Tutorial 1: Installation

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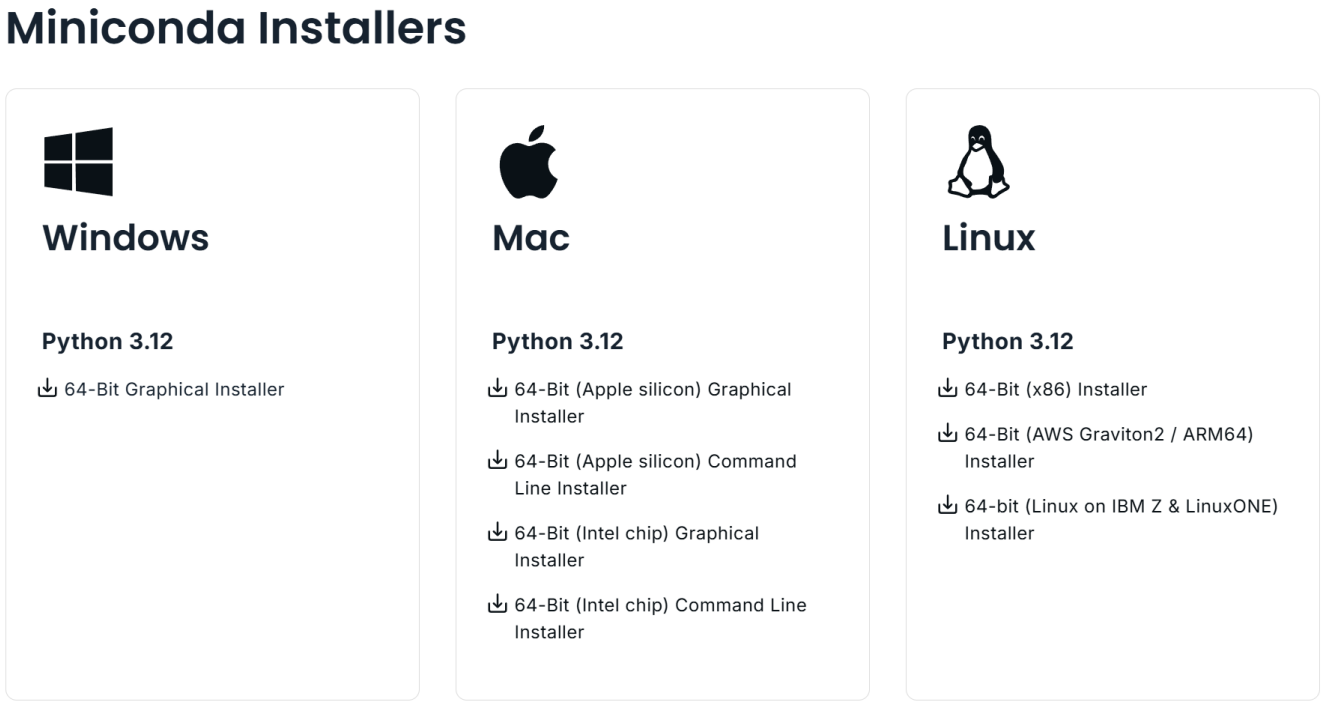
What is modWorm?

- **Multi-scale**, **multi-modal**, **modular** modeling and simulation framework for neural systems.
- **Modular constructions** and **simulations** of neuro-mechanical models.
- **Python** based framework with an option for high-performance simulations in **Julia**.
- Includes tutorials for **nematode *C. elegans*** neurons**,** nervous system and body simulations (Kim et al 2025).

Manual Installation of modWorm

1. Installing Python environment
2. Installing Julia environment
3. Installing Python dependencies
4. Installing Julia dependencies
5. Verifying installation

Installing Python environment

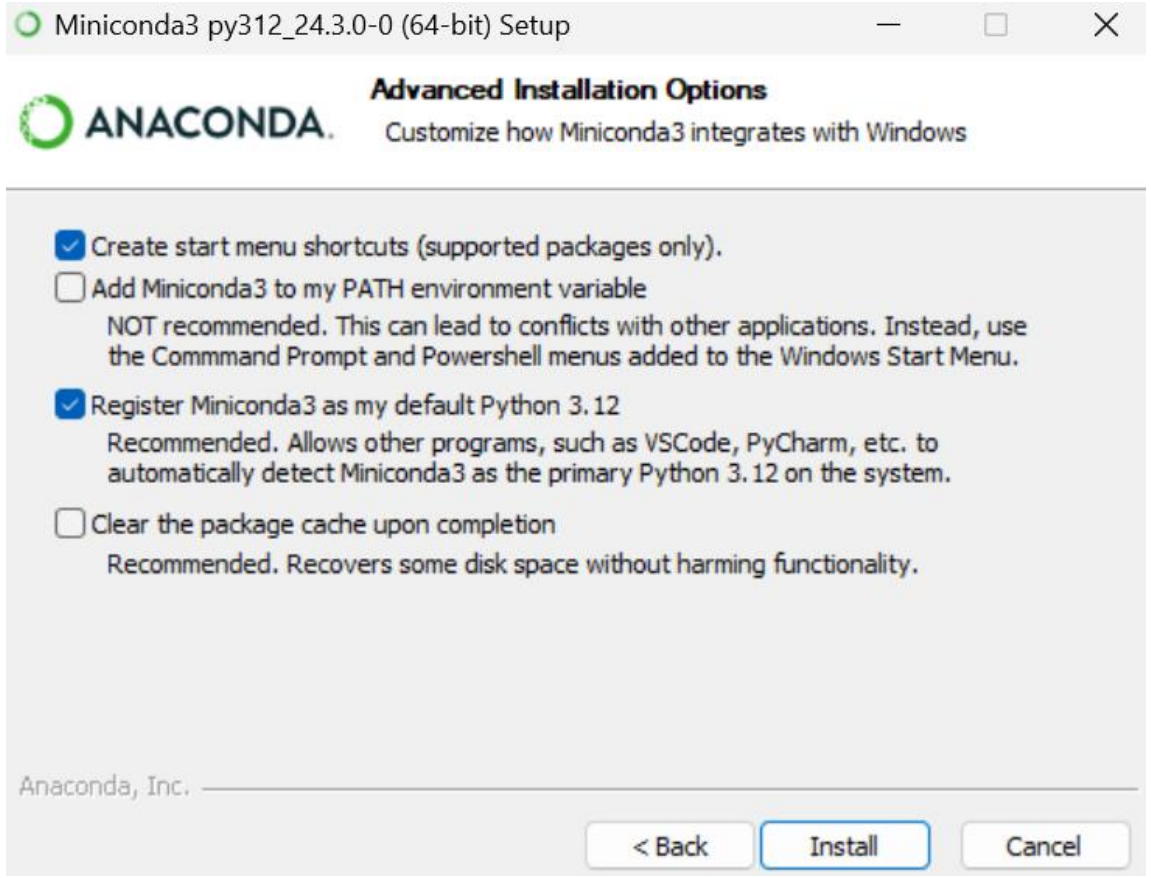


Conda Package manager
+ Base Python
+ Base modules

https://www.anaconda.com/download

Follow instruction on graphical installer

Installing Python environment



Windows

- Check "**Create start menu shortcuts**" to have Anaconda Prompt added to your start menu
- If fresh installing Python, check "**Register Miniconda (Anaconda) as my default Python**"

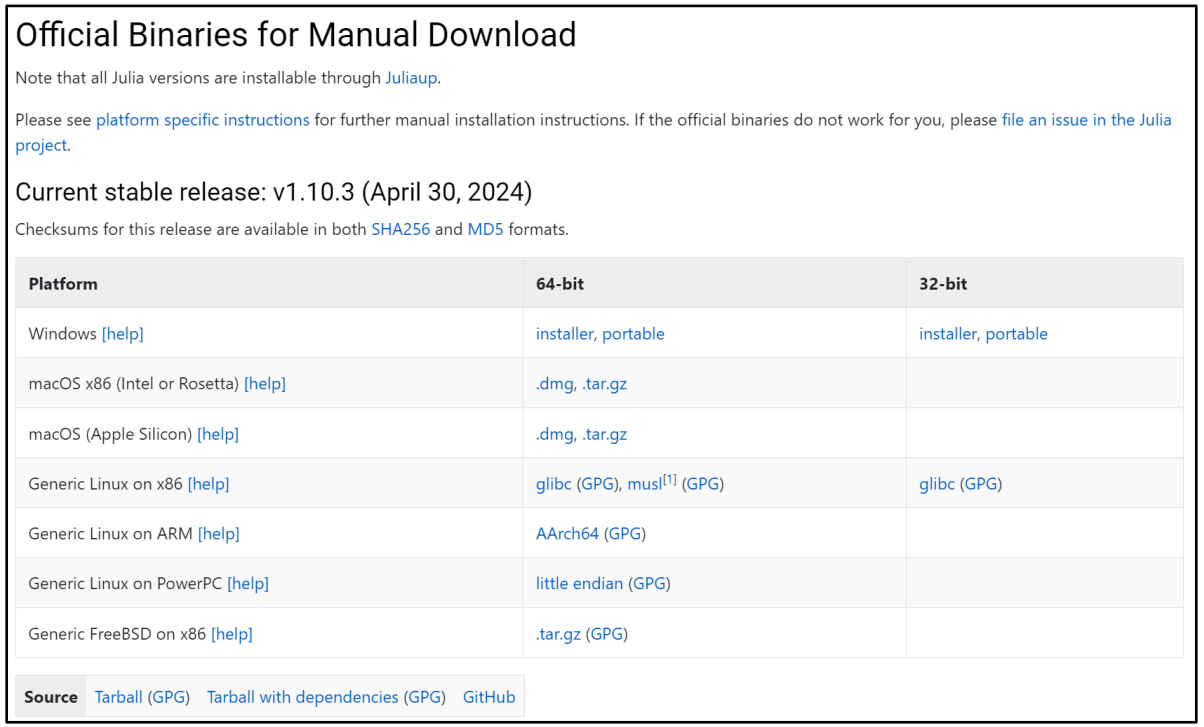
Installing Julia environment

What is **Julia programming language**?

- **High-level, general-purpose, high performance** programming language.
- Suitable for **numerical analysis** and **computational science**.
- Natively supports **GPU parallelization** for efficient computing.
- Can be easily called and used in conjunction with **Python**.

Installing Julia environment

Download page for Julia installer



Official Binaries for Manual Download

Note that all Julia versions are installable through Juliaup.

Please see platform specific instructions for further manual installation instructions. If the official binaries do not work for you, please file an issue in the Julia project.

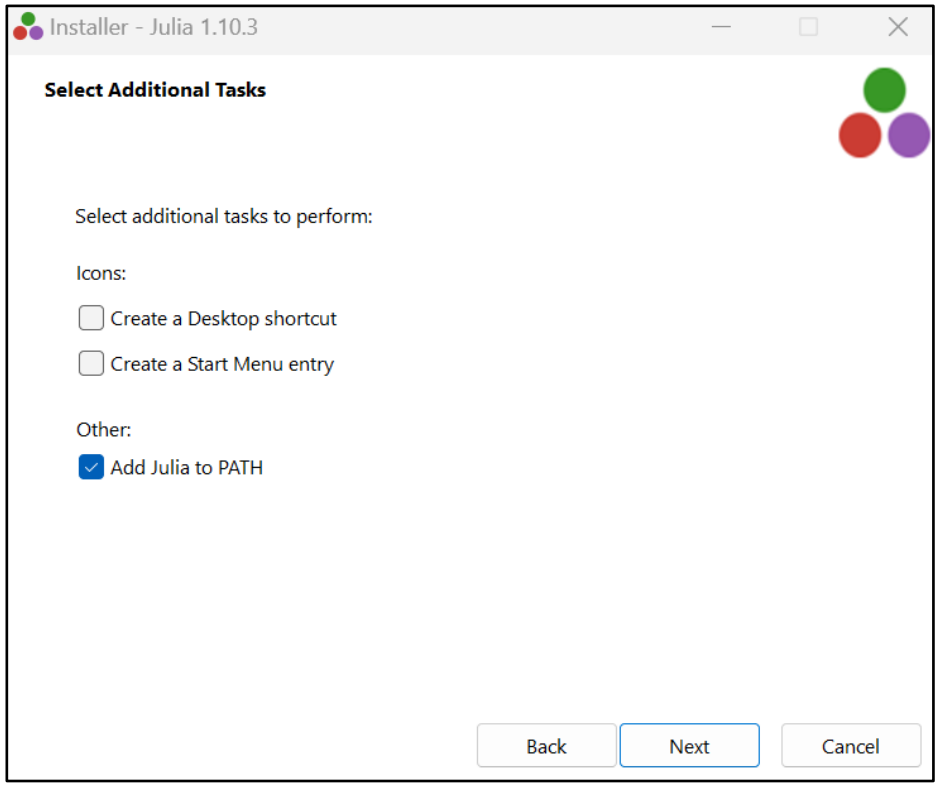
Current stable release: v1.10.3 (April 30, 2024)

Checksums for this release are available in both SHA256 and MD5 formats.

Platform	64-bit	32-bit
Windows [help]	installer, portable	installer, portable
macOS x86 (Intel or Rosetta) [help]	.dmg, .tar.gz	
macOS (Apple Silicon) [help]	.dmg, .tar.gz	
Generic Linux on x86 [help]	glibc (GPG), musl[1] (GPG)	glibc (GPG)
Generic Linux on ARM [help]	AArch64 (GPG)	
Generic Linux on PowerPC [help]	little endian (GPG)	
Generic FreeBSD on x86 [help]	.tar.gz (GPG)	

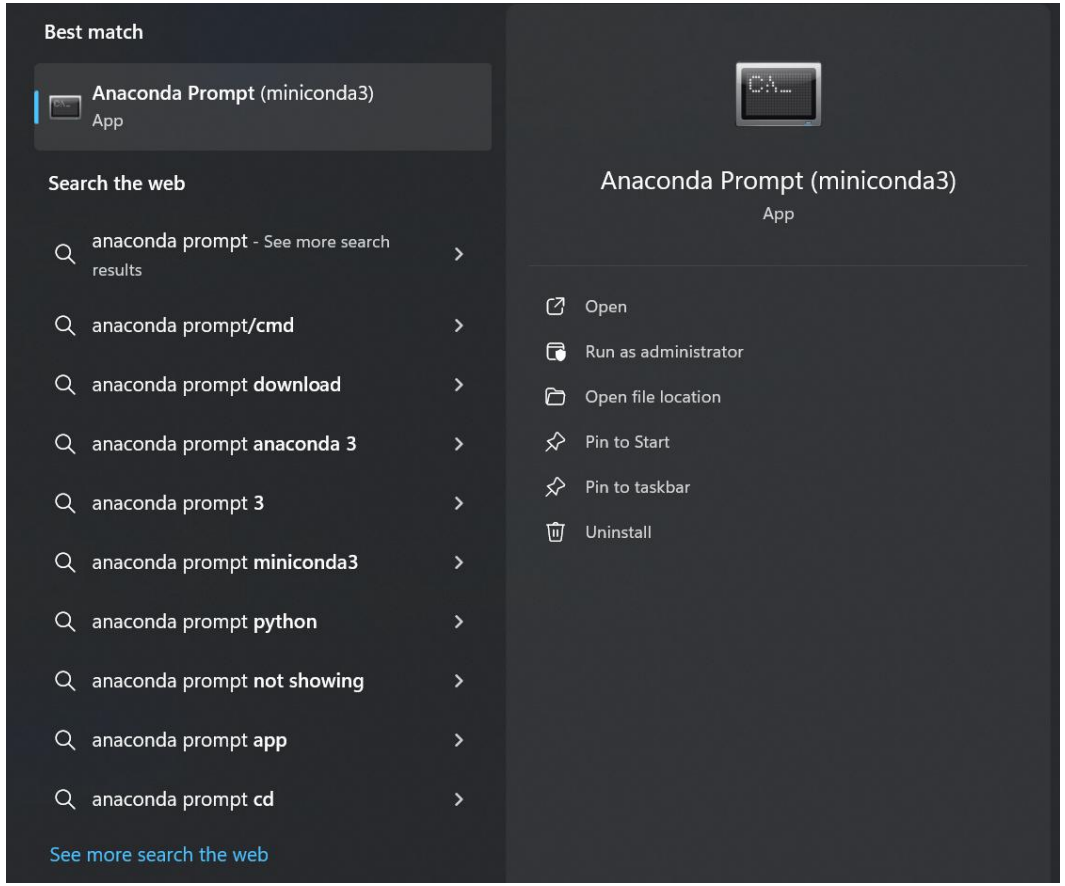
Source Tarball (GPG) Tarball with dependencies (GPG) GitHub

https://julialang.org/downloads/



Windows: Add Julia to PATH

Starting Anaconda prompt



From start menu, enter
Anaconda Prompt

Installing Python dependencies

Open **Anaconda Prompt**

Type:

> conda install scipy matplotlib statsmodels ipython jupyter ffmpeg imageio seaborn	Install Python dependencies
> pip install julia	
> python	Install PyJulia and its dependencies in Julia
>>> Import julia	
>>> julia.install()	
>>> exit()	Exit from Python session

Installing Julia dependencies

Open **Anaconda Prompt**, enter Julia session by:

```
> julia
julia> using Pkg
```

If you have **CUDA supported GPU** from https://developer.nvidia.com/cuda-gpus:

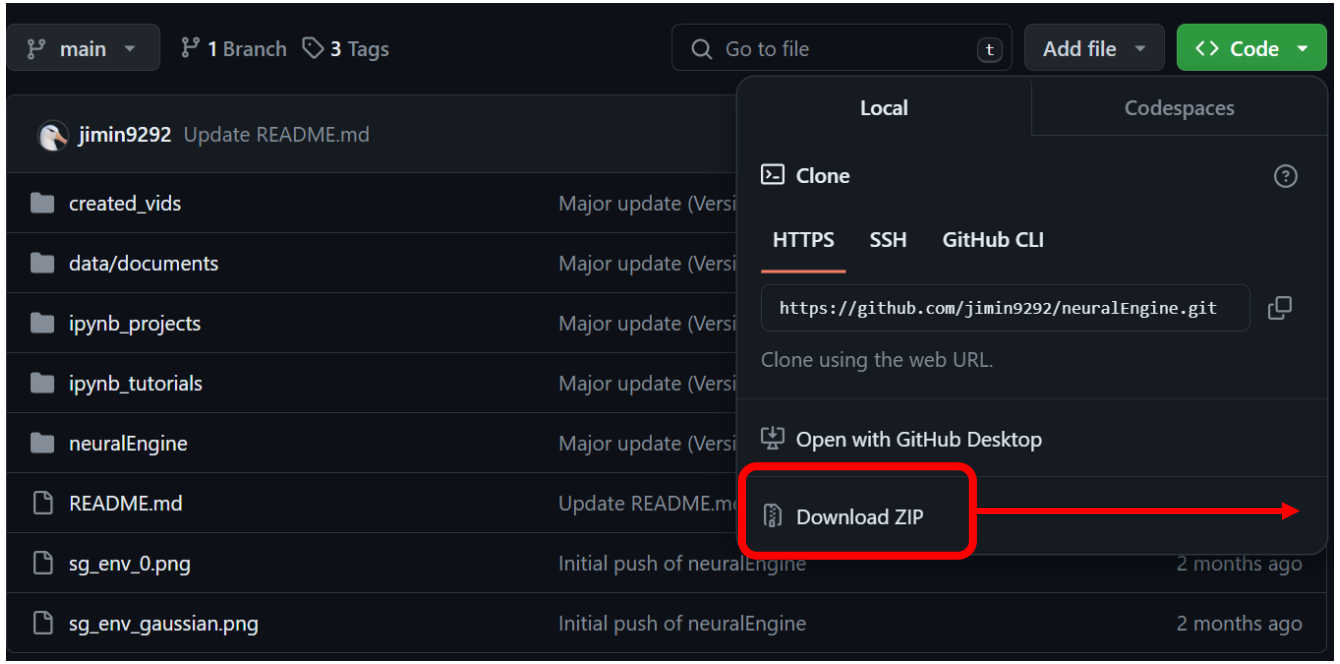
```
julia> Pkg.add(["DifferentialEquations", "OrdinaryDiffEq", "CUDA", "DiffEqGPU", "Sundials", "LinearAlgebra",
"LogExpFunctions", "Interpolations", "StatsBase"])
```

If not, install only CPU bound libraries:

```
julia> Pkg.add(["DifferentialEquations", "OrdinaryDiffEq", "Sundials", "LinearAlgebra", "LogExpFunctions", "Interpolations",
"StatsBase"])
```

Verifying modWorm installation

Official neuralEngine Github repository

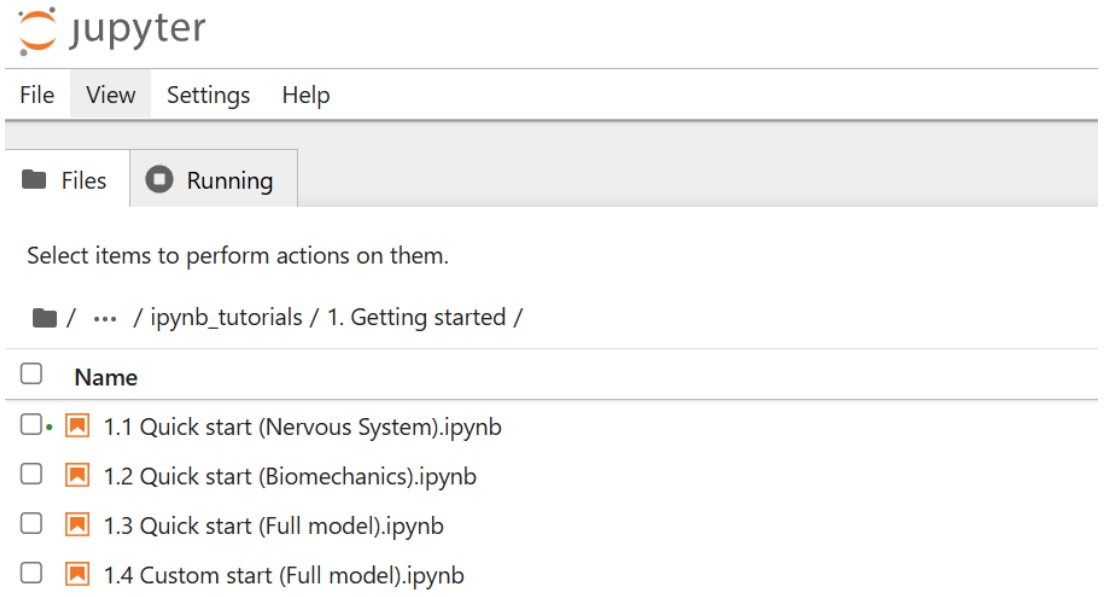


Download source code and unzip at your desired location

Verifying modWorm installation

Within **Anaconda Prompt (Windows)** or **Terminal (Mac/Linux),** type
> jupyter notebook

Navigate to modWorm-main/ipynb_tutorials



Run the **first cell** of the Getting started tutorials

Check the cell runs without an error
(invalid escape sequence warning is benign and only appears once)

```
import os
import numpy as np
import matplotlib.pyplot as plt

default_dir = os.path.dirname(os.path.dirname(os.getcwd()))
os.chdir(default_dir)

# Import neccessary modules
from modWorm import network_params as n_params
from modWorm import network_dynamics as n_dyn
from modWorm import network_interactions as n_inter
from modWorm import network_simulations as n_sim

from modWorm import utils
```