



# NeuroFedora

FOSS and Free and Open (Neuro)Science

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NeuroFedora contributors  
[neuro.fedoraproject.org](https://neuro.fedoraproject.org)



Everyone should have the freedom to study, modify, and share scientific material<sup>1</sup>.

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<sup>1</sup><http://opensourceforneuroscience.org/>

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└ Open Science

Open science is transparent and accessible knowledge that is shared and developed through collaborative networks.

Open Science

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- How the brain functions (**physiology**)

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- How it processes information (*computational*)
- About behaviours, and cognition (*behavioural, cognitive*)



## How: Research Pipeline

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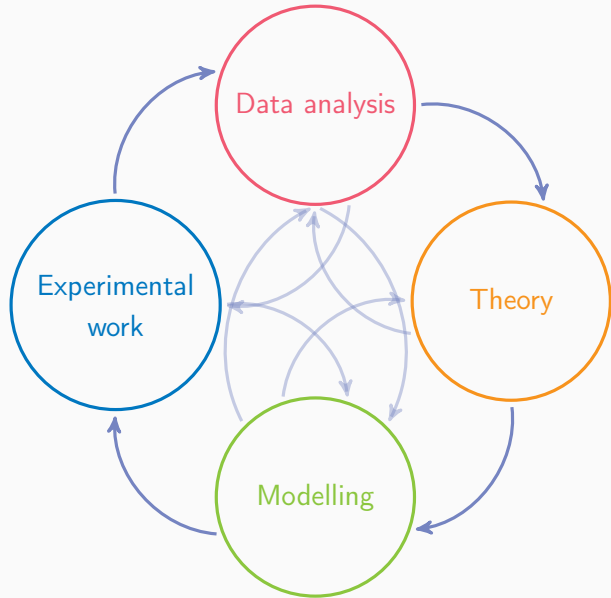
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└─ How: Research Pipeline

How: Research Pipeline

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└─ How: Research Pipeline

└─ Basic Workflow



1. A simplified diagram. Actually a lot more complex
2. General workflow of research-based work.
3. Most work now-a-days is being carried out with the use of computer software, such as ...

## Experimental:

- EEG, ECoG, intracellular and extracellular single and multi neuron recording,
- CT, DOI, MRI, f-MRI, MEG, PET,

## Data analysis:

- Statistics,
- Machine Learning, Big Data, Deep learning,

## Theory and modelling:

- Simulators of all kinds,

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└─How: Research Pipeline

└─Tools of the trade

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Theory and modelling:

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1. Experimental: DICOM/Image viewers, fsl tools, software to drive the big machines
2. Data Analysis: Simple/complex libraries, from numpy, scipy to scikit-learn, tensorflow
3. Simulators: Neuron, NEST, plenty more...
4. Lots of hardware and software is required for basic neuroscience research.

## Free/Open (neuro) Science

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└ Free/Open (neuro) Science

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# The ideal, in short:

Free/Open Science:

Everyone should have the freedom to share, study, and modify scientific material.

FOSS:

Everyone should have the freedom to share, study, and modify software<sup>5</sup>.

Free/Open Science includes and relies heavily on Free/Open Source Software (FOSS).

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<sup>2</sup>Free software foundation

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└ Free/Open (neuro) Science

└ The ideal, in short:

1. Summarizing everything
2. With the help of NeuroFedora we want to consolidate the two movements

The ideal, in short:

Free/Open Science:  
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# So we strive to use more and more FOSS

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└ Free/Open (neuro) Science

└ So we strive to use more and more FOSS



NEUROVIEW | VOLUME 96, ISSUE 5, P964-965, DECEMBER 06, 2017

## A Commitment to Open Source in Neuroscience

Padraig Gleeson • Andrew P. Davison • R. Angus Silver • Giorgio A. Ascoli  Open Access • DOI: <https://doi.org/10.1016/j.neuron.2017.10.013> •

1. A fun paper to read on Open Science + Open Software
2. Discusses reproducibility crisis. Where people are unable to reproduce data, results
3. Also the benefits of open-sourcing code. helps community. reuse. build-on and improve. publication becomes an advert for the code.

<sup>6</sup>Open source for neuroscience

# NeuroFedora: why, how, what?

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└ NeuroFedora: why, how, what?

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Let's talk about the neuroscience community first

# Neuroscience community: highly multidisciplinary

- various specialities: biologists, mathematicians, physicists, chemists, psychologists, . . . ,
- small proportion of trained software developers

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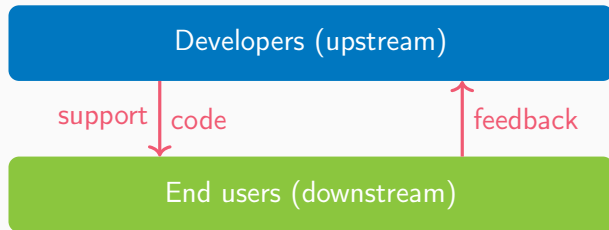
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└ Neuroscience community: highly multidisciplinary

1. The community is multi-disciplinary
2. Full of people from various fields
3. Not all have the required XP

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└ NeuroFedora: why, how, what?

└ FOSS: Developers and users

FOSS: Developers and users



1. The dev may not provide instructions on how to use the software
2. Difficult for people who lack programming knowledge to build/use the tool directly from the dev.
3. End users not always provide feedback
4. Issues with the flowchart: 1. Dev assumes the end users are knowledgeable, who know how to build/install their tool? 2. The devs expect the end users to provide regular feedback, run tests etc.

# (Anecdotal) notes on development of research software

- often **single developer**, or small development teams
- limited **maintenance, short-lived projects**
- limited **access to hardware/resources**
- limited **code quality**
- limited **use of established best practices**
- limited **testing for correctness (!)**
- **complex dependency chains**
- lack of **documentation and support**
- lack of **community development know-how**

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└ NeuroFedora: why, how, what?

└ (Anecdotal) notes on development of research software

1. Given how interdisciplinary neuroscience is, most researchers are NOT trained in development
2. based on anecdotal evidence, software used in research is not of the best quality
3. may or may not meet development standards
4. may have an instruction set on how to install/use the software
5. resolving dependencies can be difficult

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## (Anecdotal) notes on users of research software

- waste time and effort installing (and reinstalling) their software stacks
- rarely run test suites (!)
- rarely report bugs upstream
- rarely send improvements upstream
- are unaware of helpful development tools

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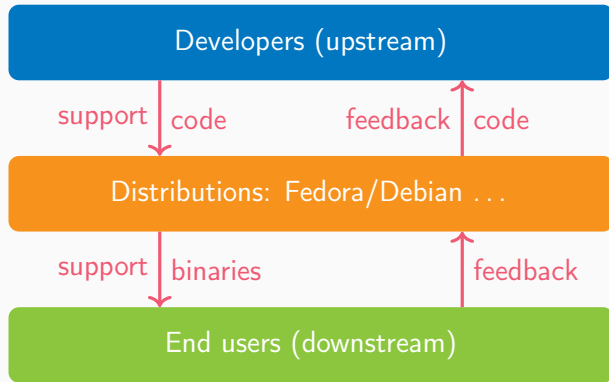
└ NeuroFedora: why, how, what?

└ (Anecdotal) notes on users of research software

1. The other side of the bridge are the users
2. also suffer from resolving dependencies
3. lack the required skill/knowledge of programming, they have a hard time setting up and using the software
4. If correctness of a tool cannot be verified, how can the correctness of the scientific result be claimed?

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# Distributions liaison between developers and users



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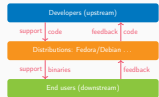
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└ Distributions liaison between developers and users

1. role of distros:
2. liaison between the users and developers
3. provide feedback, report bugs to the dev
4. simplify installation/usage XP

Distributions liaison between developers and users



# Distributions, like Fedora, are in a unique position:

- liaison between upstream and users
- have the infrastructure
- follow best practices in software development
- constantly work on community development
- learn from one another—train while working
- disseminate information to end-users

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## NeuroFedora

### └ NeuroFedora: why, how, what?

### └ Distributions, like Fedora, are in a unique position:

1. high end servers. multiple mirrors across the globe
2. firm packaging guidelines; go through a heavy-duty review process; proper testing of the software before releasing to the general user
3. many contributors hail from different backgrounds, and have a lot to learn
4. provide help to the users

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- liaison between upstream and users
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## Primary goal:

- Provide a **ready to use, integrated FOSS platform** for neuroscientists<sup>7</sup>.

## Secondary/collateral goals:

- help **improve the standard and maintenance** of tools
- help users **develop software development skills**
- **make neuroscience accessible** to non-specialists

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<sup>7</sup>Researchers, academics, hobbyists, anyone!

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## NeuroFedora

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## NeuroFedora: What we offer?

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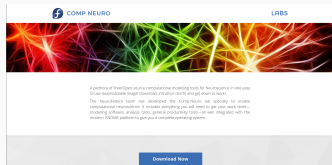
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└ NeuroFedora: What we offer?

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So, what we, as a SIG, are offering to the community?



- An OS to enable neuroscience
- Contains a plethora of computational neuroscience tools
- Packed with analysis and general productivity tools
- Integrated with GNOME

<https://labs.fedoraproject.org/en/comp-neuro/>

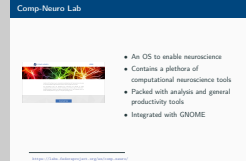
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└─ NeuroFedora: What we offer?

└─ Comp-Neuro Lab

1. The comp-neuro OS is a "spin" of Fedora with all the neuro tools pre-installed
2. Easy to use, just install and play





- A ready-to-use comp-neuro container
- Can be used with Podman/Docker
- Can be obtained from standard public container image registries like Docker Hub



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<https://docs.fedoraproject.org/en-US/neurofedora/containers/>  
<https://podman.io/>  
<https://www.docker.com/>

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- Will be 3 years old, in September 2021!<sup>8</sup>,
- 30 volunteer contributors
- software:
  - ~200 tools (packages) ready to install<sup>9</sup>:
    - NeuroMLlite, pyNeuroML, NetPyNE, Neuron, InterViews, NEST, Genesis, Brian (v1 and v2), Moose, python-libNeuroML, PyLEMS, PyNWB, ...
  - ~200 in queue<sup>10</sup>.
    - EDEN, NeuroMynerva, FlyBrainLab, GeNN, ...

<sup>8</sup> in its second iteration

<sup>9</sup> [src.fedoraproject.org: Neuro-SIG](https://src.fedoraproject.org/Neuro-SIG)

<sup>10</sup> [Pagure.io: Neuro-SIG: issues](https://pagure.io/Neuro-SIG/issues)

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IRC: [#fedora-neuro](#) on LiberaChat

Telegram: [t.me/NeuroFedora](https://t.me/NeuroFedora)

Documentation [neuro.fedoraproject.org](https://neuro.fedoraproject.org)

Blog: [neuroblog.fedoraproject.org](https://neuroblog.fedoraproject.org)

Pagure.io (FOSS Git forge): [neuro-sig/NeuroFedora](https://pagure.io/NeuroFedora)

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└ NeuroFedora: What we offer?

└ Search: “NeuroFedora”



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