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<https://github.com/physicell-training/ws2022>

Setting up PhysiCell on Windows



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[@PhysiCell](https://twitter.com/PhysiCell)

PhysiCell Project

July 2022



LUDDY

SCHOOL OF INFORMATICS, COMPUTING, AND ENGINEERING

PhysiCell Project

PhysiCell.org

 [@PhysiCell](https://twitter.com/PhysiCell)

Overview

This installation guide is prepared for installing PhysiCell to new fresh Windows. If you installed previous PhysiCell version in your PC, please uninstall MSYS 1 (previous version) and remove related directories from environmental variables.

- PhysiCell
- MSYS 2
- Adding them to path
- Anaconda
- Test modules “biorobots” and “ode-energy-sample”

Minimal
setup

-
- ImageMagick
 - COPASI
 - PhysiCell Model Builder

Traditional*
setup

*Traditional setup includes optional tools that helps for pre-simulation edits and pro-simulation analysis

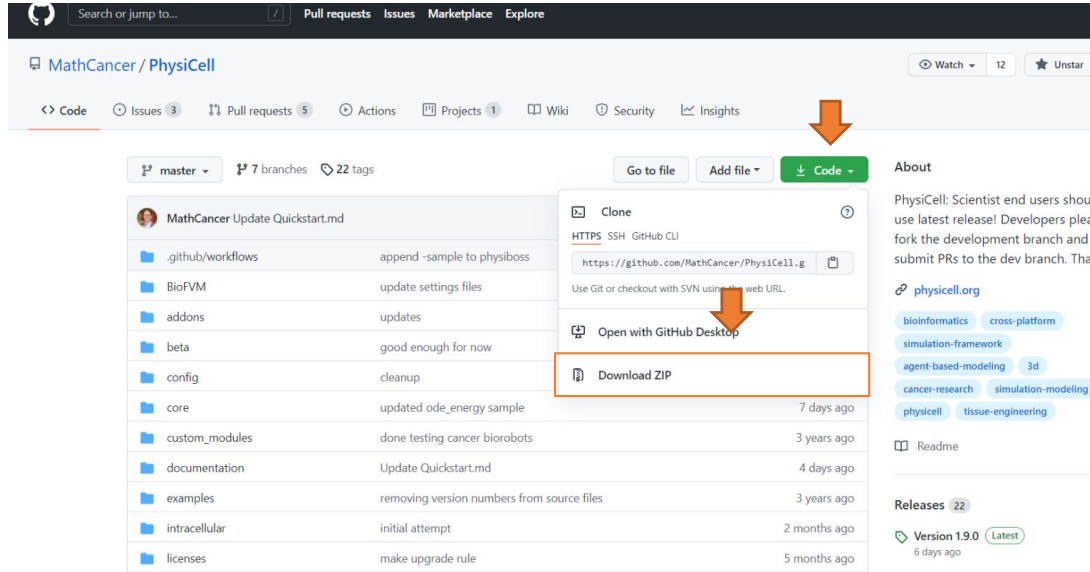
Youtube video

- Here is the video link for the recording of installation on Windows:

<https://www.youtube.com/watch?v=Jp3ZOMt761M>

PhysiCell

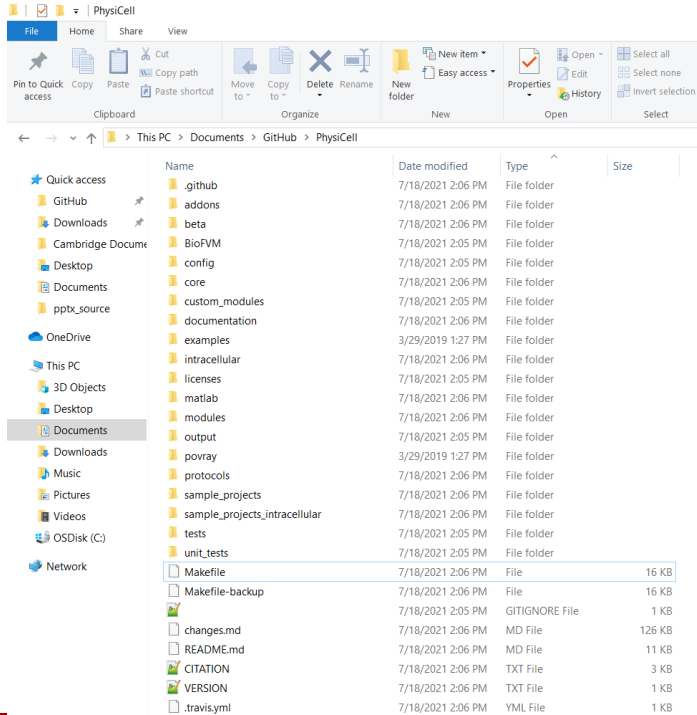
- To download PhysiCell please proceed following link:
<https://github.com/MathCancer/PhysiCell>



- Please, click green “Code” button at right.
- Then, download as “ZIP”.
- Extract to the desired directory.

PhysiCell

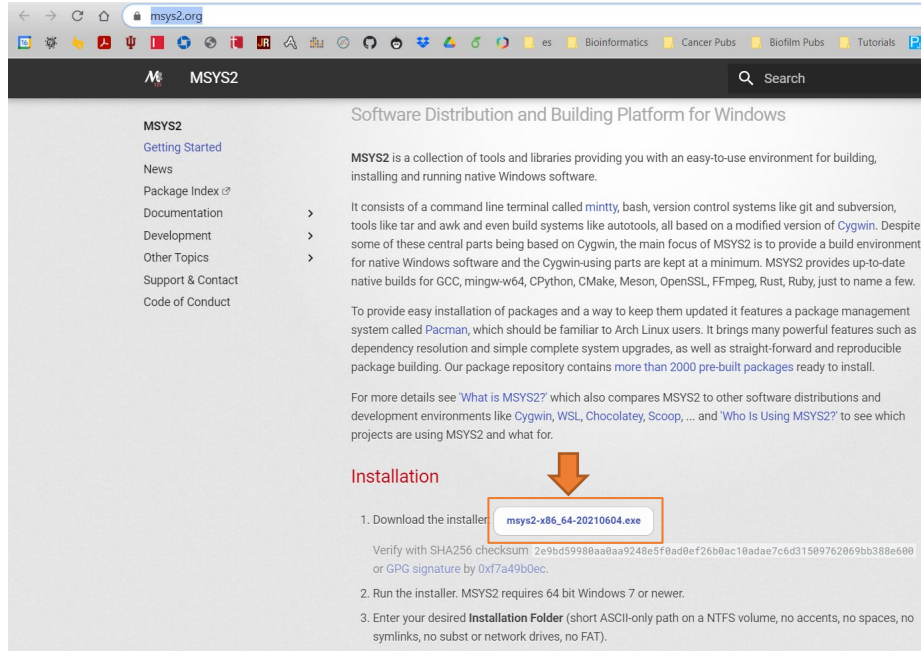
- After the extraction, PhysiCell folder should look like this:



MSYS 2

- Please proceed following link:

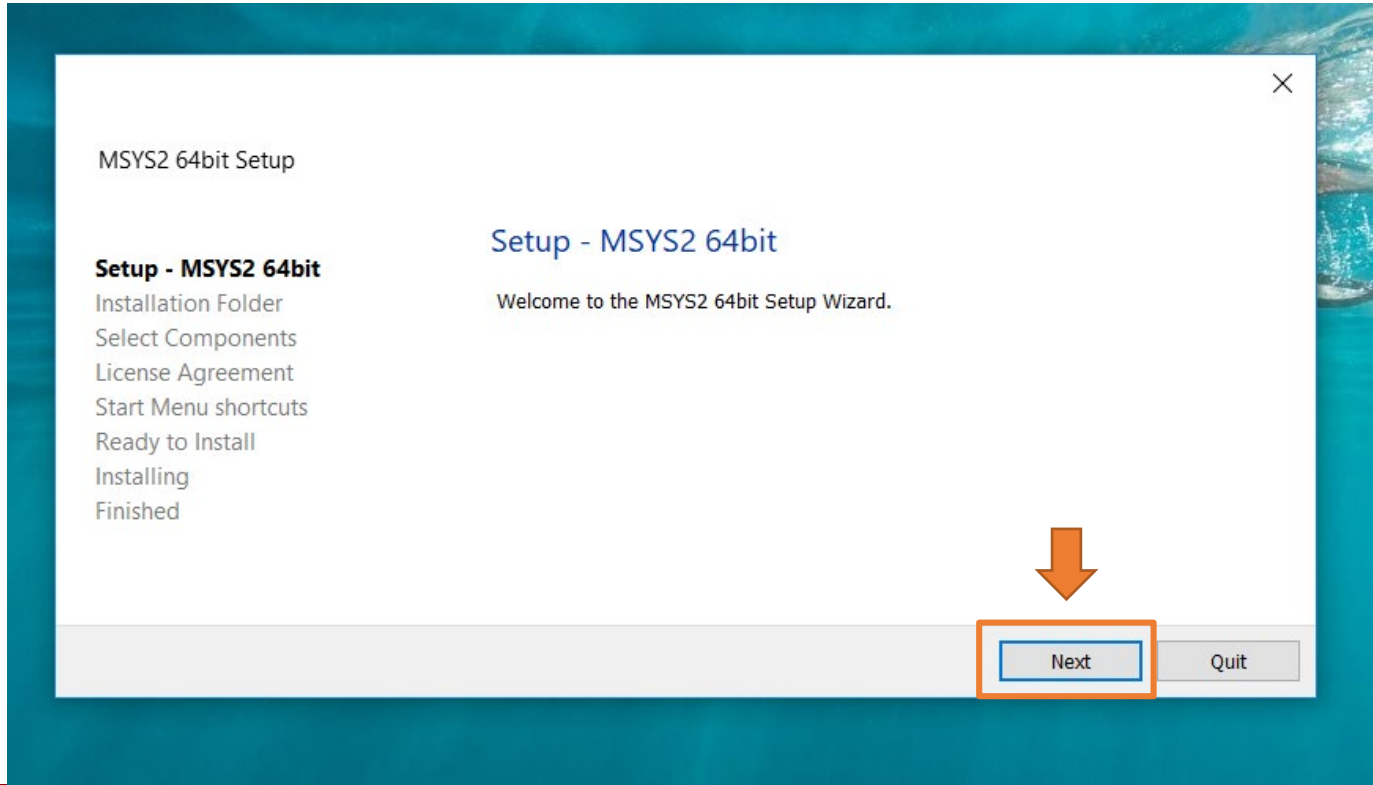
<https://www.msys2.org/>



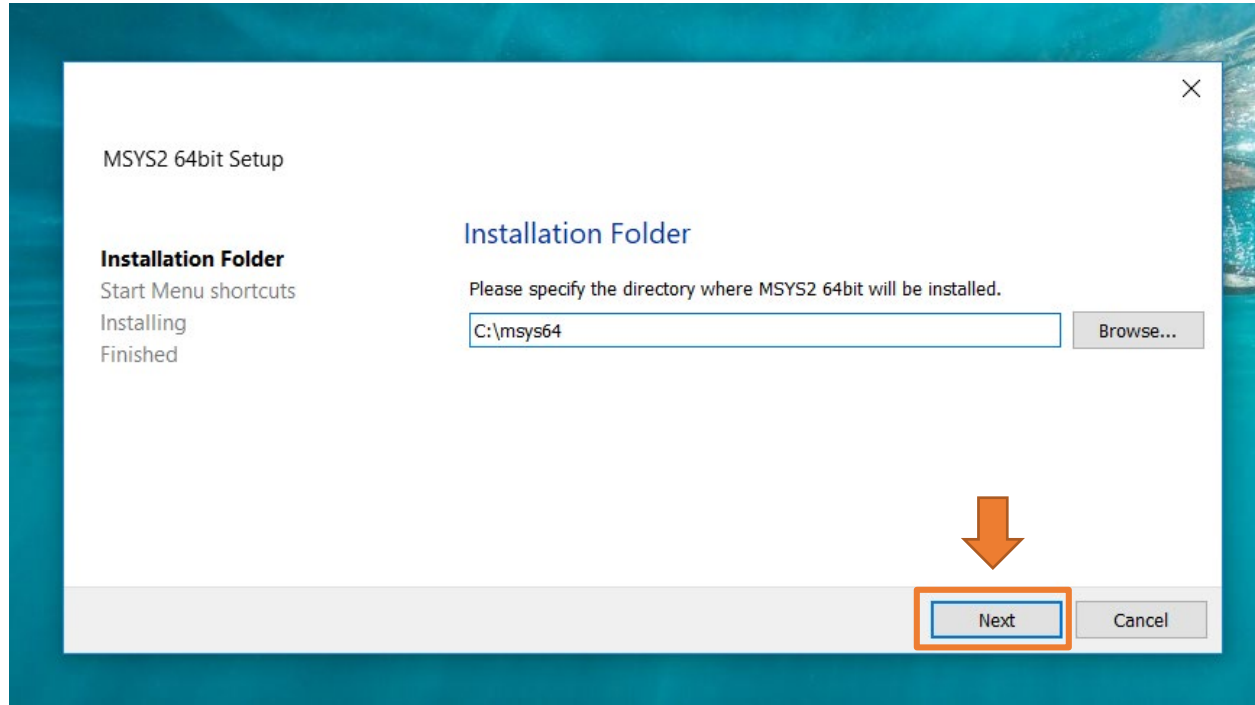
The screenshot shows the msys2.org website. The header includes the MSYS2 logo and a search bar. The left sidebar contains links: MSYS2, Getting Started, News, Package Index, Documentation, Development, Other Topics, Support & Contact, and Code of Conduct. The main content area is titled "Software Distribution and Building Platform for Windows". It describes MSYS2 as a collection of tools and libraries for building and running native Windows software. It mentions that it consists of a command line terminal called mintty, bash, version control systems like git and subversion, and tools like tar and awk. It also states that MSYS2 provides up-to-date native builds for GCC, mingw-w64, CPython, CMake, Meson, OpenSSL, FFmpeg, Rust, Ruby, etc. An orange arrow points to the "Installation" section. Under "Installation", step 1 says "Download the installer" and shows a button labeled "msys2-x86_64-20210604.exe". Below this, it provides SHA256 and GPG checksums. Step 2 says "Run the installer. MSYS2 requires 64 bit Windows 7 or newer." Step 3 says "Enter your desired Installation Folder (short ASCII-only path on a NTFS volume, no accents, no spaces, no symlinks, no subst or network drives, no FAT)." A yellow underline is at the bottom of the installation instructions.

- Please, click “msys-x64_64-202XXX.exe” button at bottom.
- It should download installer.
- Open it with double-clicking the installer.

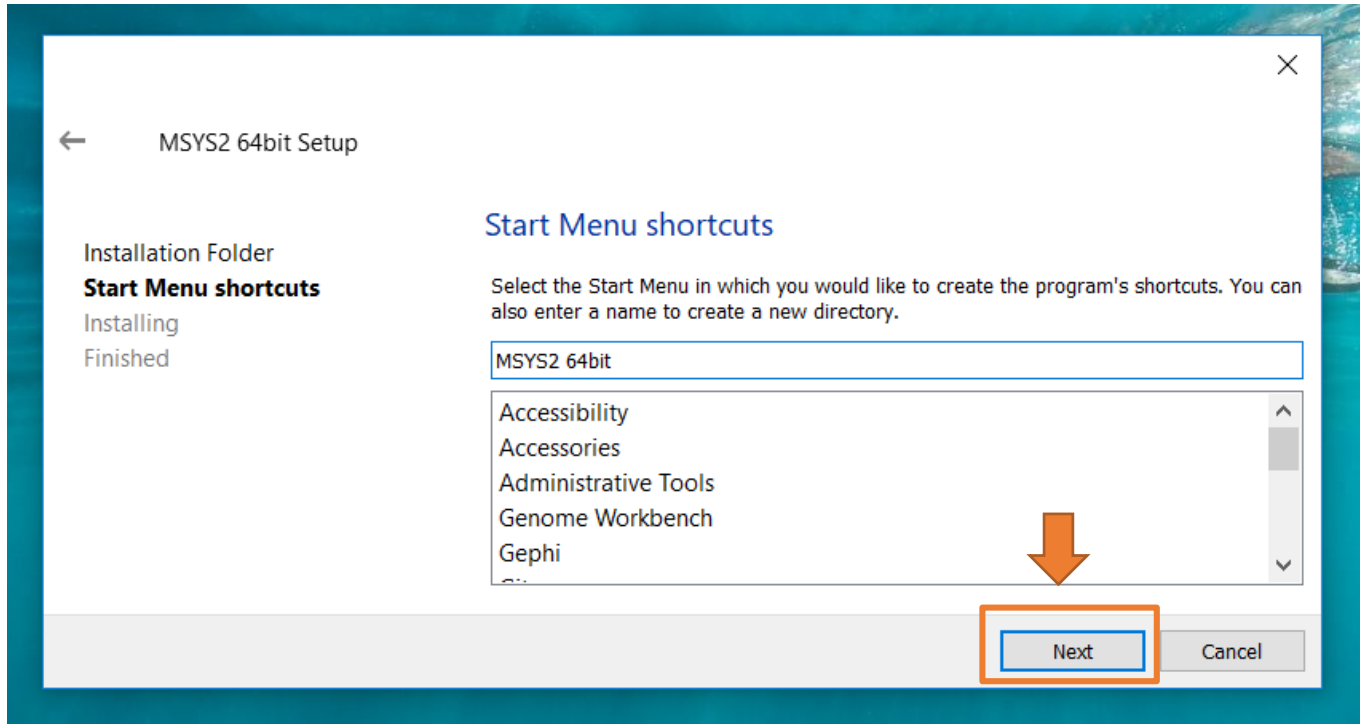
MSYS 2



MSYS 2



MSYS 2



LUDDY

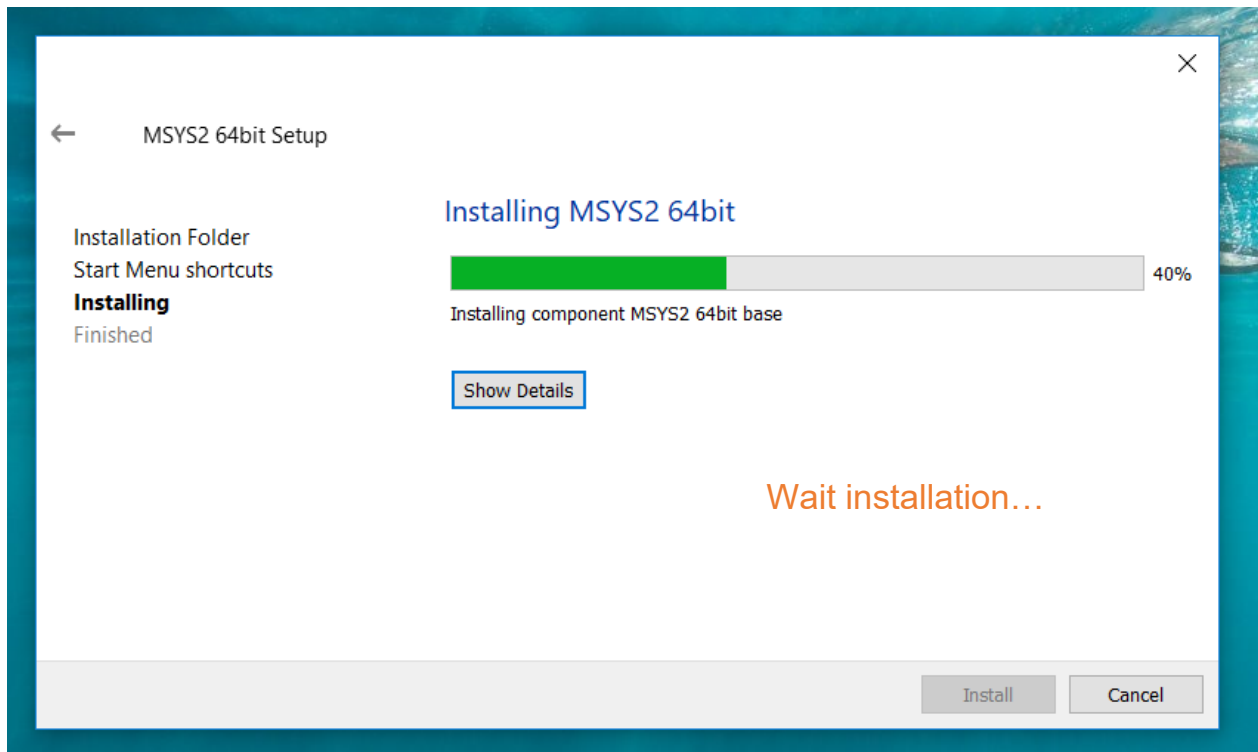
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PhysiCell Project

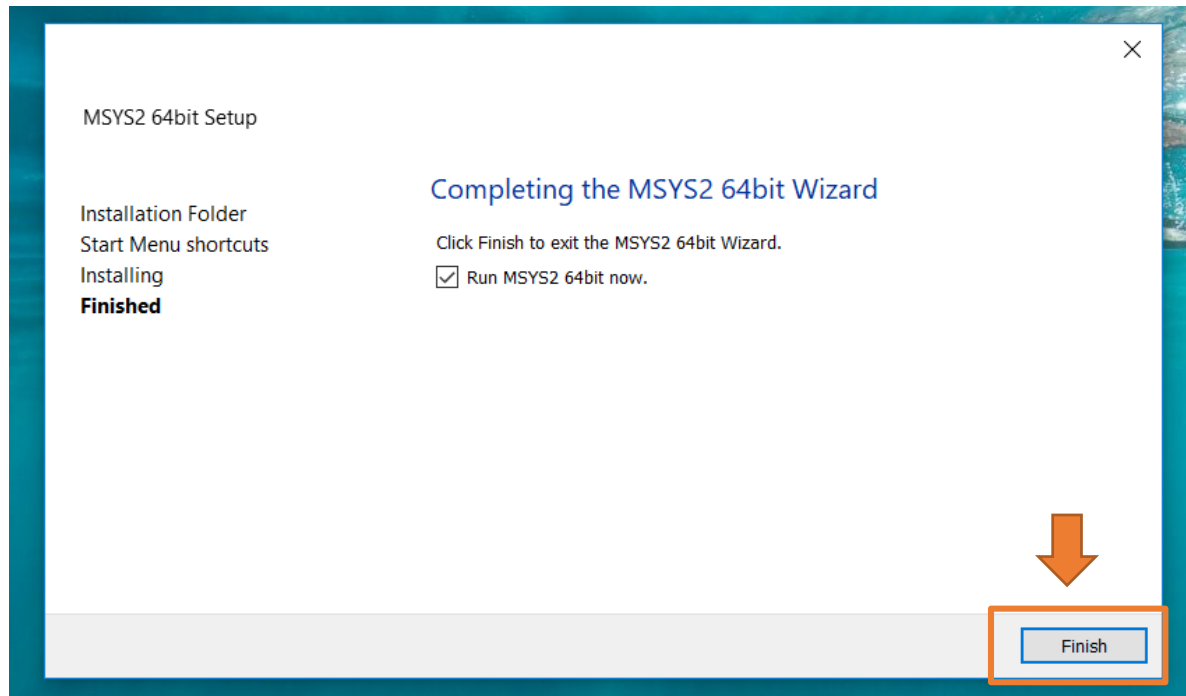
PhysiCell.org

@PhysiCell

MSYS 2



MSYS 2

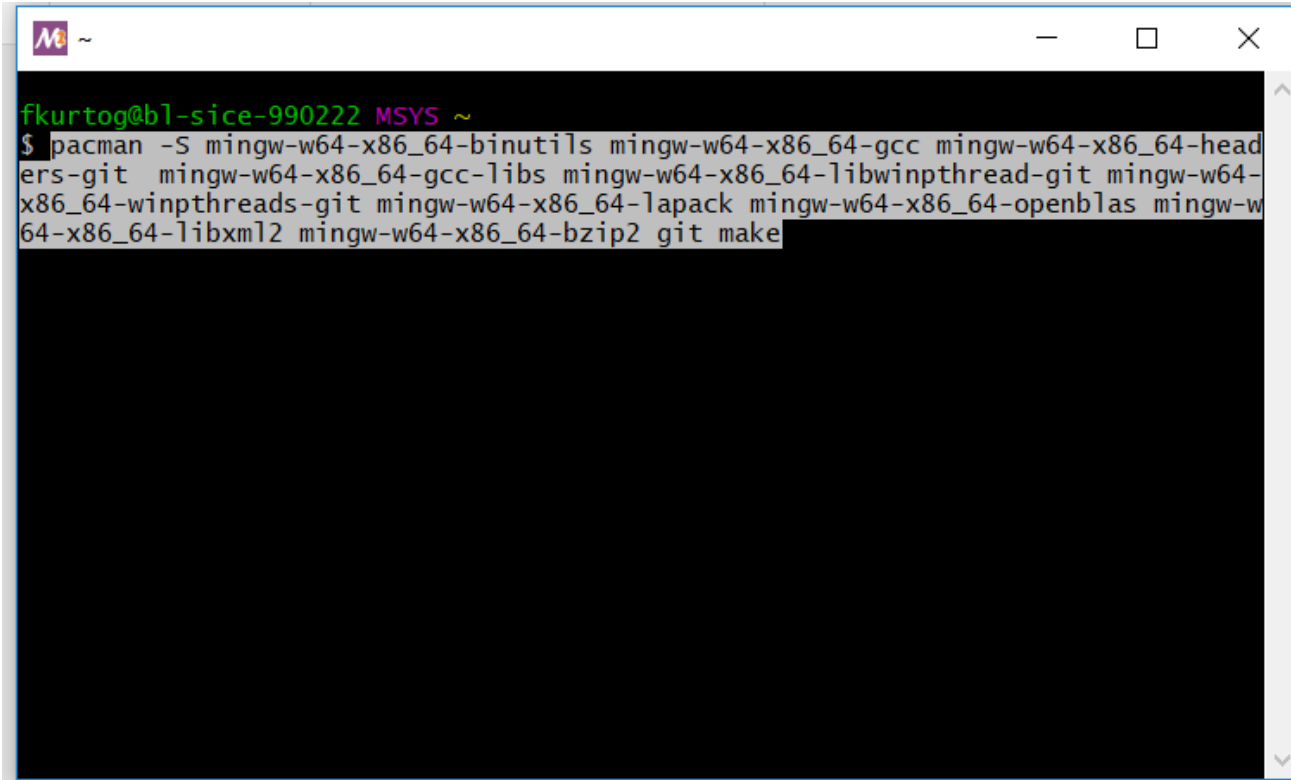


MSYS 2

- After MSYS2 command prompt is opened, please copy and paste following line. Then, press enter.

```
pacman -S mingw-w64-x86_64-binutils mingw-w64-x86_64-gcc mingw-w64-x86_64-headers-  
git mingw-w64-x86_64-gcc-libs mingw-w64-x86_64-libwinpthread-git mingw-w64-  
x86_64-winpthreads-git mingw-w64-x86_64-lapack mingw-w64-x86_64-openblas mingw-  
w64-x86_64-libxml2 mingw-w64-x86_64-bzip2 git make
```

MSYS 2



```
fkurtog@bl-sice-990222 MSYS ~  
$ pacman -S mingw-w64-x86_64-binutils mingw-w64-x86_64-gcc mingw-w64-x86_64-head  
ers-git mingw-w64-x86_64-gcc-libs mingw-w64-x86_64-libwinpthread-git mingw-w64-  
x86_64-winpthreads-git mingw-w64-x86_64-lapack mingw-w64-x86_64-openblas mingw-w  
64-x86_64-libxml2 mingw-w64-x86_64-bzip2 git make
```



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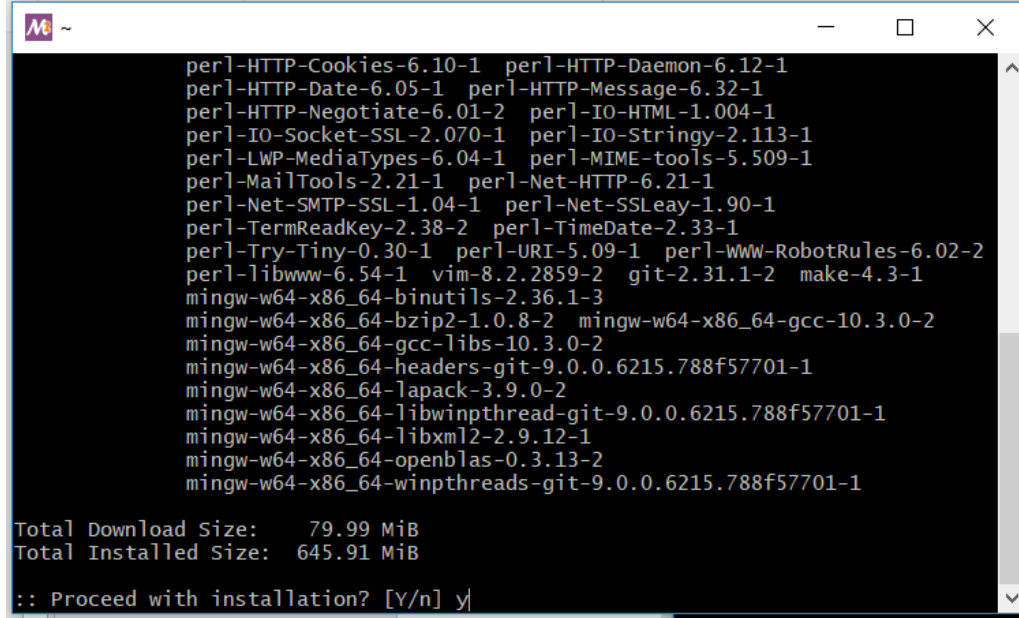
PhysiCell Project

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@PhysiCell

MSYS 2

- Give “y” (yes) answer to the msys2. Press enter...



```
perl-HTTP-Cookies-6.10-1 perl-HTTP-Daemon-6.12-1
perl-HTTP-Date-6.05-1 perl-HTTP-Message-6.32-1
perl-HTTP-Negotiate-6.01-2 perl-IO-HTML-1.004-1
perl-IO-Socket-SSL-2.070-1 perl-IO-Stringy-2.113-1
perl-LWP-MediaTypes-6.04-1 perl-MIME-tools-5.509-1
perl-MailTools-2.21-1 perl-Net-HTTP-6.21-1
perl-Net-SMTP-SSL-1.04-1 perl-Net-SSLeay-1.90-1
perl-TermReadKey-2.38-2 perl-TimeDate-2.33-1
perl-Try-Tiny-0.30-1 perl-URI-5.09-1 perl-www-RobotRules-6.02-2
perl-libwww-6.54-1 vim-8.2.2859-2 git-2.31.1-2 make-4.3-1
mingw-w64-x86_64-binutils-2.36.1-3
mingw-w64-x86_64-bzip2-1.0.8-2 mingw-w64-x86_64-gcc-10.3.0-2
mingw-w64-x86_64-gcc-libs-10.3.0-2
mingw-w64-x86_64-headers-git-9.0.0.6215.788f57701-1
mingw-w64-x86_64-lapack-3.9.0-2
mingw-w64-x86_64-libwinpthread-git-9.0.0.6215.788f57701-1
mingw-w64-x86_64-libxml2-2.9.12-1
mingw-w64-x86_64-openblas-0.3.13-2
mingw-w64-x86_64-winthreads-git-9.0.0.6215.788f57701-1

Total Download Size: 79.99 MiB
Total Installed Size: 645.91 MiB

:: Proceed with installation? [Y/n] y
```

MSYS 2

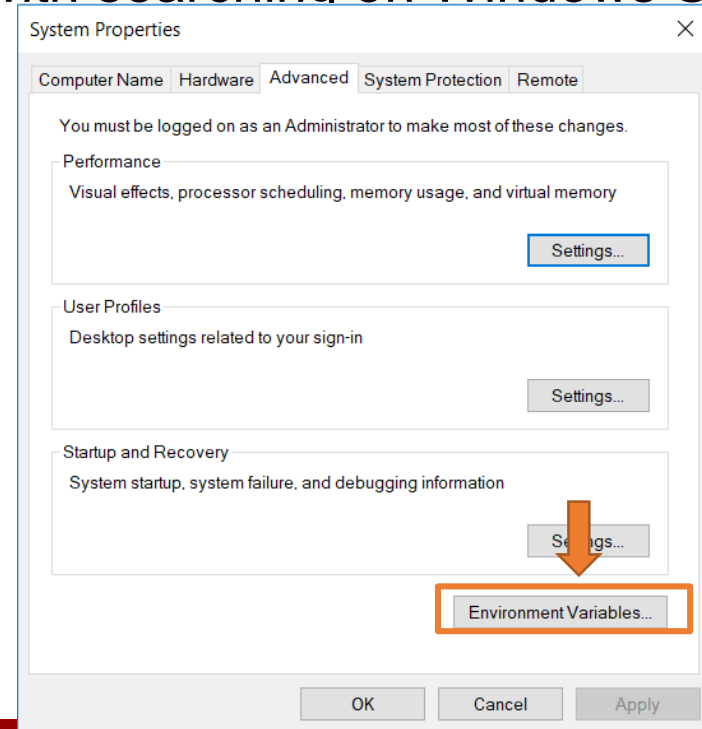
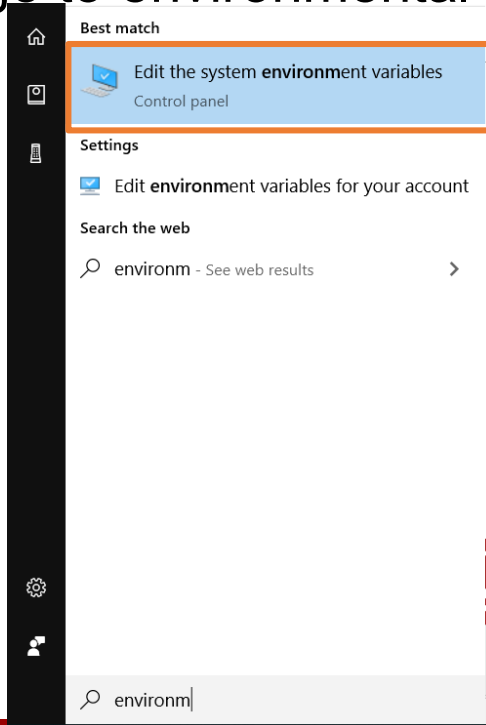
- It will take some time to install all required libraries. But in the end, you should not see any errors.

```
M ~
(45/57) installing perl-Try-Tiny [#####] 100%
(46/57) installing perl-libwww [#####] 100%
Optional dependencies for perl-libwww
perl-LWP-Protocol-https: for https:// url schemes
(47/57) installing perl-TimeDate [#####] 100%
(48/57) installing perl-MailTools [#####] 100%
(49/57) installing perl-IO-Stringy [#####] 100%
(50/57) installing perl-Convert-BinHex [#####] 100%
module test... pass.
(51/57) installing perl-MIME-tools [#####] 100%
(52/57) installing perl-Net-SSLeay [#####] 100%
(53/57) installing perl-IO-Socket-SSL [#####] 100%
(54/57) installing perl-Net-SMTP-SSL [#####] 100%
(55/57) installing perl-TermReadKey [#####] 100%
(56/57) installing git [#####] 100%
Optional dependencies for git
python: various helper scripts
subversion: git svn
(57/57) installing make [#####] 100%
:: Running post-transaction hooks...
(1/1) Updating the info directory file...

fkurtog@bl-sice-990222 MSYS ~
$ |
```

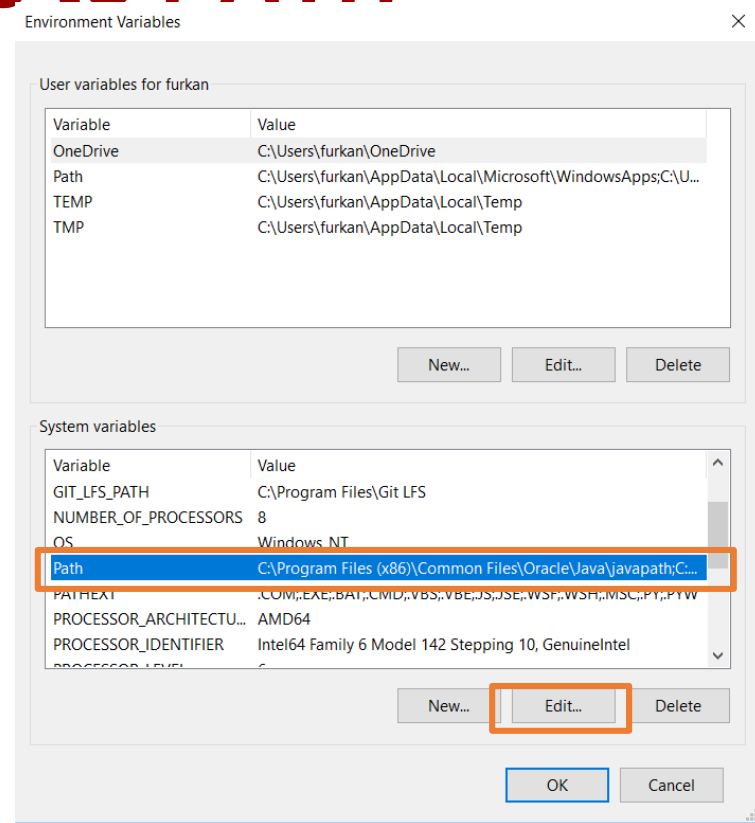
Adding directories to PATH

- Please go to environmental variables with searching on Windows Start Menu.



Adding directories to PATH

- Please select to SYSTEM PATH and press “Edit...”



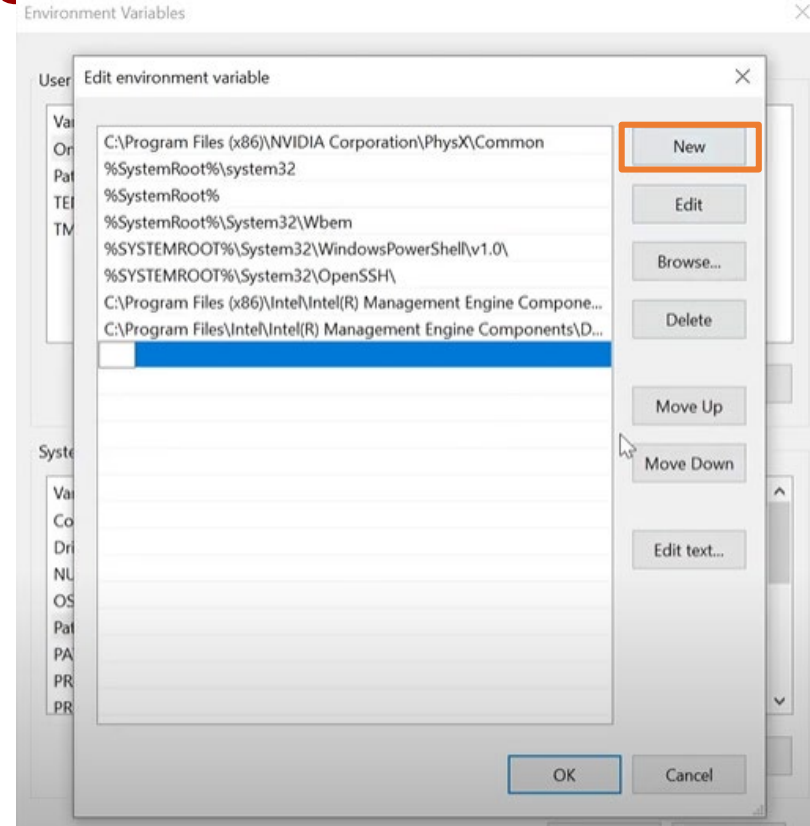
Adding directories to PATH

- Please press “New”. And add following paths to there:

C:\msys64\mingw64\bin

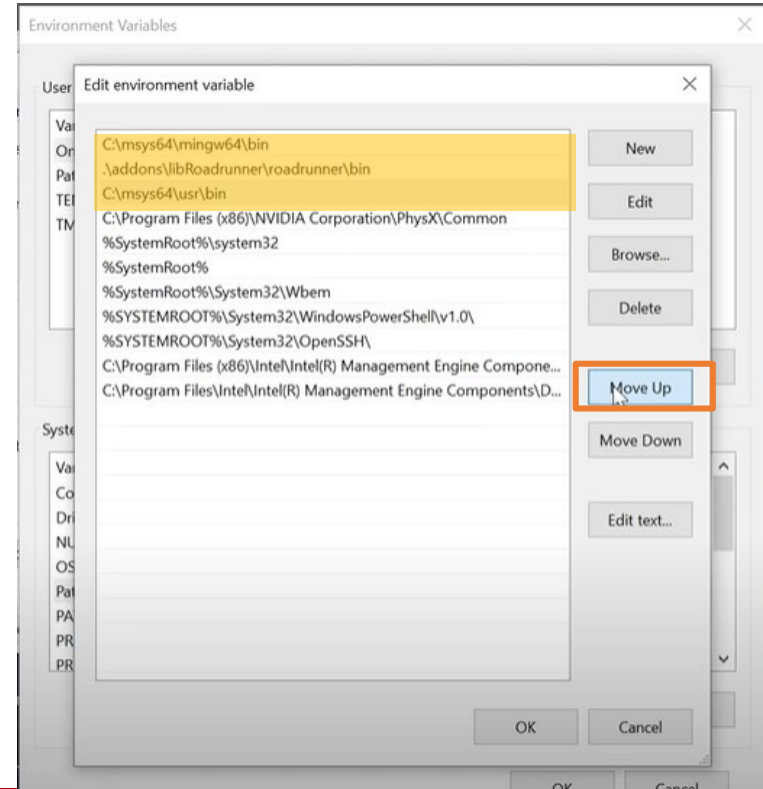
C:\msys64\usr\bin

.\addons\libRoadrunner\roadrunner\bin



Adding directories to PATH

- Then please “MOVE UP”, newly added three paths.
- The list should like the following image.



Anaconda

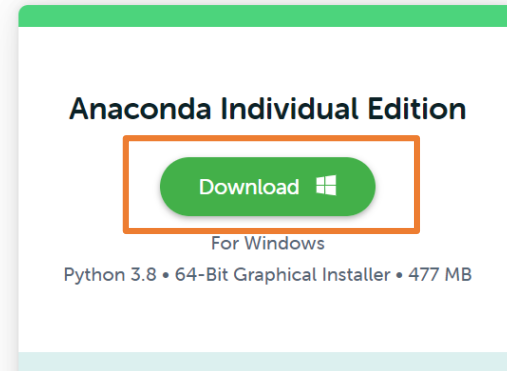
- Please proceed following link:
<https://www.anaconda.com/products/individual>



Individual Edition

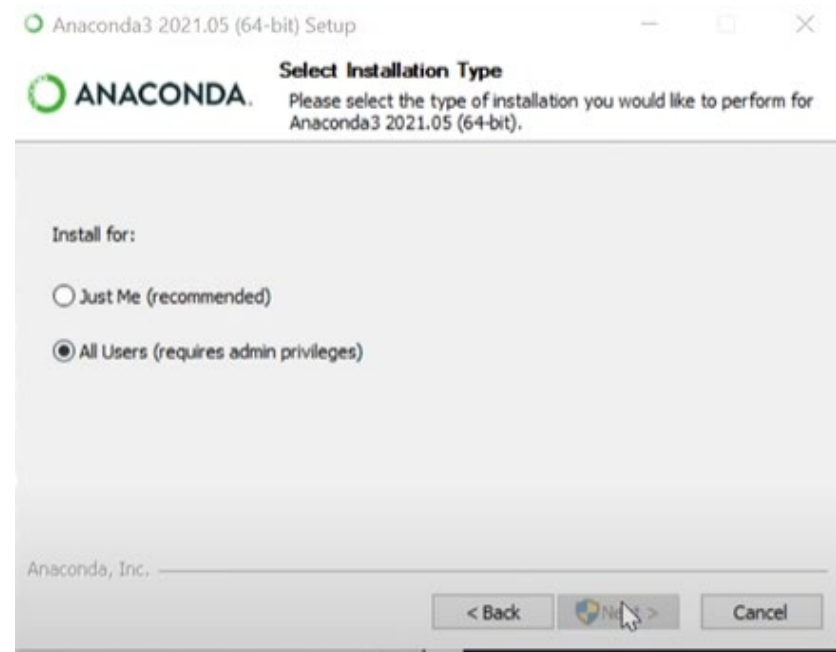
Your data science toolkit

With over 25 million users worldwide, the open-source Individual Edition (Distribution) is the easiest way to perform Python/R data science and machine learning on a single machine. Developed for



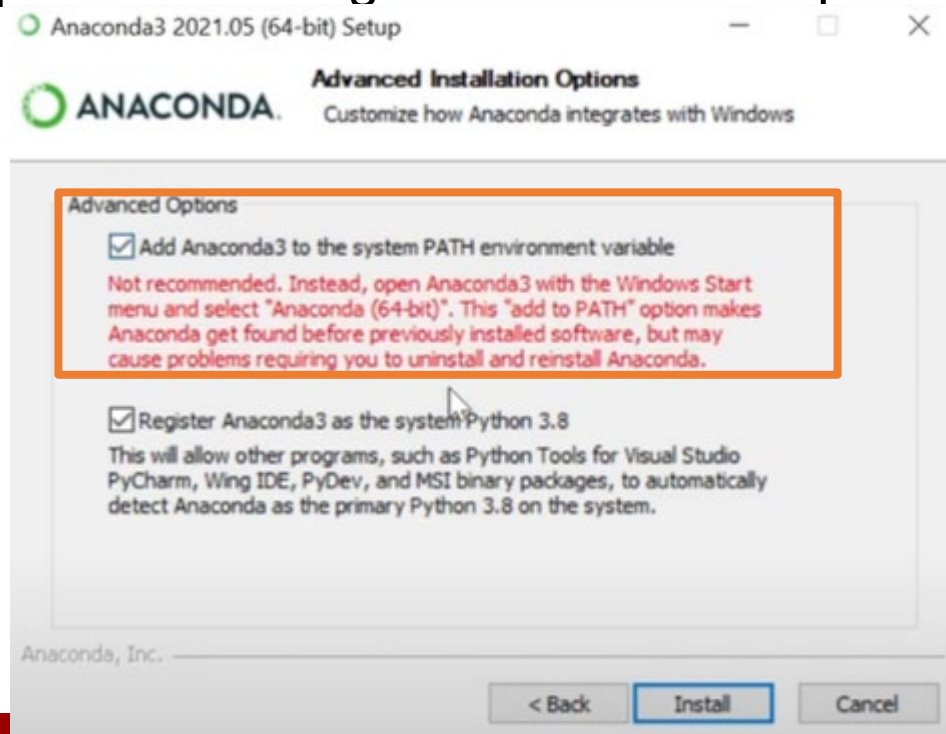
Anaconda

- Please install for all users. (This step is required for msys2 path priorities)
- If you cannot install for all users. Please add msys2 paths for current user in the environmental variables. (Instead of systems variables, please use upper user variables)



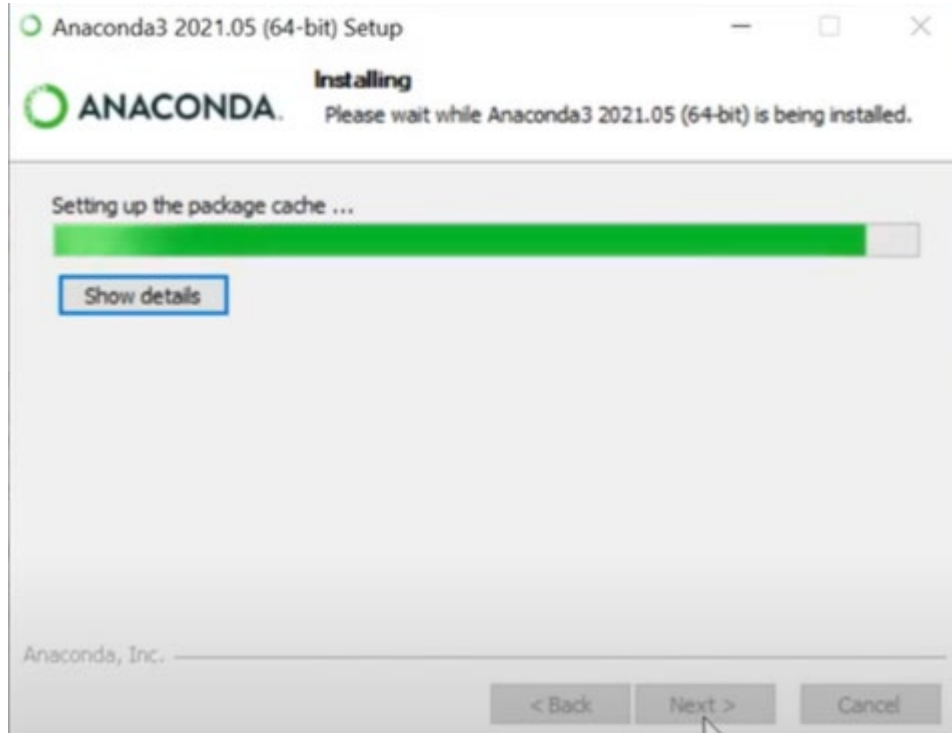
Anaconda

- Please select option for adding Anaconda to the path.



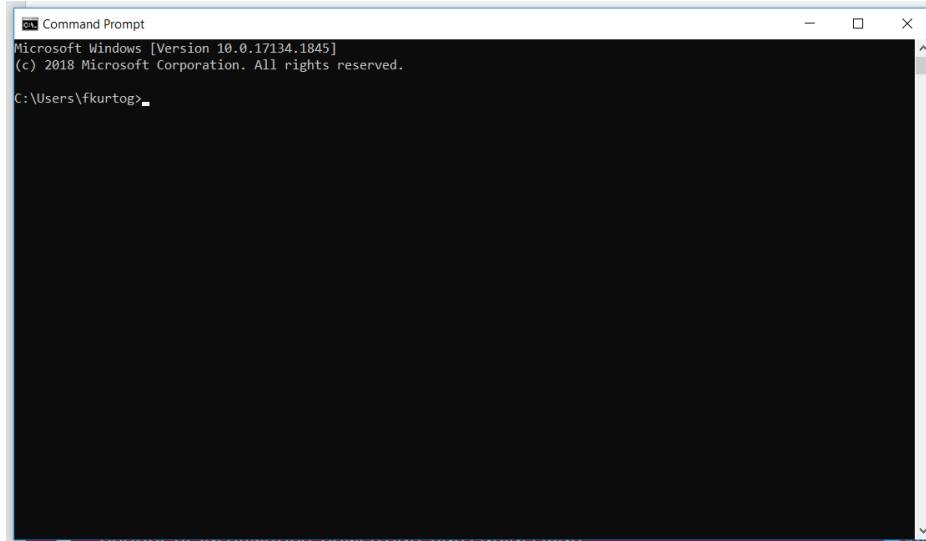
Anaconda

- Installation...



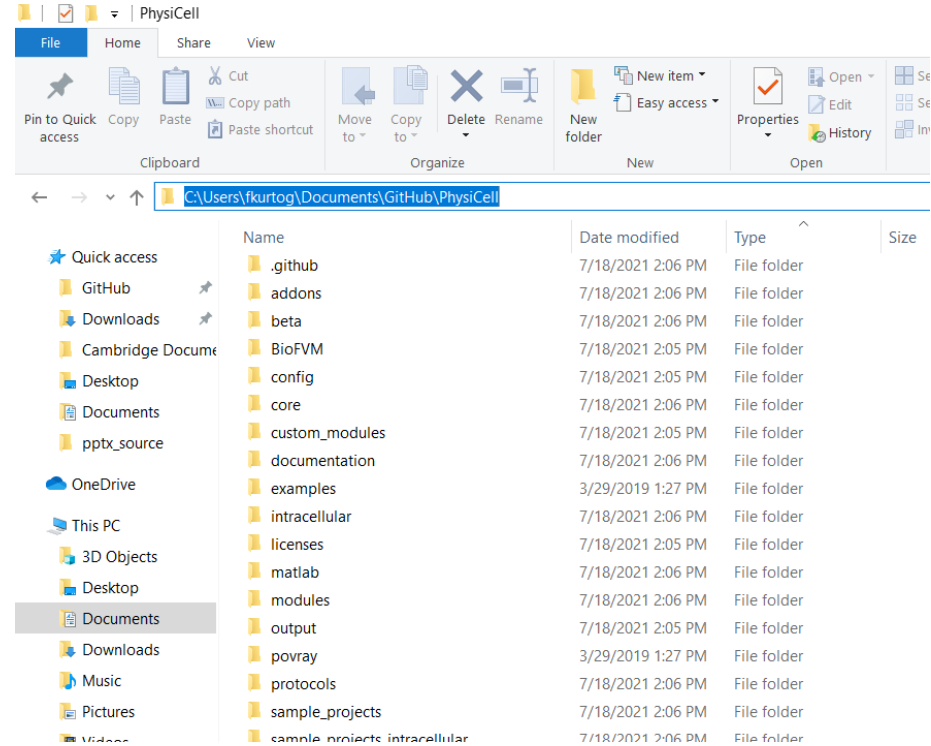
Test Module : “biorobots”

- At this moment PhysiCell is ready to work. Let’s try “biorobots”, first.
- Open command prompt from Start menu with typing “cmd”.



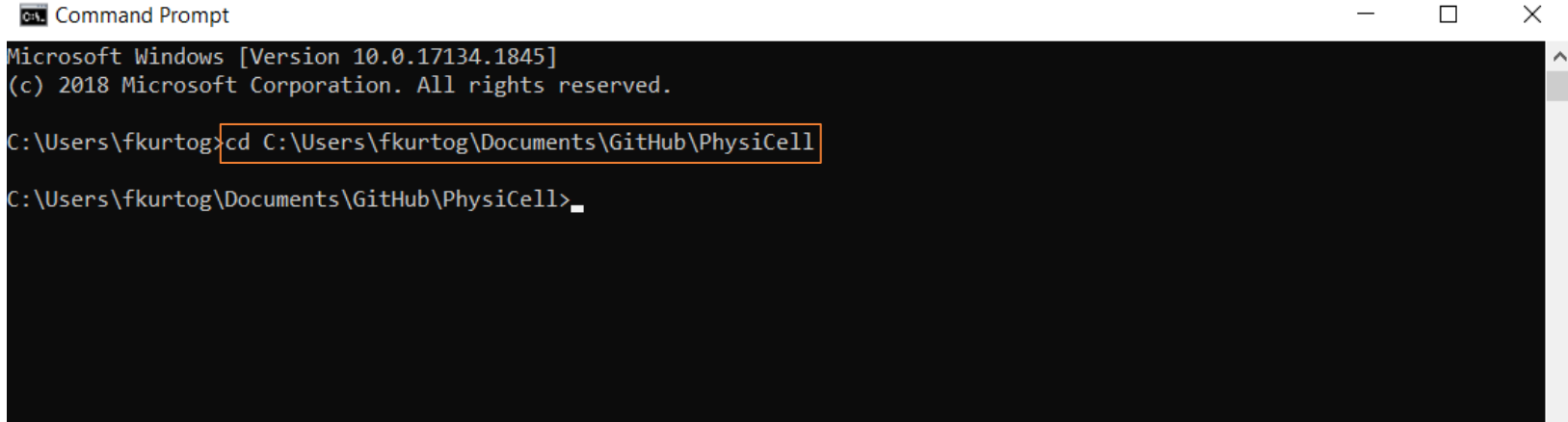
Going to PhysiCell folder

- Proceed to the PhysiCell folder at File Browser.
- Click to the directory address from top.
- Copy it



Going to PhysiCell folder

- Type “cd” and paste the copied directory with space between them.



```
Command Prompt
Microsoft Windows [Version 10.0.17134.1845]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\fkurtog>cd C:\Users\fkurtog\Documents\GitHub\PhysiCell

C:\Users\fkurtog\Documents\GitHub\PhysiCell>
```

Testing Modules (biorobots)

- Let's compile "biorobots" sample project first.
- Please run following commands in the command prompt.

```
make biorobots-sample
```

```
make
```

- This should successfully compile biorobots sample project that ready to run with following command.

```
./biorobots.exe
```

First simulation...

```
Command Prompt - birobots.exe

Placing 15 director cells ...
Placing cargo cells ...
Placing worker cells ...
done!
Using PhysiCell version 1.9.0
Please cite DOI: 10.1371/journal.pcbi.1005991
Project website: http://PhysiCell.MathCancer.org

See ALL_CITATIONS.txt for this list.
current simulated time: 0 min (max: 2880 min)
total agents: 514
interval wall time: 0 days, 0 hours, 0 minutes, and 0.0075989 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.0094352 seconds

Using method diffusion_decay_solver__constant_coefficients_LOD_2D (2D LOD with Thomas Algorithm) ...

Warning and FYI: Very small vectors are normalized to 0 vector

current simulated time: 2 min (max: 2880 min)
total agents: 513
interval wall time: 0 days, 0 hours, 0 minutes, and 0.163112 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.173366 seconds

current simulated time: 4 min (max: 2880 min)
total agents: 513
interval wall time: 0 days, 0 hours, 0 minutes, and 0.139892 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.313664 seconds
```

Testing Modules (ode-energy-sample)

- If the first test is successfully created .mat and .xml files in the output folder. Let's try “ode-sample” sample project. To do that:

```
make ode-energy-sample
```

```
make
```

- While compilation, you should see “libroadrunner” installation. After the compilation, please use following command to run simulation.

```
./ode_energy.exe
```

Second simulation... (ode-energy-sample)

```
Command Prompt - ode_energy.exe
Number of boundary species = 0
Number of compartments = 1
Floating species names:
-----
Glucose Oxygen Energy Lactate apoptosis_rate migration_speed Lac_Secretion_Rate Transition_Rate

Glucose -> 0
Oxygen -> 1
Energy -> 2
Lactate -> 3
apoptosis_rate -> 4
migration_speed -> 5
Lac_Secretion_Rate -> 6
Transition_Rate -> 7
0) 100
1) 100
2) 450
3) 0
4) 0
5) 0
6) 0
7) 0.000166667

----- start: librr_intracellular.cpp: start() called
----- start: doing: rrHandle = createRRInstance()
----- start: rrHandle = 0x1d1bb045f30
      sbml_filename = ./config/Toy_Metabolic_Model.xml
```

Overview

We have finished the minimal setup. Following slides will show traditional setup.

- PhysiCell
 - MSYS 2
 - Adding them to path
 - Anaconda
 - Test modules “biorobots” and “ode-energy-sample”
-

Minimal
setup

- ImageMagick
- COPASI
- PhysiCell Model Builder

Traditional*
setup

*Traditional setup includes optional tools that helps for pre-simulation edits and pro-simulation analysis

ImageMagick

- Please proceed the following link:
<https://imagemagick.org/script/download.php>
- And go below for “Windows Binary Release” and click there to download.

Windows Binary Release

ImageMagick runs on Windows 10 (x86 & x64), Windows 8 (x86 & x64), Windows 7 (x86 & x64), Windows Server 2012, Windows Vista (x86 & x64) with Service Pack 2, Windows Server 2008 (x86 & x64) with Service Pack 2, and Windows Server 2008 R2 (x64).

The amount of memory can be an important factor, especially if you intend to work on large images. A minimum of 512 MB of RAM is recommended, but the more RAM the better. Although ImageMagick runs well on a single core computer, it automatically runs in parallel on multi-core systems reducing run times considerably.

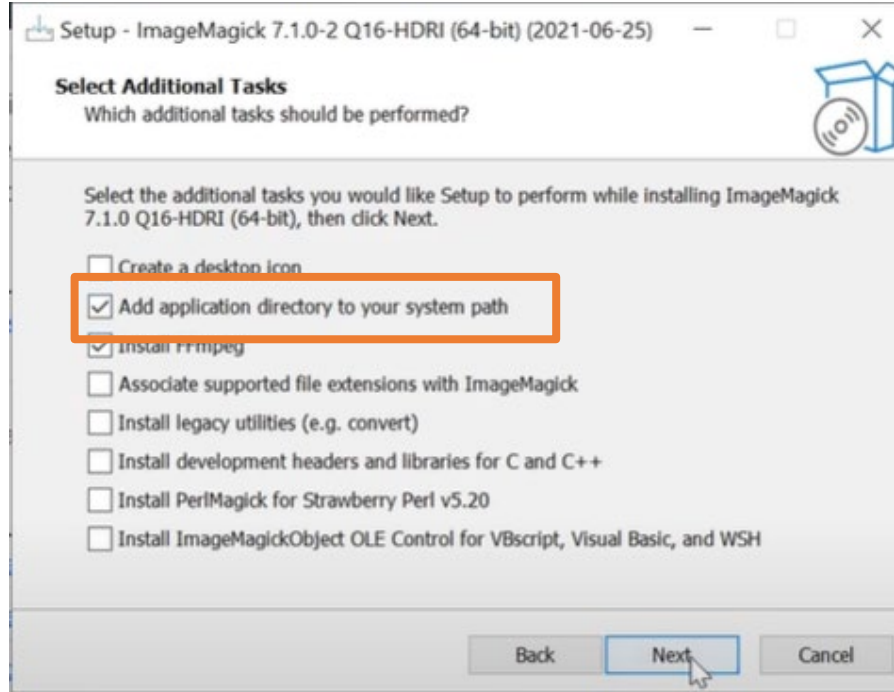
The Windows version of ImageMagick is self-installing. Simply click on the appropriate version below and it will launch itself and ask you a few installation questions. Versions with *Q8* in the name are 8 bits-per-pixel component (e.g. 8-bit red, 8-bit green, etc.), whereas, *Q16* in the filename are 16 bits-per-pixel component. A *Q16* version permits you to read or write 16-bit images without losing precision but requires twice as much resources as the *Q8* version. Versions with *dll* in the filename include ImageMagick libraries as [dynamic link libraries](#). Unless you have a Windows 32-bit OS, we recommend this version of ImageMagick for 64-bit Windows:

Version	Description
ImageMagick-7.1.0-4-Q16-HDRI-x64-dll.exe	Win64 dynamic at 16 bits-per-pixel component with High-dynamic-range imaging enabled

Or choose from these alternate Windows binary distributions:

ImageMagick

- Please be sure the option for adding directory to path is selected.



COPASI

- Please proceed following link to download COPASI

<http://copasi.org/>

- Install regularly



PhysiCell Model Builder (1)

- The Model Builder is a GUI to let you create/edit a .xml configuration file that defines (nearly all of) a PhysiCell model.

- Download the latest release at:

<https://github.com/PhysiCell-Tools/PhysiCell-model-builder/releases>

- Uncompress the .zip, change directory into it, and run it:

```
$ unzip PhysiCell-model-builder-2.5.0.zip  
$ cd PhysiCell-model-builder-2.5.0  
$ python bin/gui4xml.py
```

Note that if your setup automatically unzips files after downloading, this command will not work. INSTEAD, **skip** the unzip command and go directly to the second command

This should display the GUI (next page):

PhysiCell Model Builder (2)

The screenshot shows the 'PhysiCell Model Builder: copy_template.xml' window. It has a menu bar with 'File' and tabs for 'Config Basics', 'Microenvironment', 'Cell Types', and 'User Params'. The 'Config Basics' tab is active, displaying several configuration sections:

- Domain (micron):** A grid of input fields for domain boundaries and spacing.

Domain (micron)					
Xmin	-500	Xmax	500	dx	20
Ymin	-500	Ymax	500	dy	20
Zmin	-10	Zmax	10	dz	20
- ☐ Virtual walls
- Misc runtime parameters:** Fields for 'Max Time' (7200 min), '# threads' (6), and 'output folder' (output).

Save data: ☒ SVG every 60 min ☒ Full every 360 min
- Initial conditions of cells (x,y,z, type):** A section with an input field for 'cells.csv'.

A User Guide for the Model Builder is still be written.

It is a tool that is still considered “beta”, so your feedback will be very valuable.

Funding Acknowledgements



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- Breast Cancer Research Foundation
- Jayne Koskinas Ted Giovanis Foundation for Health and Policy
- National Cancer Institute (U01CA232137)
- National Science Foundation (1720625)

Training Materials:

- Administrative supplement to NCI U01CA232137 (Year 2)