

# **Tellurium : A Python Based Modeling and Reproducibility Platform for Systems Biology**

**Kiri Choi**

University of Washington

Newcastle - COMBINE 2016

# Background

The usage of Python has been steadily growing in scientific community:

- Good general purpose language
- Large set of powerful libraries
- Easy to learn, easy to read, and easy to write
- Free and open

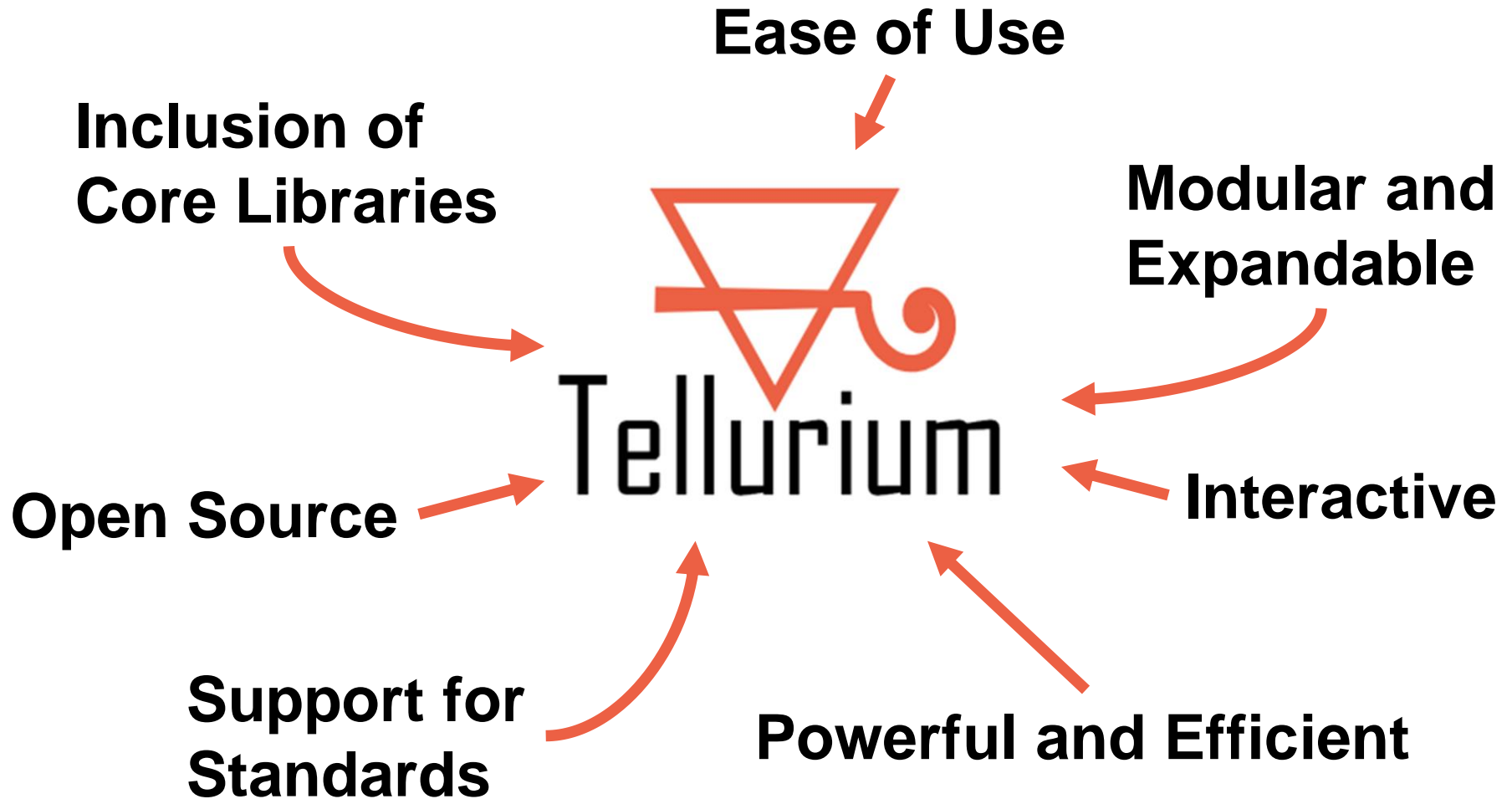
# Background

Systems and synthetic biology community has a long history of supporting standards for reproducibility and exchangeability

... and we want our software to fully support it.



# Overview





## Python Libraries



spyder

**IDE Plugins/  
Modules**



Tellurium



WinPython

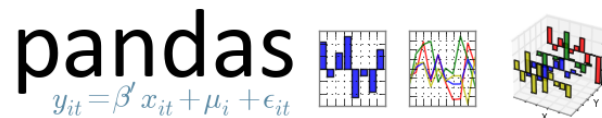
**Self-Contained  
Environment**



**Tools for Reproducibility**



## Python Libraries



seaborn



## Python Libraries



spyder

**IDE Plugins/  
Modules**



Tellurium



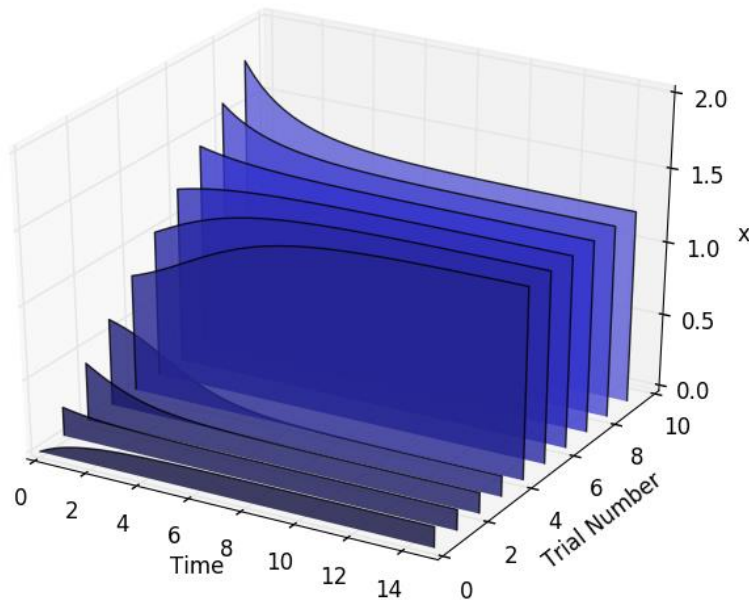
WinPython

**Self-Contained  
Environment**

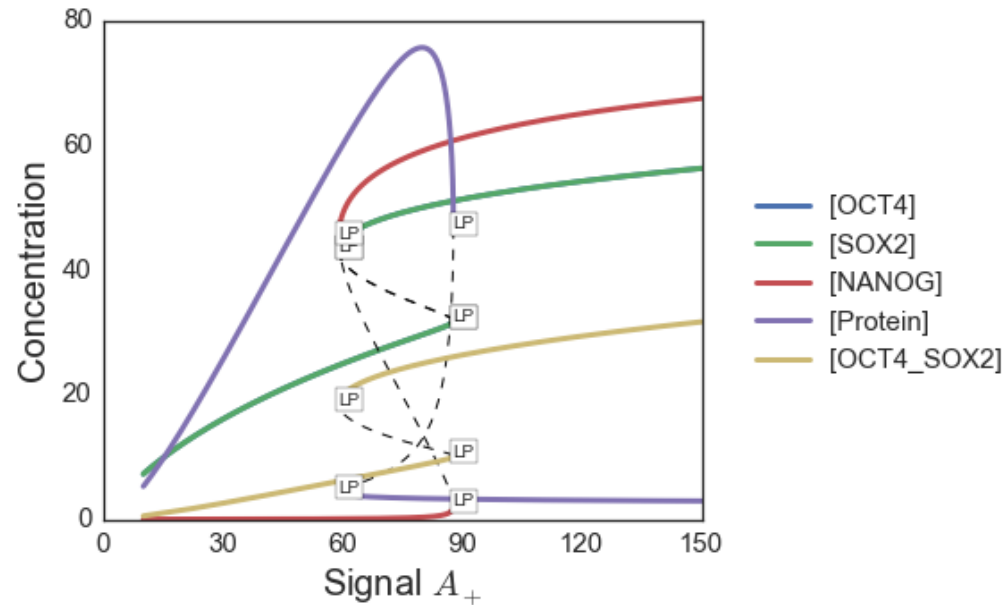


**Tools for Reproducibility**

# Parameter Scan



# Bifurcation Analysis<sup>1</sup>



<sup>1</sup>Chickarmane V, C Troein, UA Nuber, HM Sauro, and C Peterson. 2006. "Transcriptional dynamics of the embryonic stem cell switch". PLoS Computational Biology. 2 (9).





## Python Libraries



spyder

IDE Plugins/  
Modules



Self-Contained  
Environment



Tools for Reproducibility

# Application

Demo: MAPK cascade model<sup>1</sup>

- Tellurium can import, export, and modify the COMBINE archive.
- Using Antimony and phraSED-ML, Tellurium allows users to approach the models and simulation setups with ease.

<sup>1</sup>Kholodenko, Boris N. 2000. "Negative feedback and ultrasensitivity can bring about oscillations in the mitogen-activated protein kinase cascades". European Journal of Biochemistry. 267 (6): 1583-1588.

# Future Directions

- Inclusion of additional packages/plugins
  - Biopython
  - PySCeS
  - Etc.
- Support for SBGN (Systems Biology Graphical Notation)
- Provide conda packages for easier installation for Mac OS and Linux (almost done!)

# Availability

Windows/Mac OS installers, source codes, and full documentations are available at:

**[tellurium.analogmachine.org](http://tellurium.analogmachine.org)**

under open source Apache License 2.0

For conda packages, check

**<https://anaconda.org/sys-bio/>**

# Acknowledgements

## Sauro Lab

Herbert Sauro

Kyle Medley

Lucian Smith

Bryan Bartley

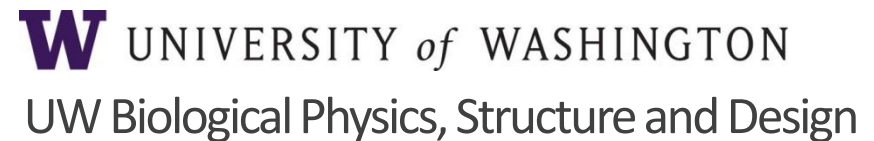
Kyung Hyuk Kim

Caroline Cannistra

Kaylene Stocking

## Institute of Theoretical Biology

Matthias König



This project is funded by  
NIGMS GM081070



This project is funded by  
BMBF 031L0054

# Thank You