

Slides, videos, links and more:

<https://github.com/physicell-training/ws2021>

Setting up PhysiCell on Windows

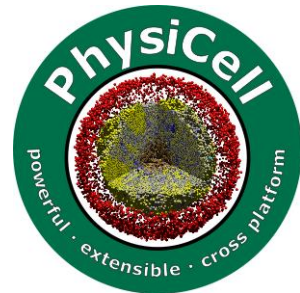


Furkan Kurtoglu & Aneequa Sundus

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

PhysiCell Project

July 25, 2021



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Thank you very much for watching!



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Overview

This installation guide is prepared for installing PhysiCell to new fresh Windows. If you install PhysiCell 1.8.0 or previous version in your PC. Please uninstall MSYS 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>



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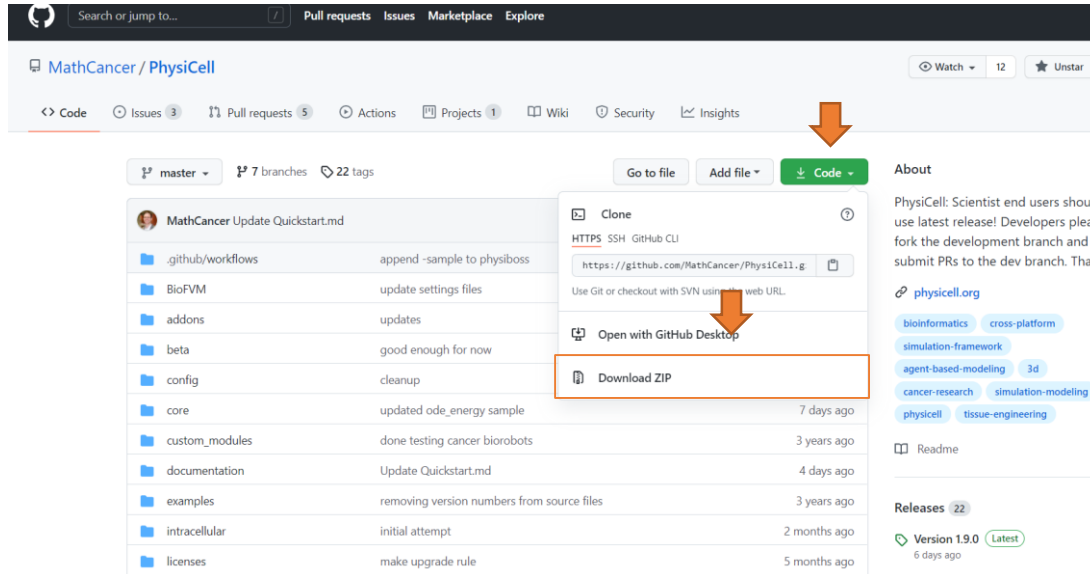
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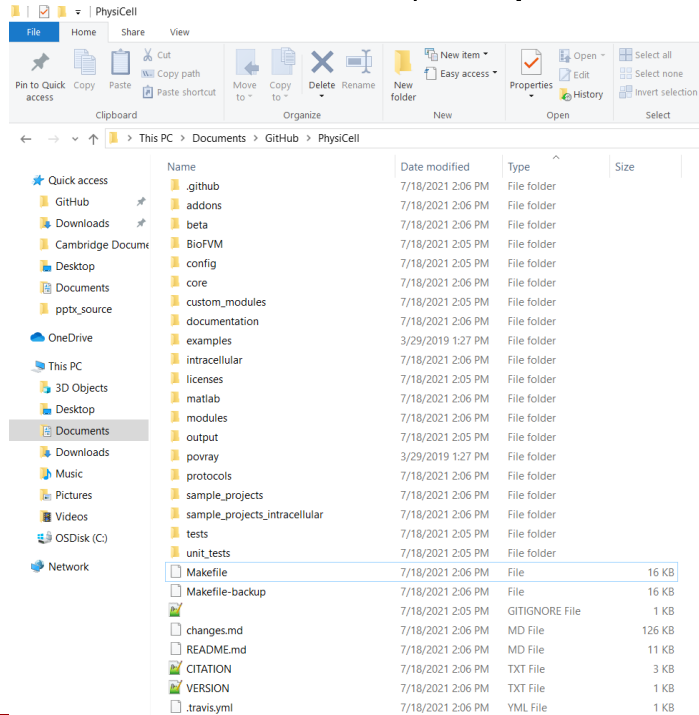
- To download PhysiCell please proceed following link:
<https://github.com/MathCancer/PhysiCell>



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

PhysiCell

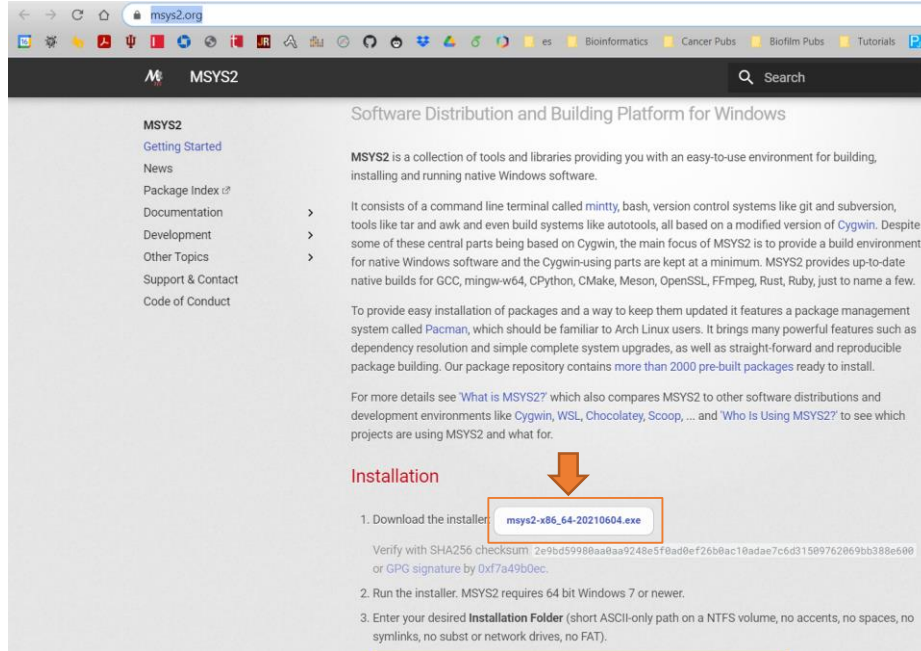
- After the extraction, PhysiCell folder should look like this:



MSYS 2

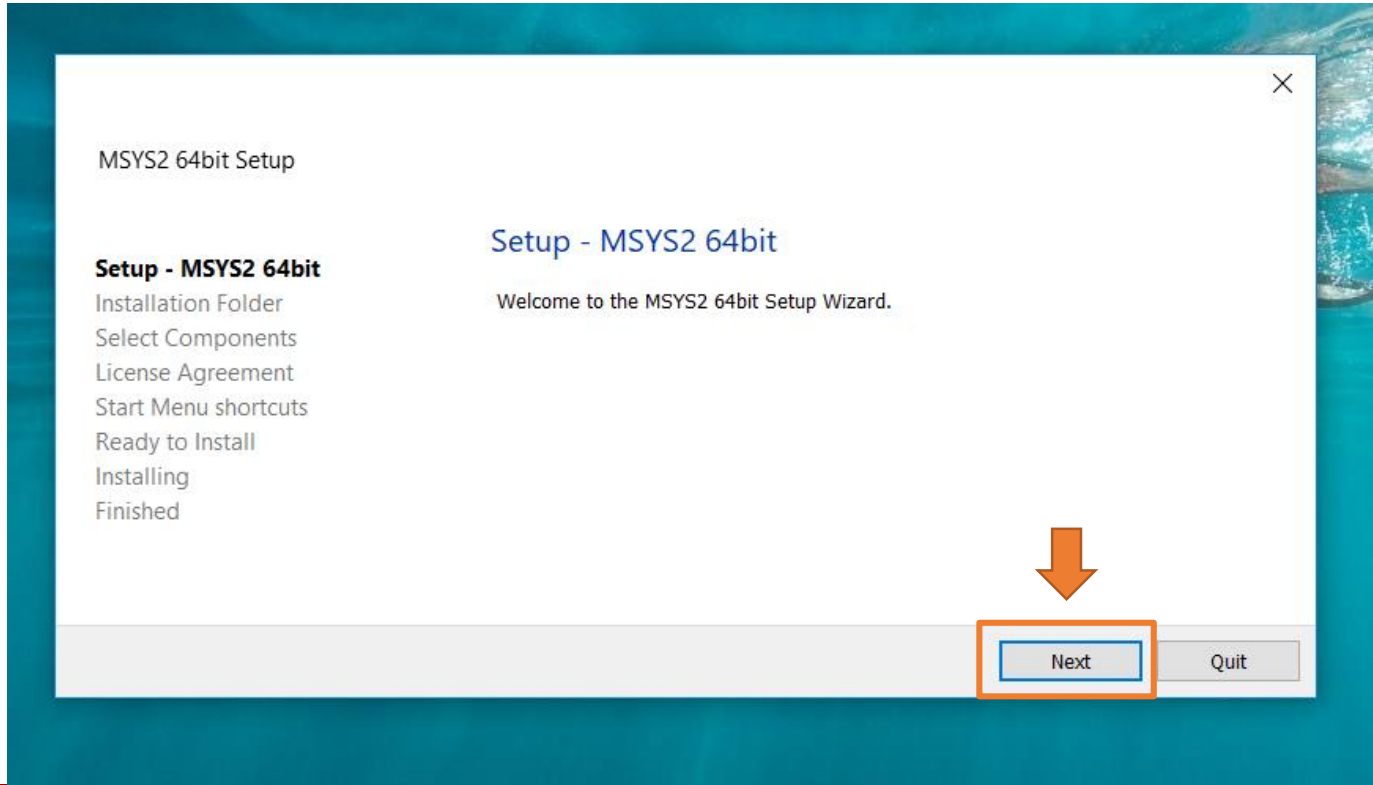
- Please proceed following link:

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



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

MSYS 2



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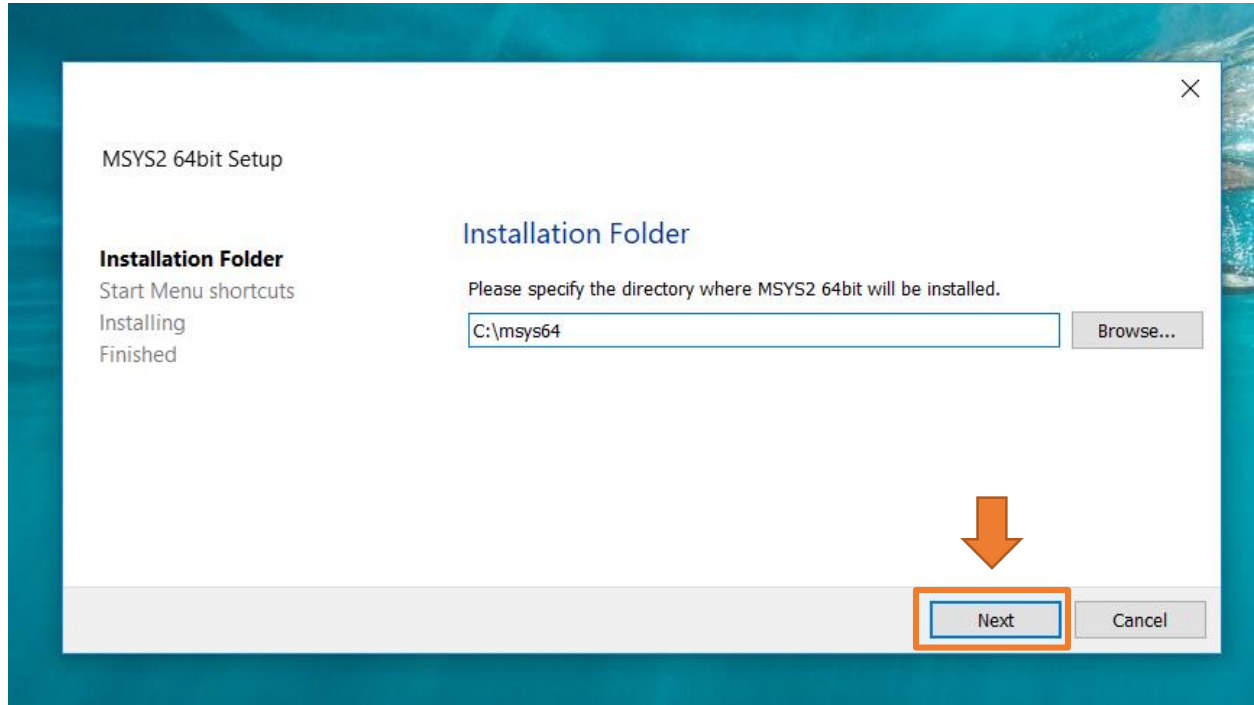
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MSYS 2



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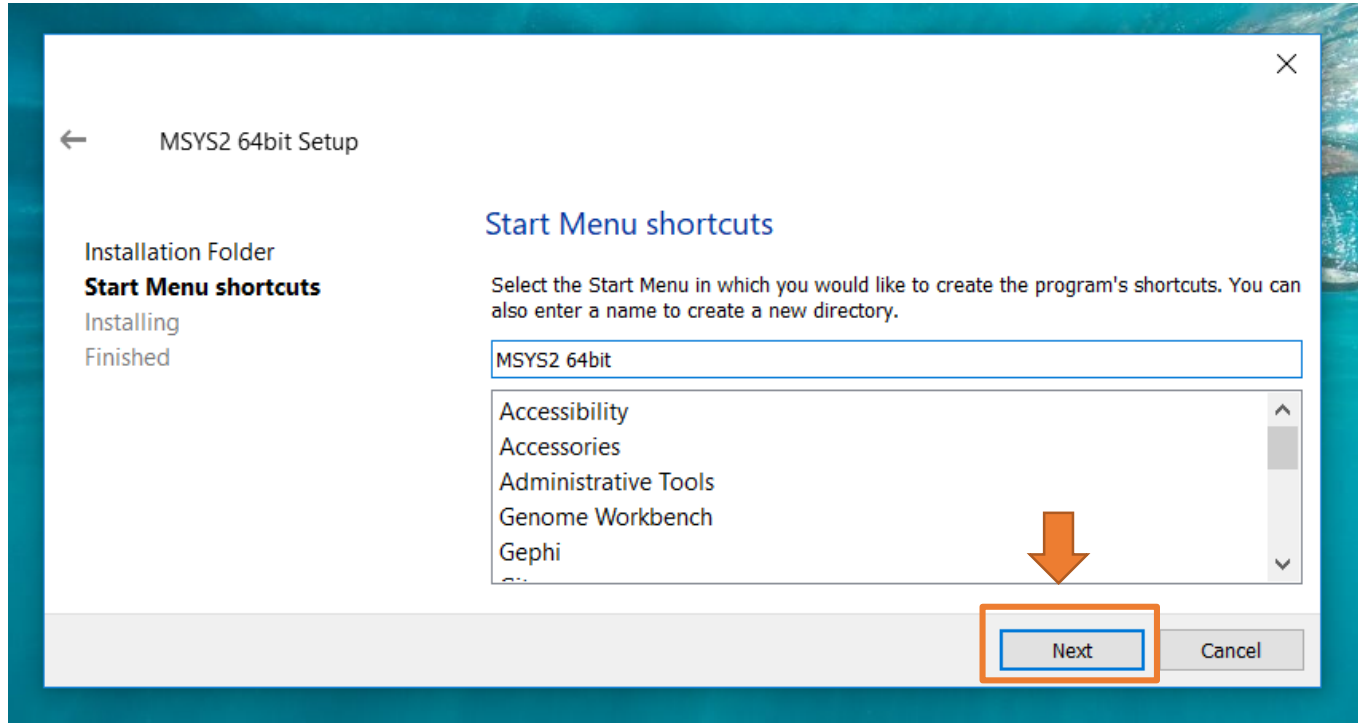
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MSYS 2



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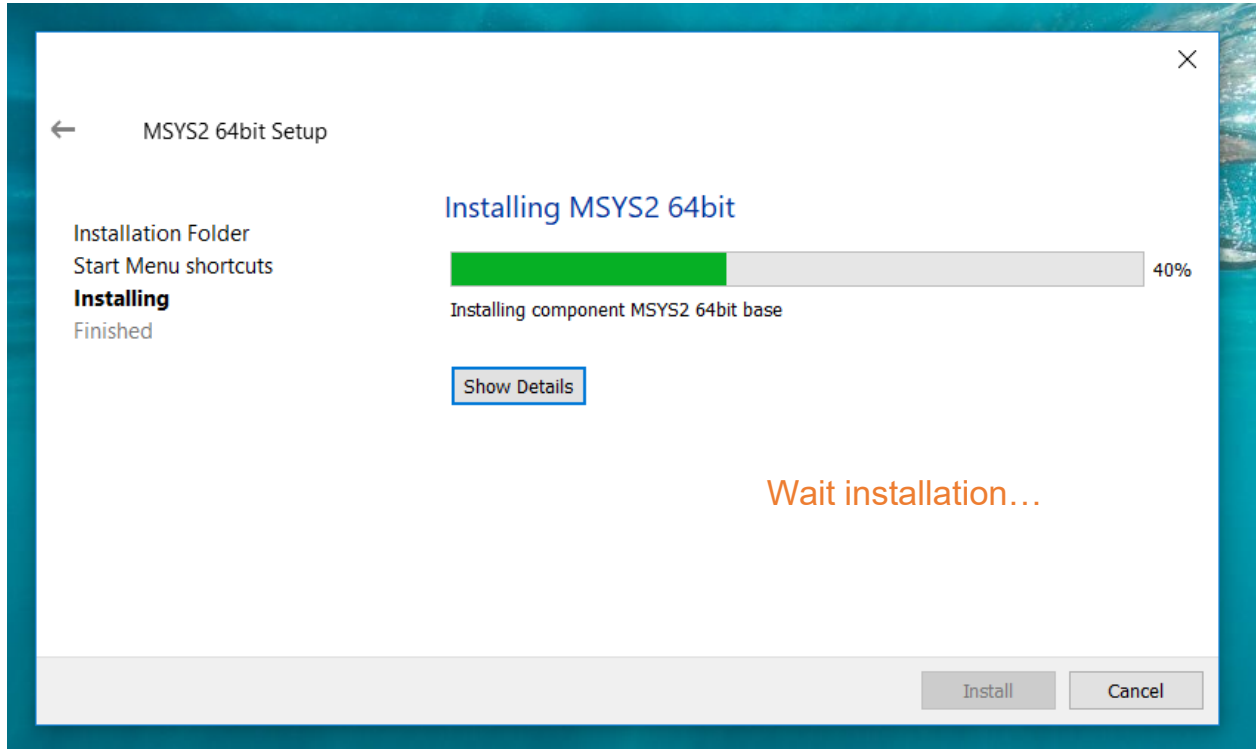
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MSYS 2



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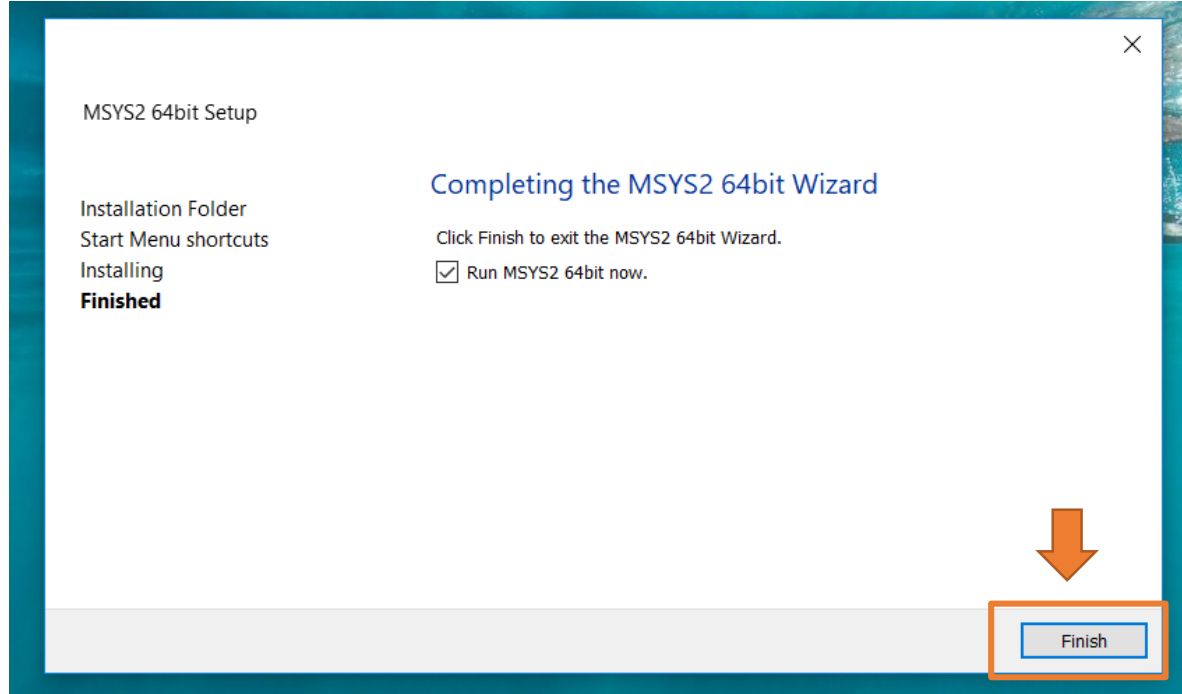
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MSYS 2



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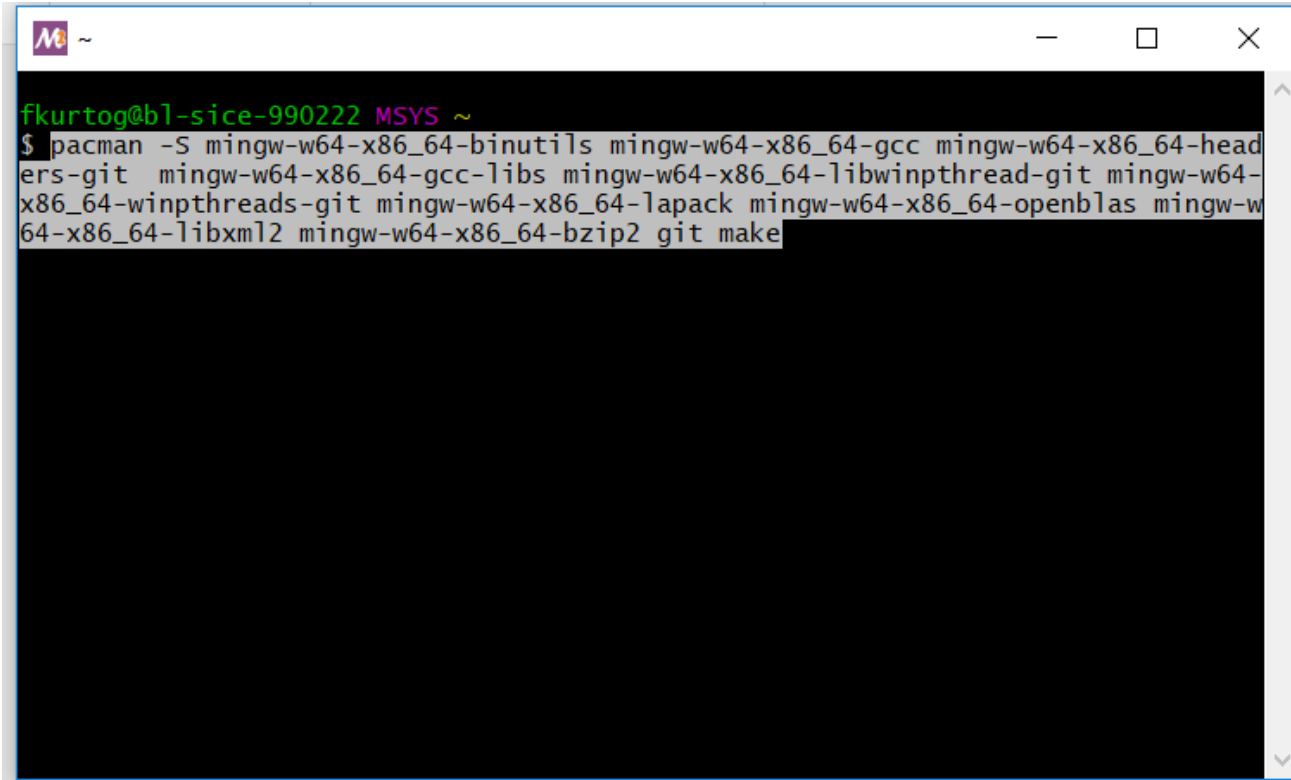
 **@PhysiCell**

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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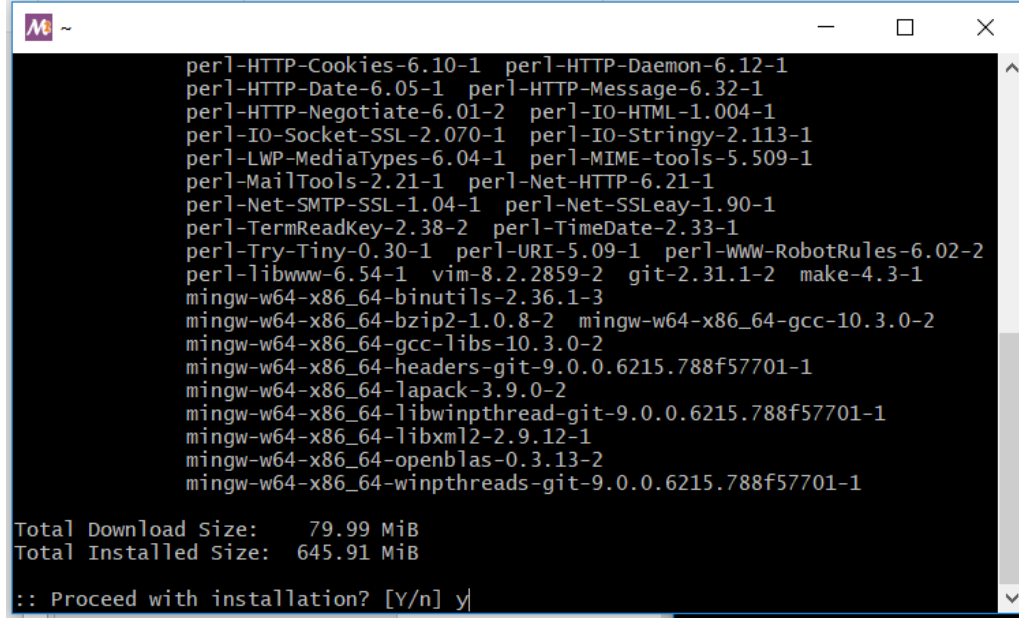
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MSYS 2

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



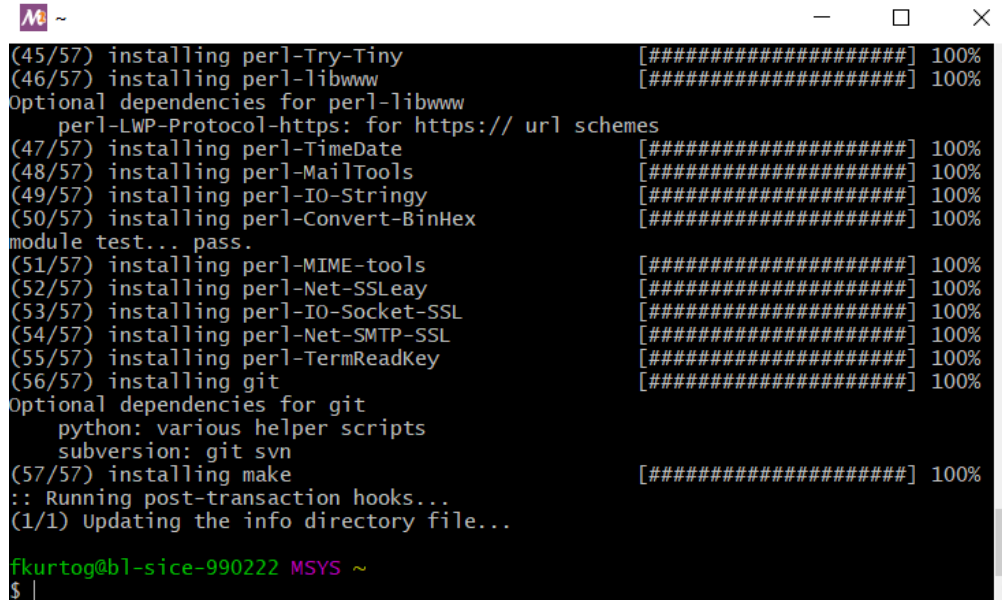
```
perl-HTTP-Cookies-6.10-1 perl-HTTP-Daemon-6.12-1
perl-HTTP-Date-6.05-1 perl-HTTP-Message-6.32-1
perl-HTTP-Negotiate-6.01-2 perl-IO-HTML-1.004-1
perl-IO-Socket-SSL-2.070-1 perl-IO-Stringy-2.113-1
perl-LWP-MediaTypes-6.04-1 perl-MIME-tools-5.509-1
perl-MailTools-2.21-1 perl-Net-HTTP-6.21-1
perl-Net-SMTP-SSL-1.04-1 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.

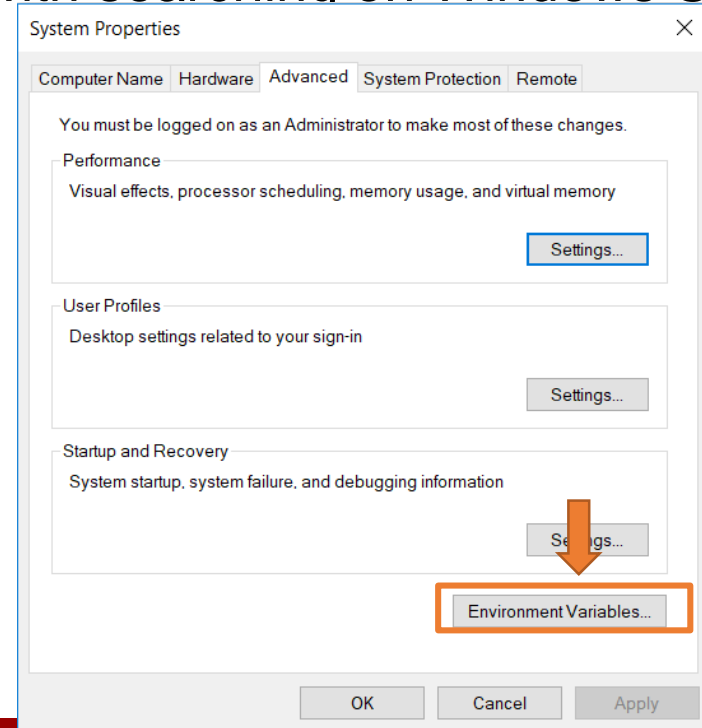
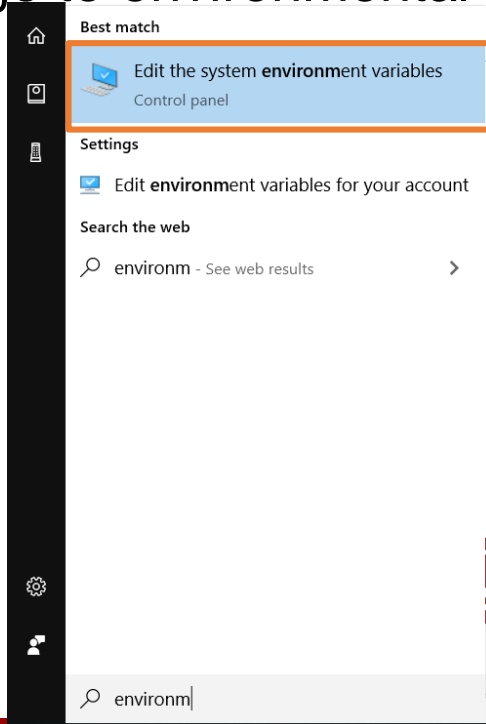
A terminal window with a dark background and light-colored text. The window title bar shows a purple icon, a tilde symbol, and standard window controls (minimize, maximize, close). The output shows the installation progress of various Perl modules and other dependencies. Each line includes a progress indicator like (45/57), the name of the package being installed, a progress bar consisting of a series of hash symbols, and the completion percentage (100%). The packages listed include perl-Try-Tiny, perl-libwww, perl-LWP-Protocol-https, perl-TimeDate, perl-MailTools, perl-IO-Stringy, perl-Convert-BinHex, perl-MIME-tools, perl-Net-SSLeay, perl-IO-Socket-SSL, perl-Net-SMTP-SSL, perl-TermReadKey, git, python, subversion, and make. The terminal ends with the prompt 'fkurtog@bl-sice-990222 MSYS ~' and a dollar sign on the next line.

```
(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 ~
$
```

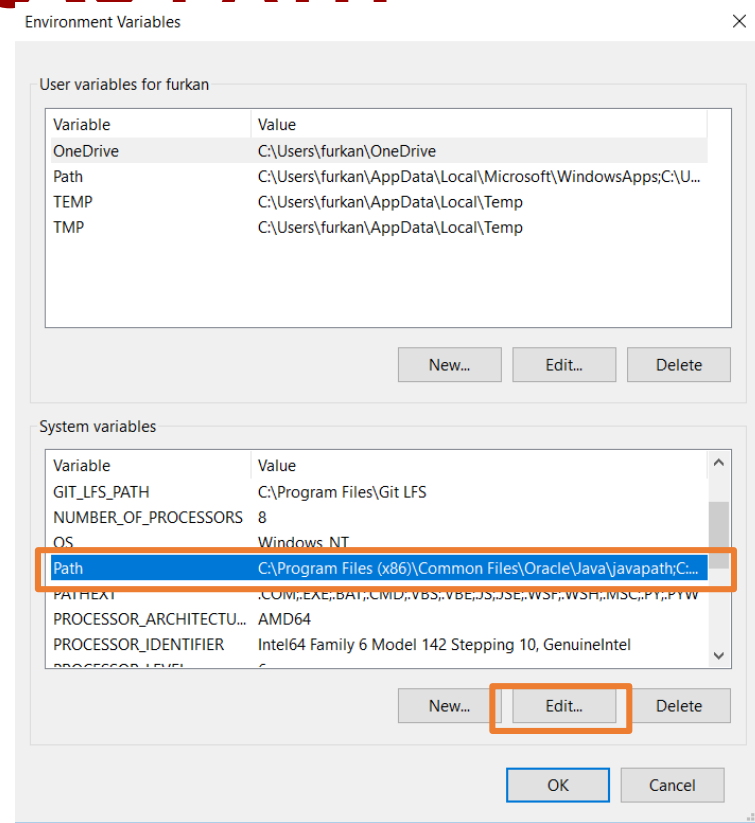

Adding directories to PATH

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



Adding directories to PATH

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



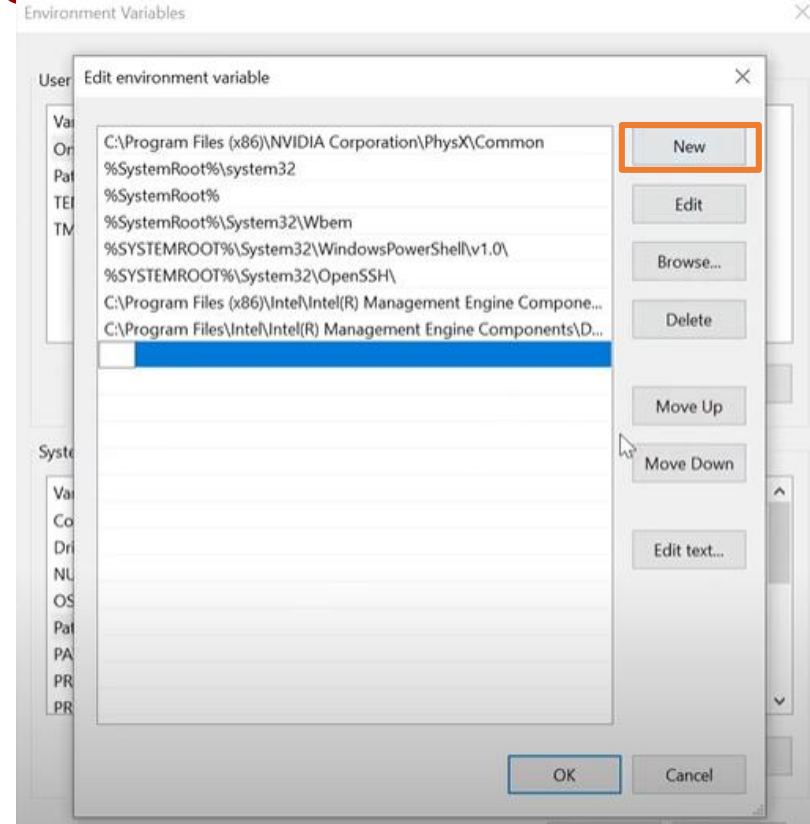
Adding directories to PATH

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

C:\msys64\mingw64\bin

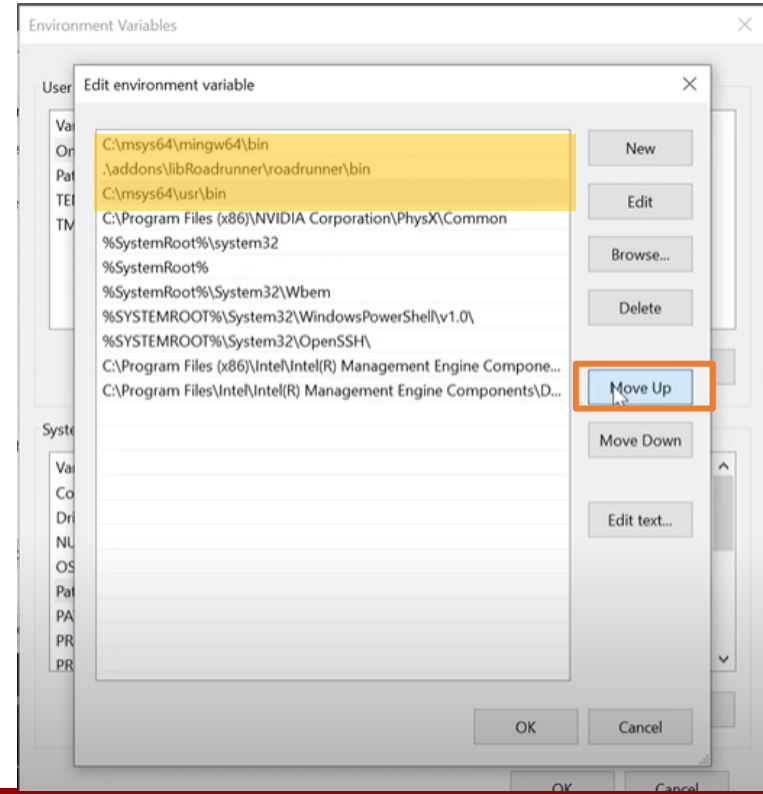
C:\msys64\usr\bin

.\addons\libRoadrunner\roadrunner\bin



Adding directories to PATH

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



Anaconda

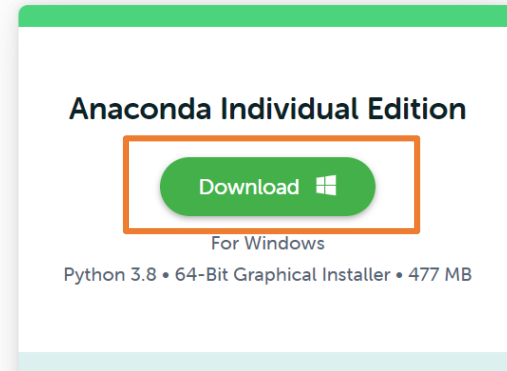
- Please proceed following link:
<https://www.anaconda.com/products/individual>



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



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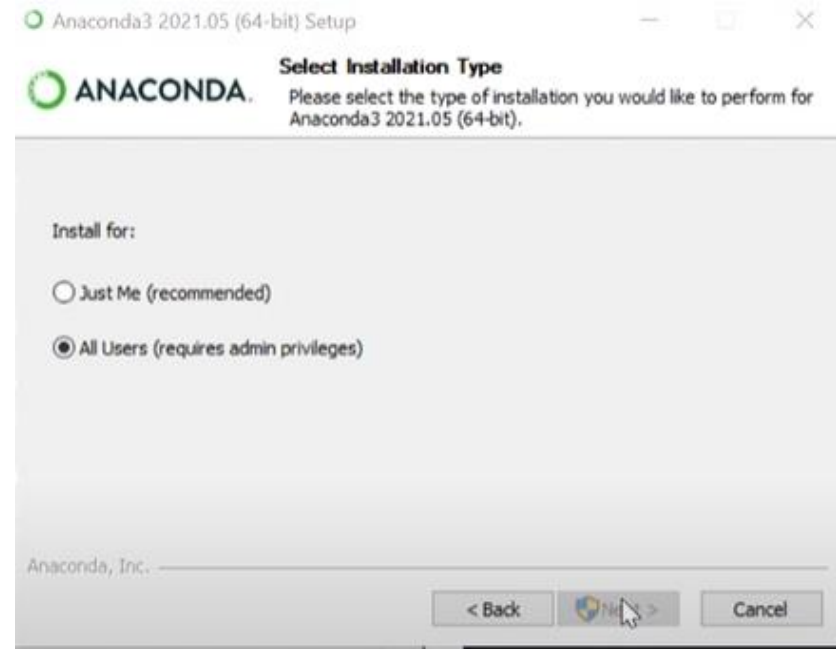
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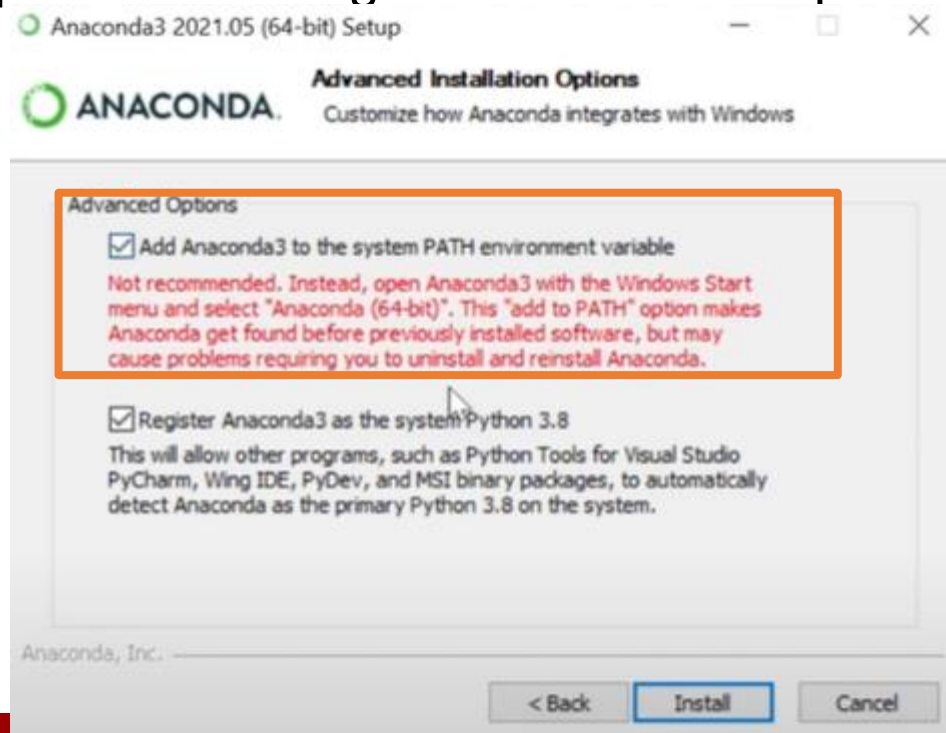
Anaconda

- 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)



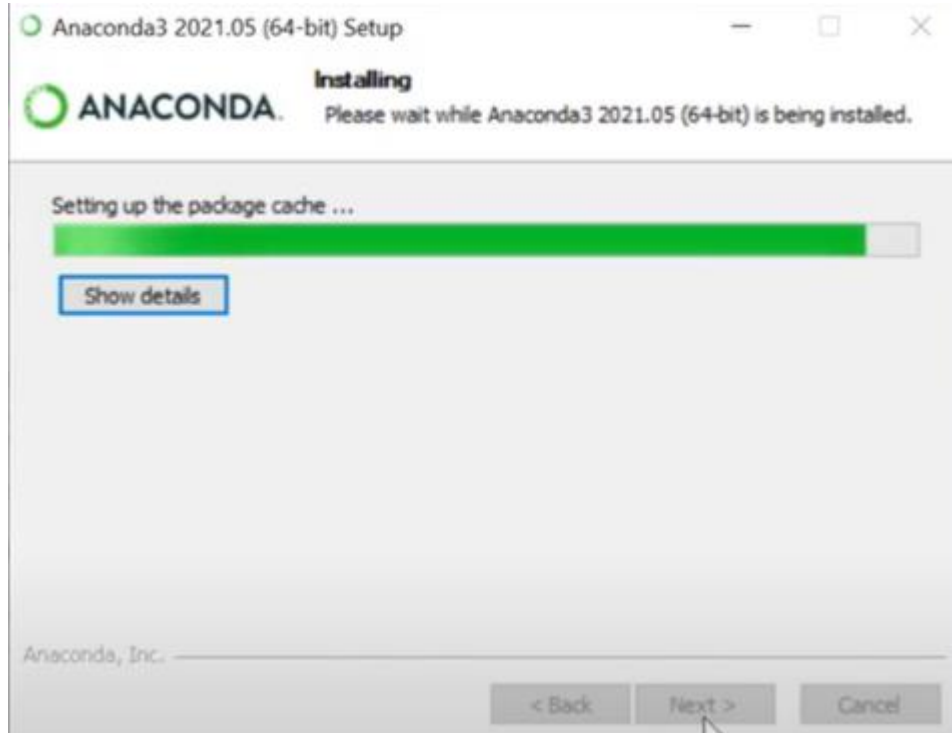
Anaconda

- Please select option for adding Anaconda to the path.



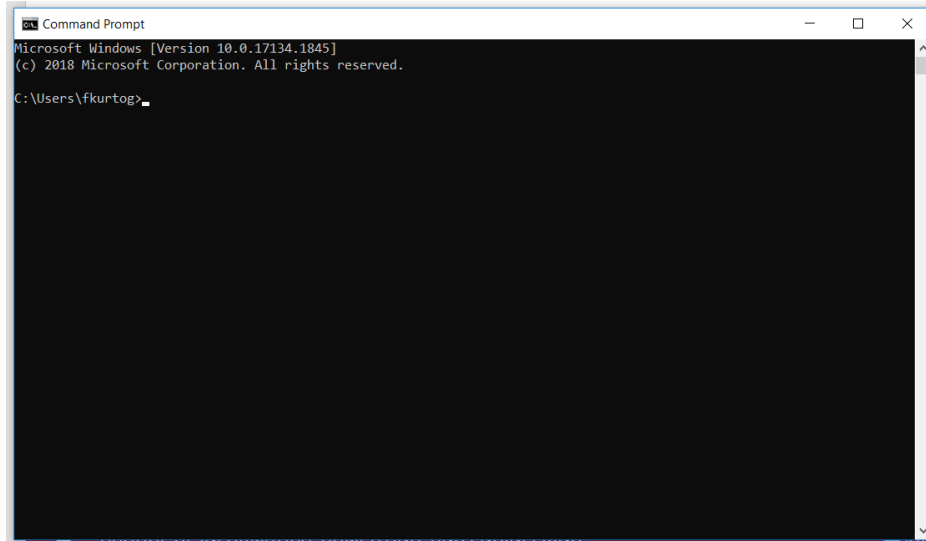
Anaconda

- 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”.



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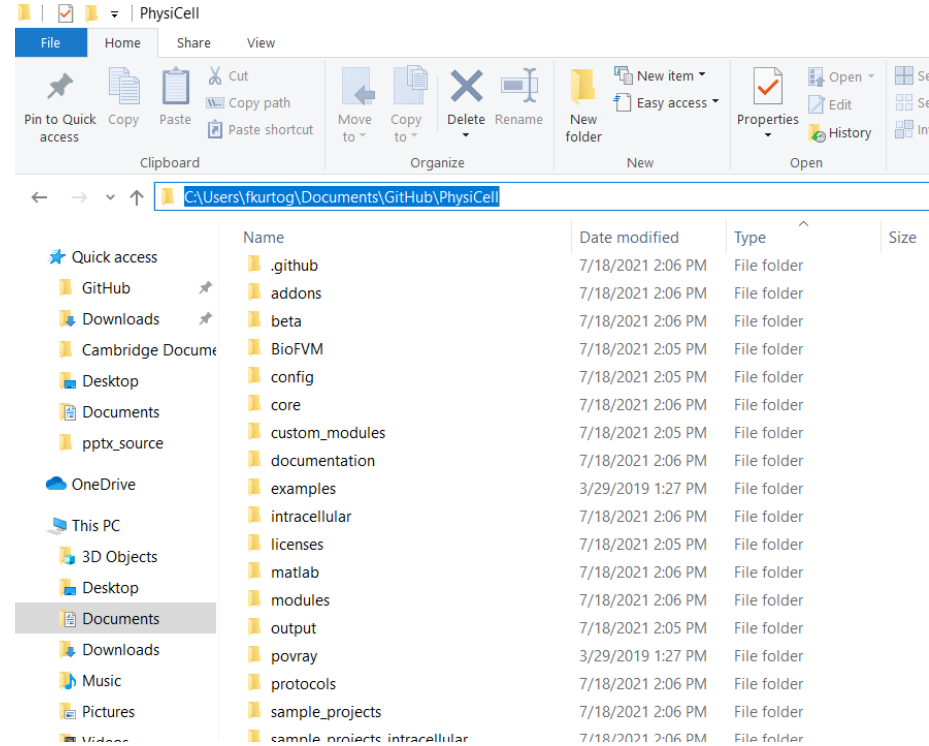
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Going to PhysiCell folder

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



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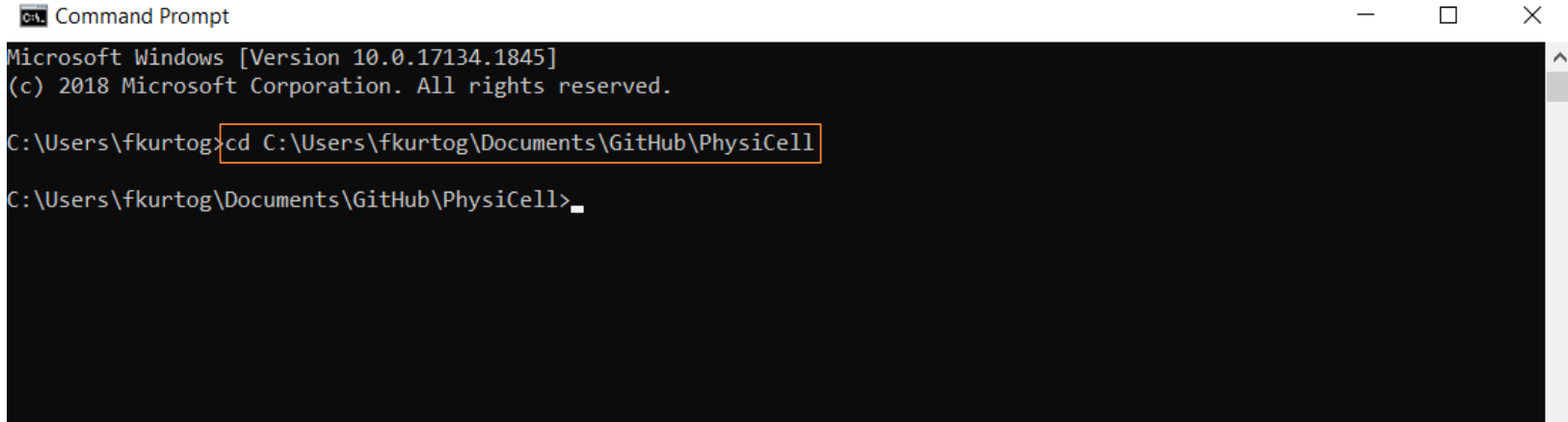
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Going to PhysiCell folder

- 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 - biorobots.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
```



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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
- Minimal setup
-
- Test modules “biorobots” and “ode-energy-sample”
 - 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.

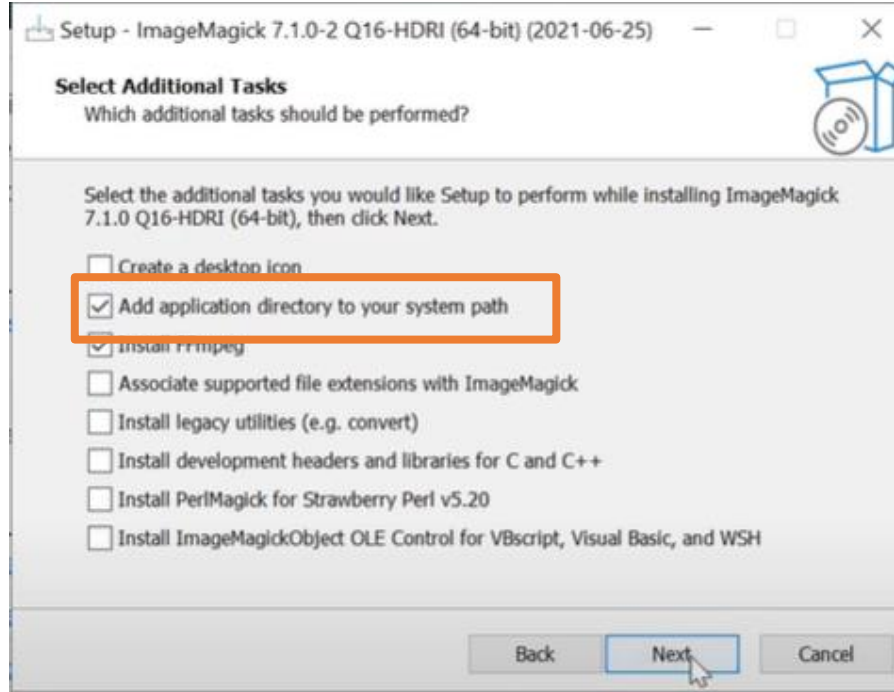
The Windows version of ImageMagick is self-installing. Simply click on the appropriate version below and it will launch itself and ask you a few installation questions. Versions with *Q8* in the name are 8 bits-per-pixel component (e.g. 8-bit red, 8-bit green, etc.), whereas, *Q16* in the filename are 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-1.1.zip  
$ cd PhysiCell-model-builder-1.1  
$ 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 'Tools'. Below the menu bar are tabs: 'Config Basics' (selected), 'Microenvironment', 'Cell Types', 'Cell Custom Data', and 'User Params'. The main content area is divided into three sections, each with an orange header bar:

- Domain (micron):** Contains input fields for Xmin (-500), Xmax (500), Ymin (-500), Ymax (500), Zmin (-10), and Zmax (10). To the right of these are input fields for dx (20), dy (20), and dz (20). There is also a checkbox for 'Virtual walls'.
- Misc runtime parameters:** Contains input fields for 'Max Time' (7200) and '# threads' (6). Below these is an 'output folder' field with the value 'output'. At the bottom of this section are 'Save data:' options: a checked checkbox for 'SVG' followed by 'every 60 min', and a checked checkbox for 'Full' followed by 'every 360 min'.
- Initial conditions of cells (x,y,z, type):** Contains a checkbox for 'config/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



PhysiCell Development:

- 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)