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 biomechanics simulations (Kim et al 2025).

Manual Installation of modWorm

1. Installing Julia environment

2. Installing Python environment

3. Installing Python dependencies

4. Installing Julia dependencies

5. Verifying installation

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
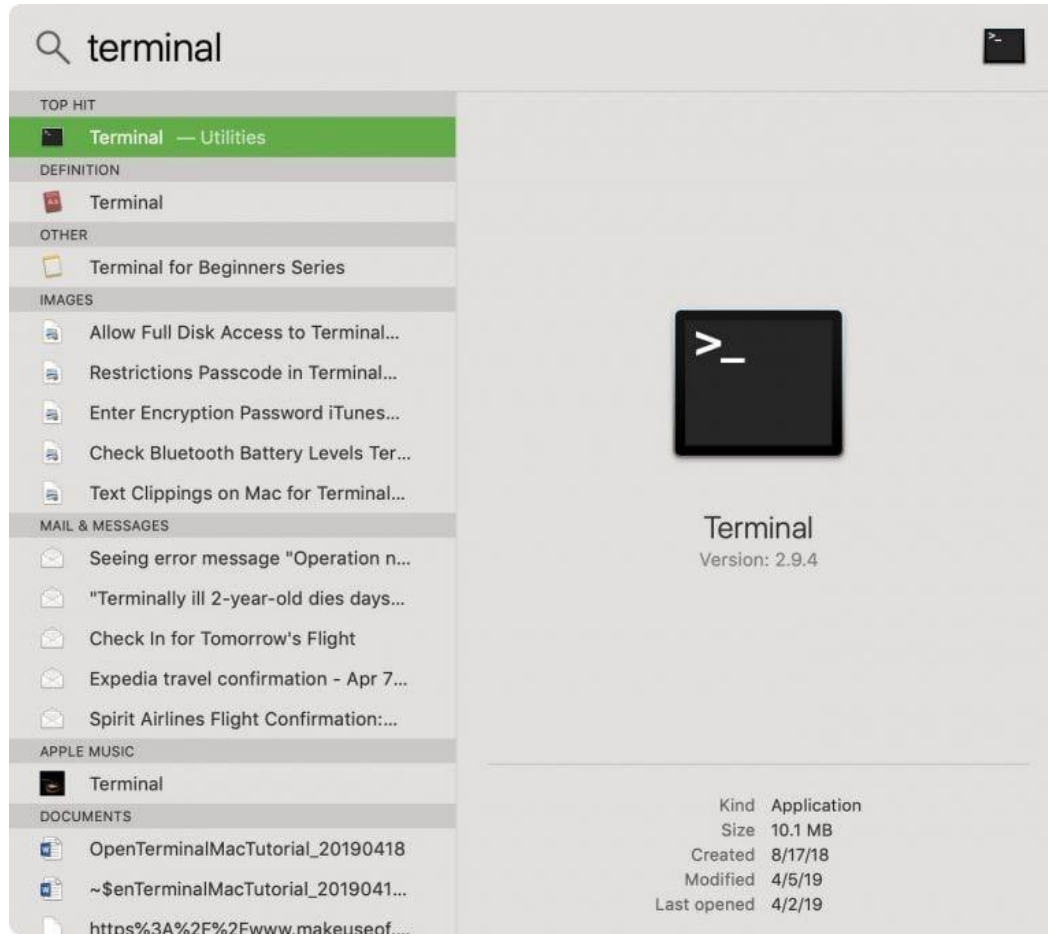
Open Terminal

Type:

curl -fsSL https://install.julialang.org | sh

- Choose "Proceed with installation" when prompted

Exit terminal after completion

Installing Python environment

Miniconda Installers

☐ Windows	🍎 Mac	🐧 Linux
Python 3.12	**Python 3.12**	**Python 3.12**
⬇ 64-Bit Graphical Installer	⬇ 64-Bit (Apple silicon) Graphical Installer	⬇ 64-Bit (x86) Installer
	⬇ 64-Bit (Apple silicon) Command Line Installer	⬇ 64-Bit (AWS Graviton2 / ARM64) Installer
	⬇ 64-Bit (Intel chip) Graphical Installer	⬇ 64-bit (Linux on IBM Z & LinuxONE) Installer
	⬇ 64-Bit (Intel chip) Command Line Installer	

Conda Package manager
+ Base Python
+ Base modules

https://www.anaconda.com/download

Follow instruction on graphical installer
(Make sure to select **correct chip type**)

Installing Python dependencies

Open **Terminal**

Type:

> conda install scipy matplotlib statsmodels ipython jupyter ffmpeg imageio seaborn
> pip install julia
> python
>>> Import julia
>>> julia.install()
>>> exit()

Install Python dependencies

Install PyJulia and its dependencies in Julia

Exit from Python session

Installing Julia dependencies

Open new **Terminal**, enter Julia session by:

> julia

Install **Julia dependencies** by typing following commands:

julia> using Pkg

julia> Pkg.add(["DifferentialEquations", "OrdinaryDiffEq", "Sundials", "LinearAlgebra", "LogExpFunctions", "Interpolations", "StatsBase"])
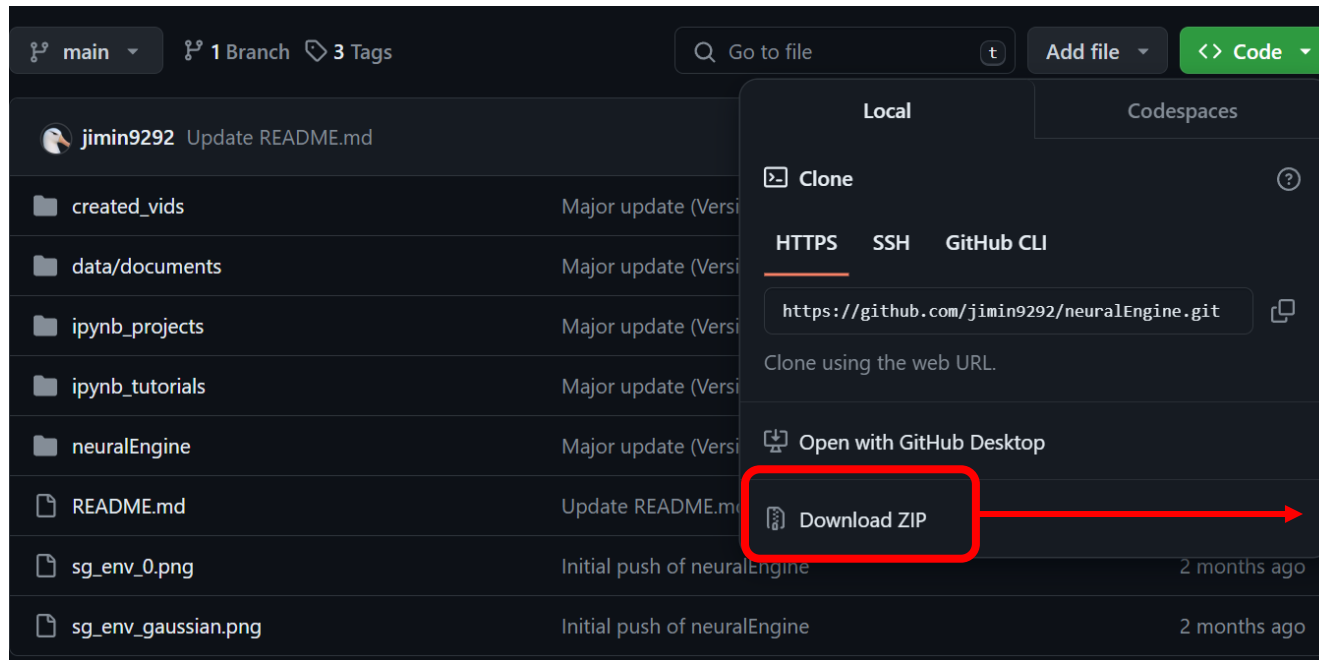
Exit terminal after completion

Julia> exit()

Verifying modWorm installation

Official modWorm Github repository

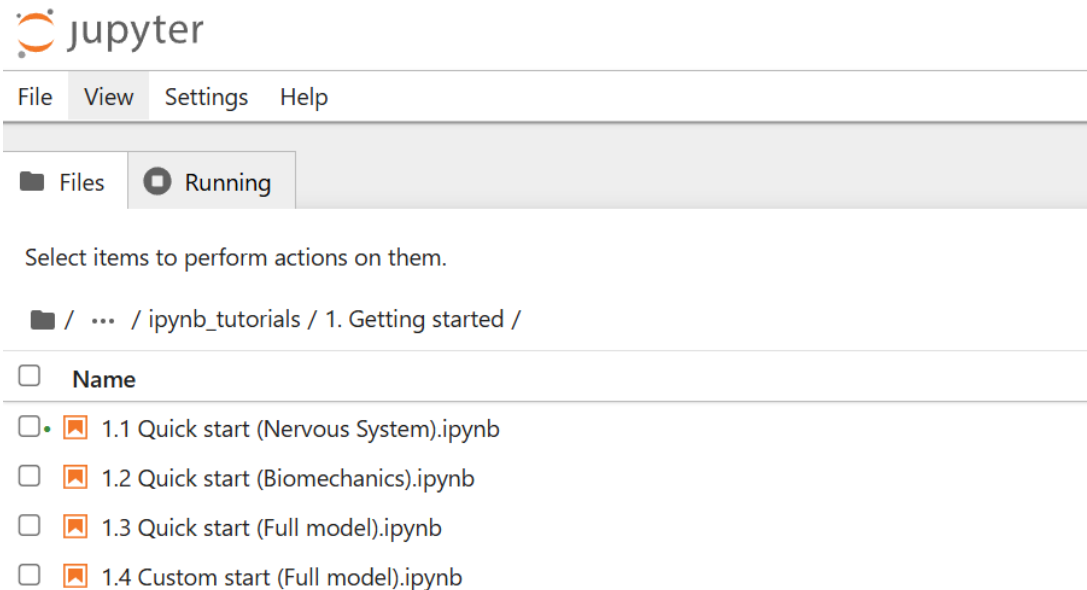Download source code and unzip at your desired location

Verifying modWorm installation

Open **Terminal**

> jupyter notebook

Navigate to modWorm-main/ipynb_tutorials/
1. Getting started

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)

```python
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
```