantages

NeuroML: Documentation

- Jupyterbook

NeuroML: projects

- GSoC, Outreachy, good computer science students