

Slides, videos, links and more:

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

Setting up PhysiCell on Windows

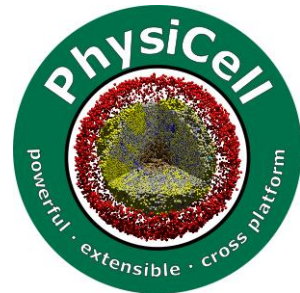


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 [@PhysiCell](https://twitter.com/PhysiCell)

PhysiCell Project

July 2022



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

Obtaining PhysiCell

- Number of ways
 - Git clone
 - GitHub Desktop
 - Using `get_physicell.py`



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PhysiCell Project

PhysiCell.org

 **@PhysiCell**

Using get_physicell.py

- This way requires python.
- Python script will download PhysiCell to desired path.
- Therefore, we need python installed.
- We recommend Anaconda for python

Anaconda Installation



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Anaconda

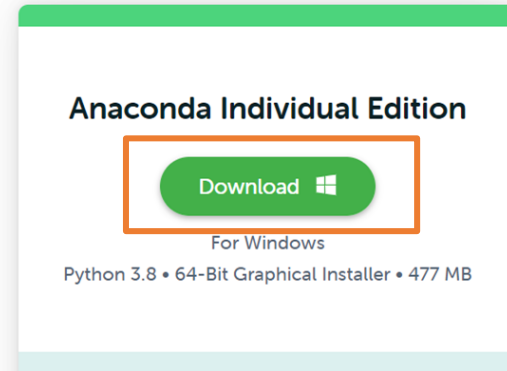
- Please proceed following link:
<https://www.anaconda.com/products/individual>



Individual Edition

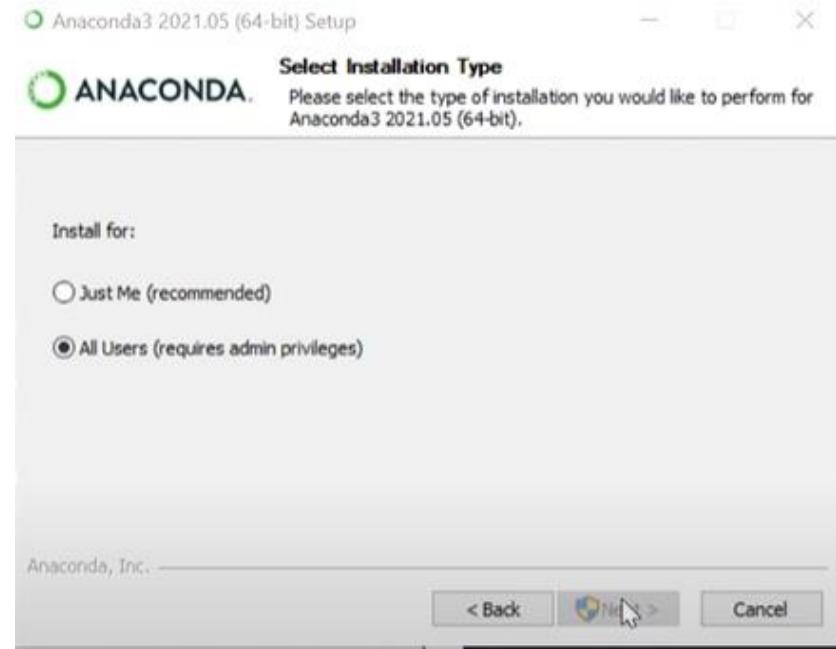
Your data science toolkit

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



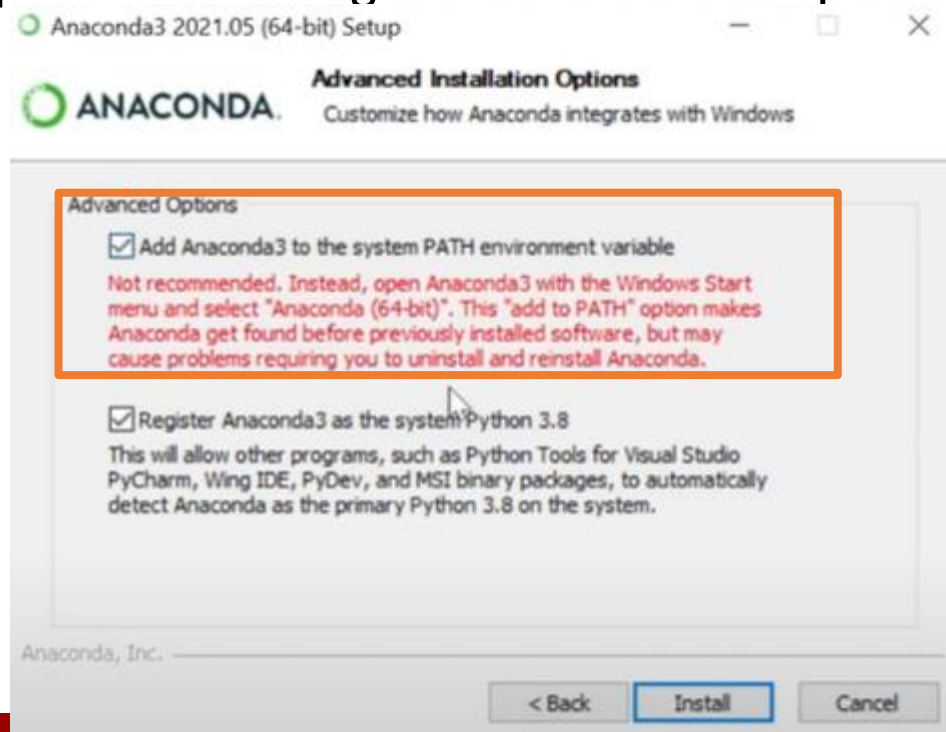
Anaconda

- 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)



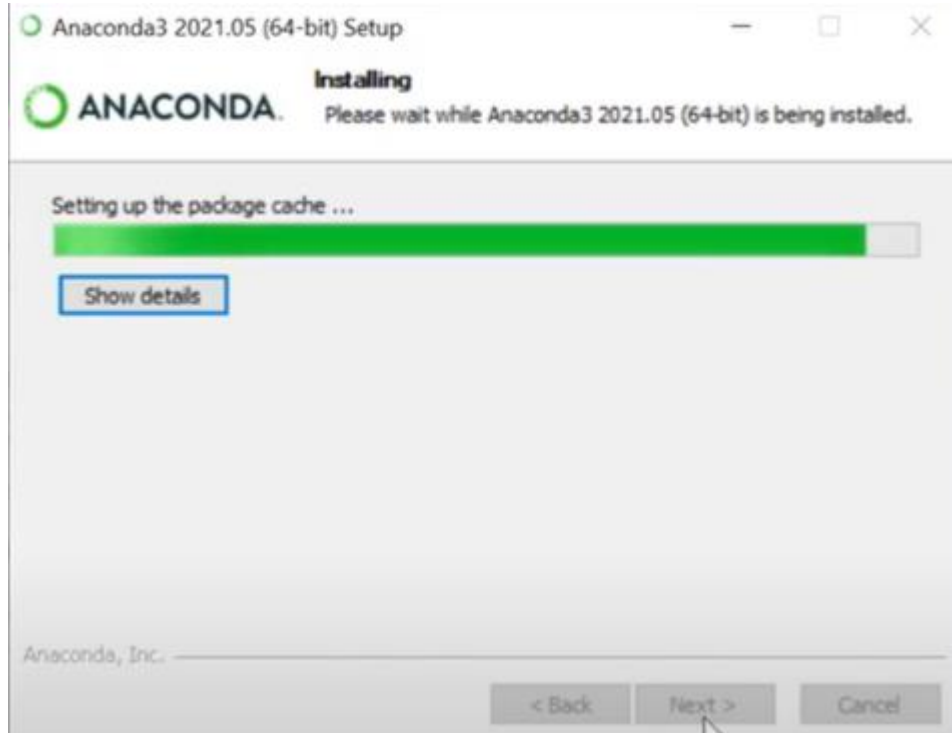
Anaconda

- Please select option for adding Anaconda to the path.



Anaconda

- Installation...



get_physicell.py

- We will use following python script
https://github.com/physicell-training/ws2022/blob/main/setup/get_physicell.py



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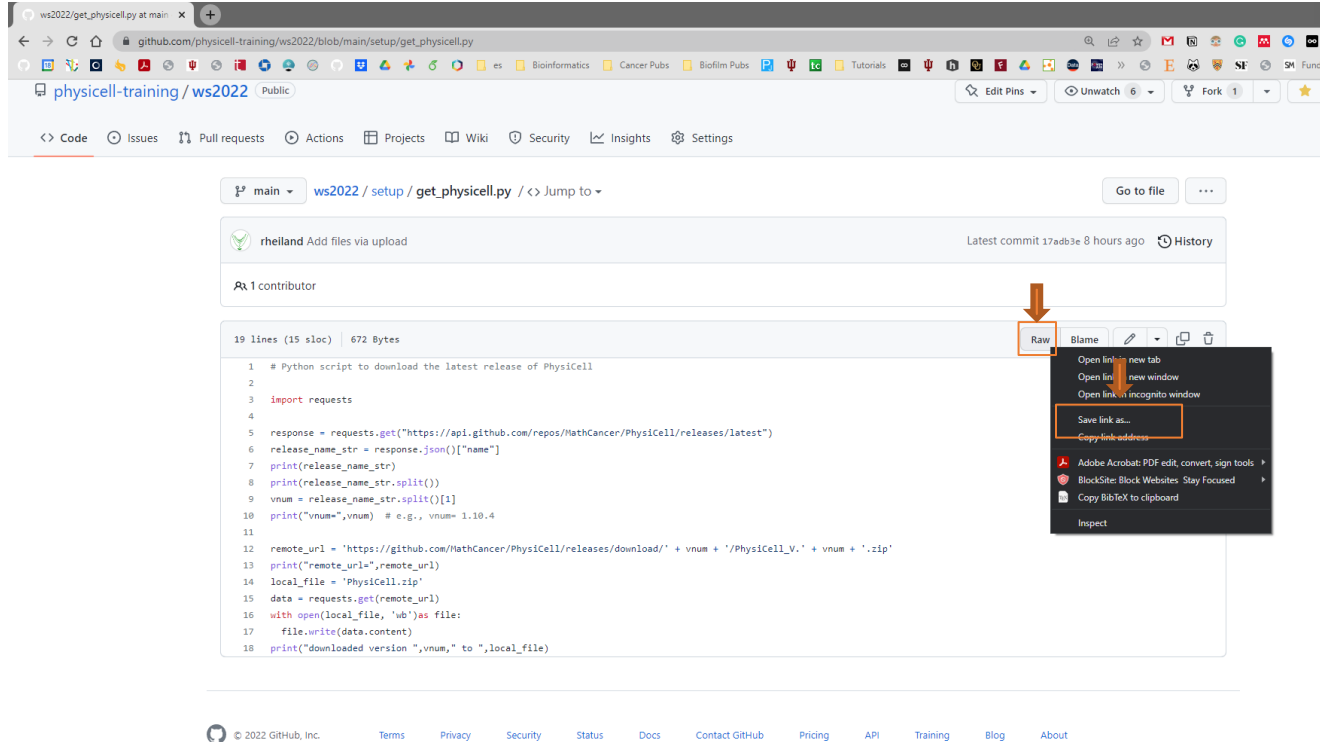
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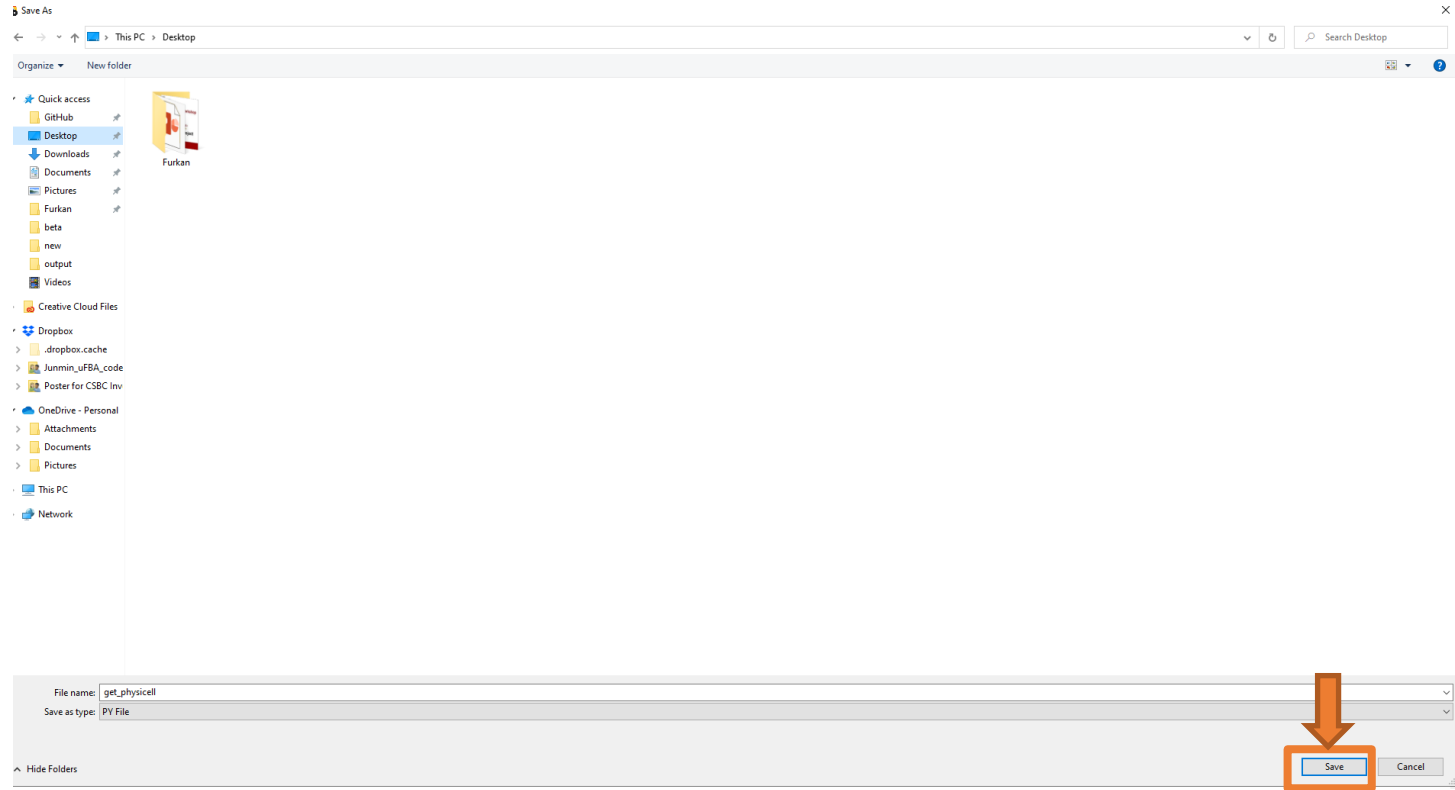
PhysiCell.org

 **@PhysiCell**

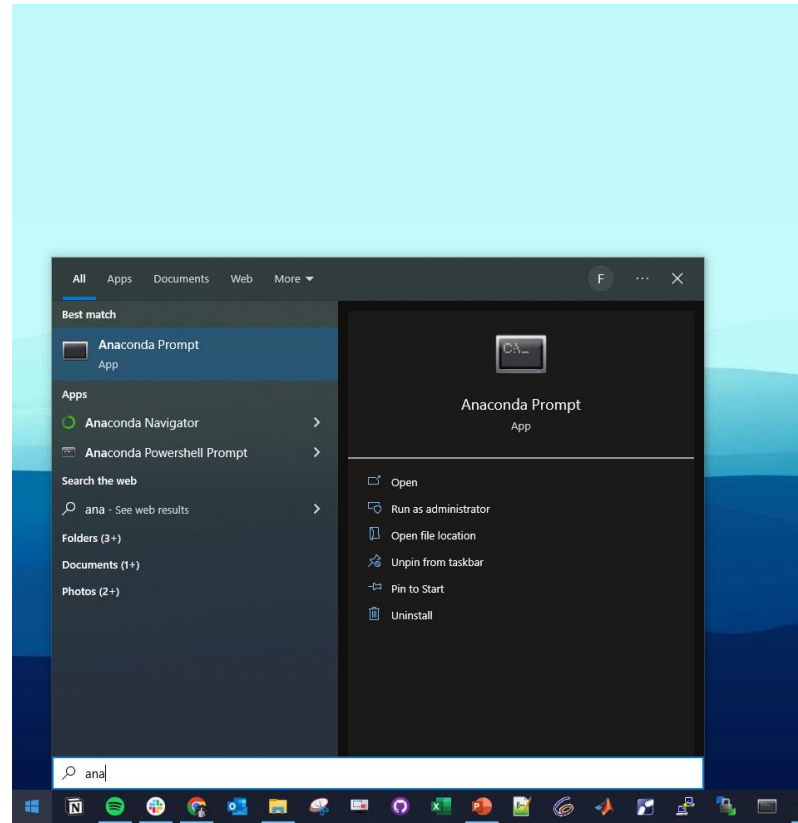
- Right click on “Raw” and “Save link as...”



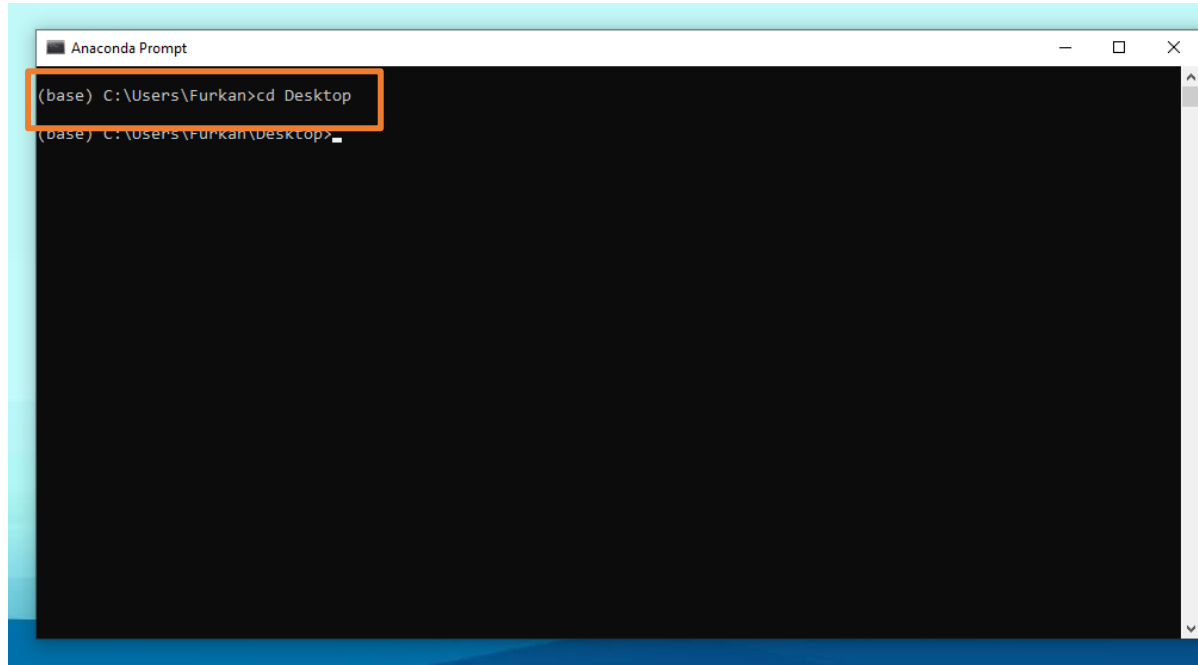
- Save to desired path



- Open Anaconda Prompt



- Change Directory to where it is downloaded
“cd” is used to change directory.

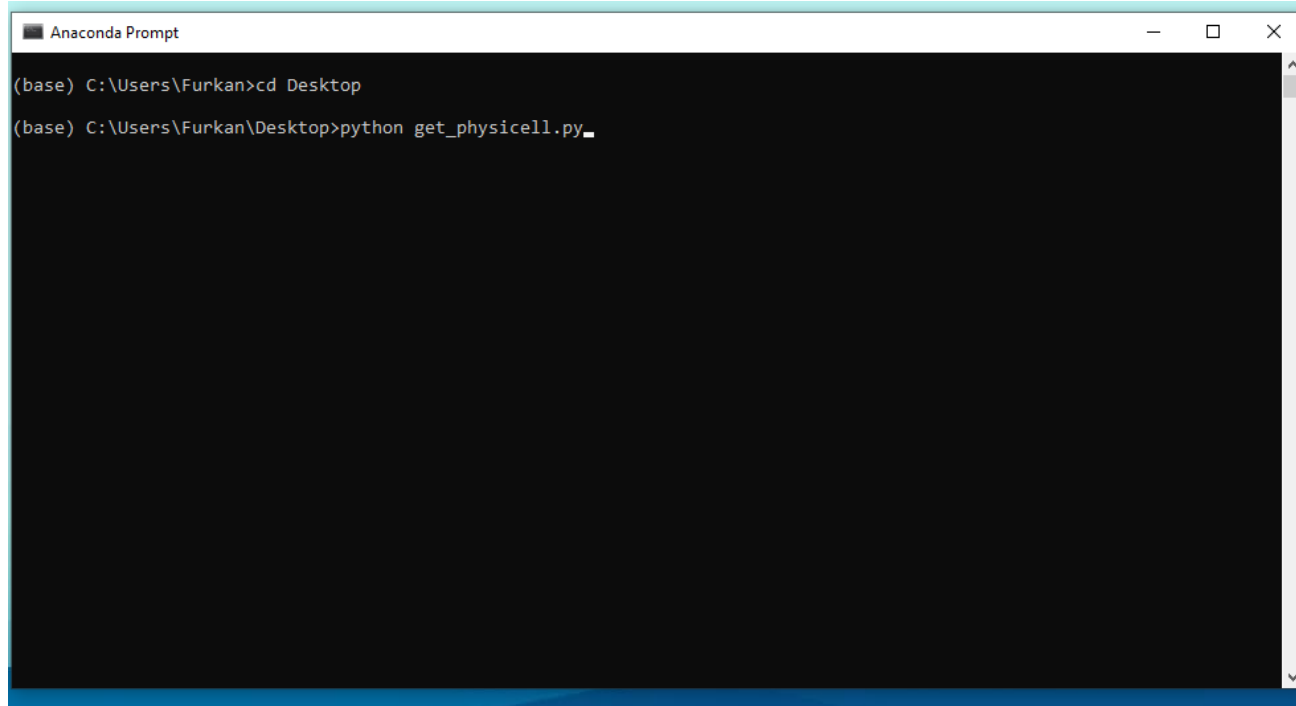


The image shows a screenshot of an Anaconda Prompt window. The window title is "Anaconda Prompt". The command prompt shows the current directory as "C:\Users\Furkan" and the command "cd Desktop" has been entered. The prompt is highlighted with an orange box.

```
(base) C:\Users\Furkan>cd Desktop  
(base) C:\Users\Furkan\Desktop>
```

- Execute following command and press enter

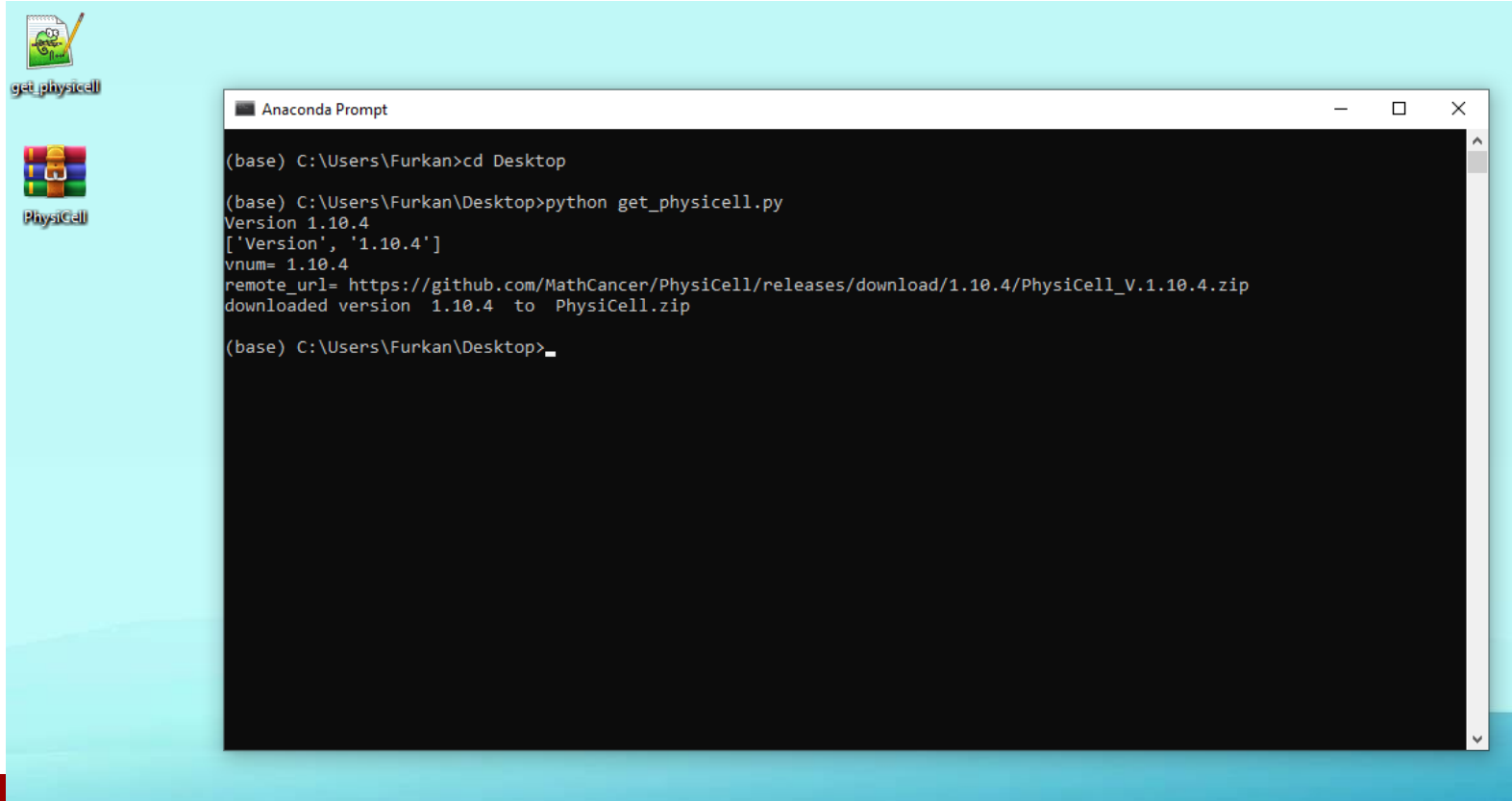
```
python get_physicell.py
```



The image shows a screenshot of an Anaconda Prompt window. The window has a title bar that says "Anaconda Prompt" and standard Windows window controls (minimize, maximize, close). The command prompt shows the following sequence of commands and the current prompt:

```
(base) C:\Users\Furkan>cd Desktop  
(base) C:\Users\Furkan\Desktop>python get_physicell.py_
```

- It should download the latest version

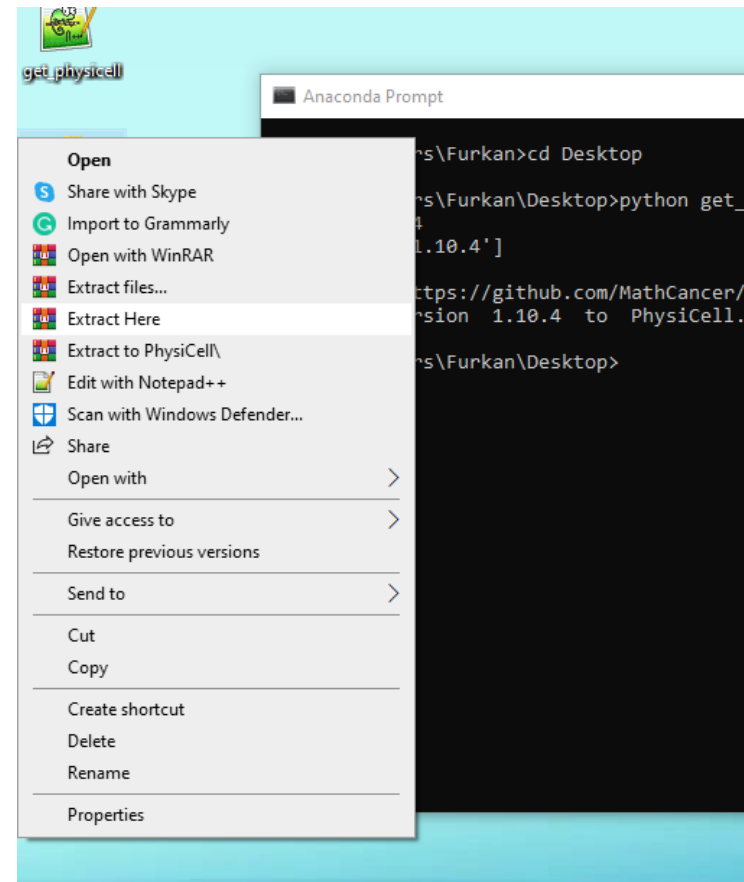


```
(base) C:\Users\Furkan>cd Desktop

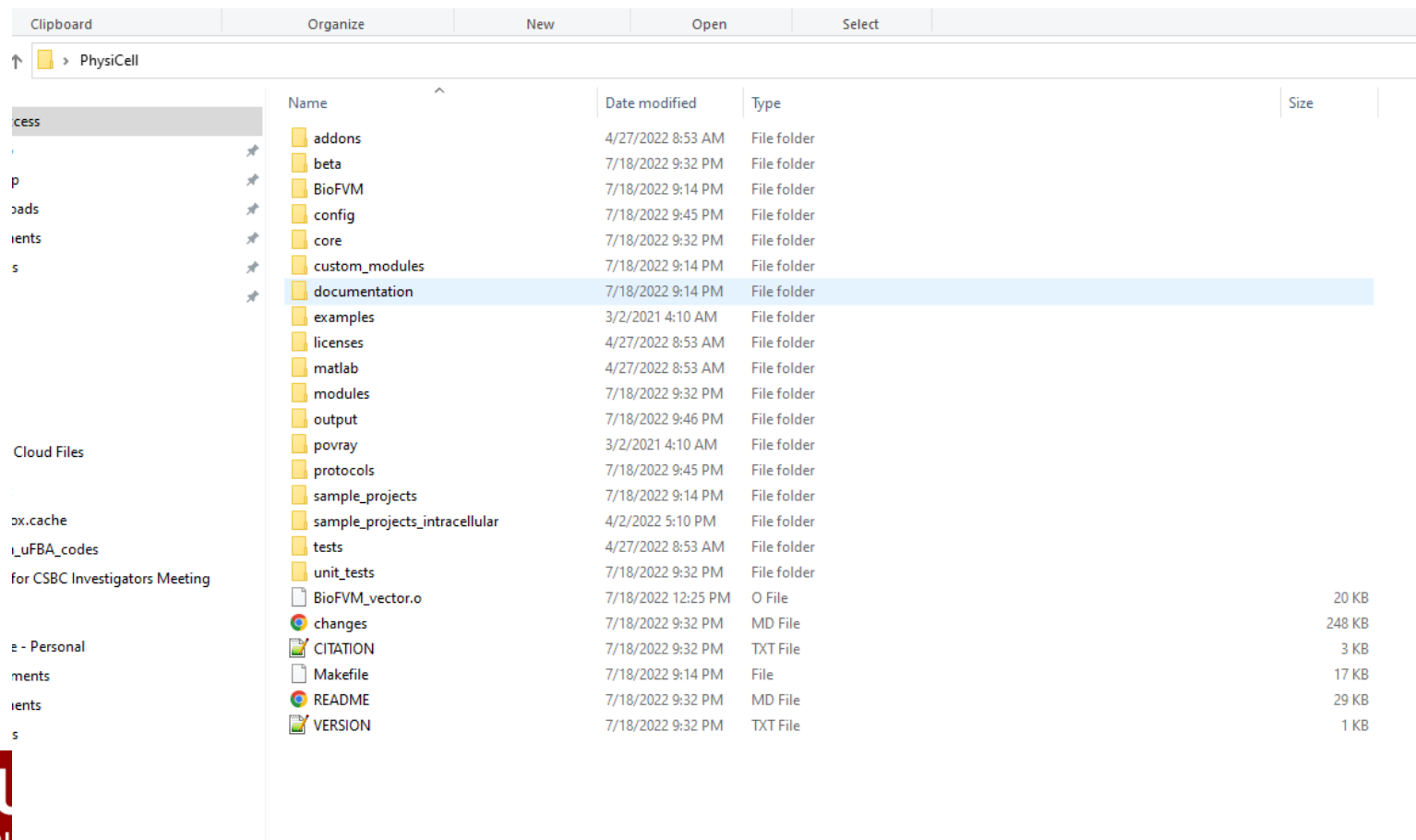
(base) C:\Users\Furkan\Desktop>python get_physicell.py
Version 1.10.4
['Version', '1.10.4']
vnum= 1.10.4
remote_url= https://github.com/MathCancer/PhysiCell/releases/download/1.10.4/PhysiCell_V.1.10.4.zip
downloaded version 1.10.4 to PhysiCell.zip

(base) C:\Users\Furkan\Desktop>_
```


- Extract the PhysiCell from zip file



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



The screenshot shows a Windows File Explorer window with the address bar set to 'PhysiCell'. The left sidebar shows the navigation pane with 'PhysiCell' selected. The main pane displays a list of files and folders. The 'documentation' folder is highlighted in blue.

Name	Date modified	Type	Size
addons	4/27/2022 8:53 AM	File folder	
beta	7/18/2022 9:32 PM	File folder	
BioFVM	7/18/2022 9:14 PM	File folder	
config	7/18/2022 9:45 PM	File folder	
core	7/18/2022 9:32 PM	File folder	
custom_modules	7/18/2022 9:14 PM	File folder	
documentation	7/18/2022 9:14 PM	File folder	
examples	3/2/2021 4:10 AM	File folder	
licenses	4/27/2022 8:53 AM	File folder	
matlab	4/27/2022 8:53 AM	File folder	
modules	7/18/2022 9:32 PM	File folder	
output	7/18/2022 9:46 PM	File folder	
povray	3/2/2021 4:10 AM	File folder	
protocols	7/18/2022 9:45 PM	File folder	
sample_projects	7/18/2022 9:14 PM	File folder	
sample_projects_intracellular	4/2/2022 5:10 PM	File folder	
tests	4/27/2022 8:53 AM	File folder	
unit_tests	7/18/2022 9:32 PM	File folder	
BioFVM_vector.o	7/18/2022 12:25 PM	O File	20 KB
changes	7/18/2022 9:32 PM	MD File	248 KB
CITATION	7/18/2022 9:32 PM	TXT File	3 KB
Makefile	7/18/2022 9:14 PM	File	17 KB
README	7/18/2022 9:32 PM	MD File	29 KB
VERSION	7/18/2022 9:32 PM	TXT File	1 KB

MSYS2 Installation



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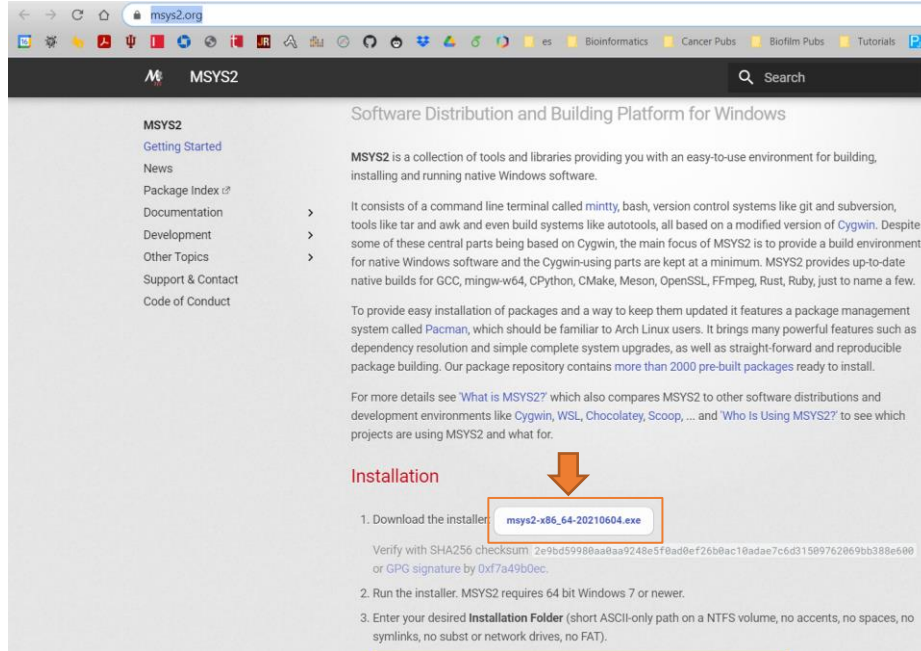
PhysiCell.org

 **@PhysiCell**

MSYS 2

- Please proceed following link:

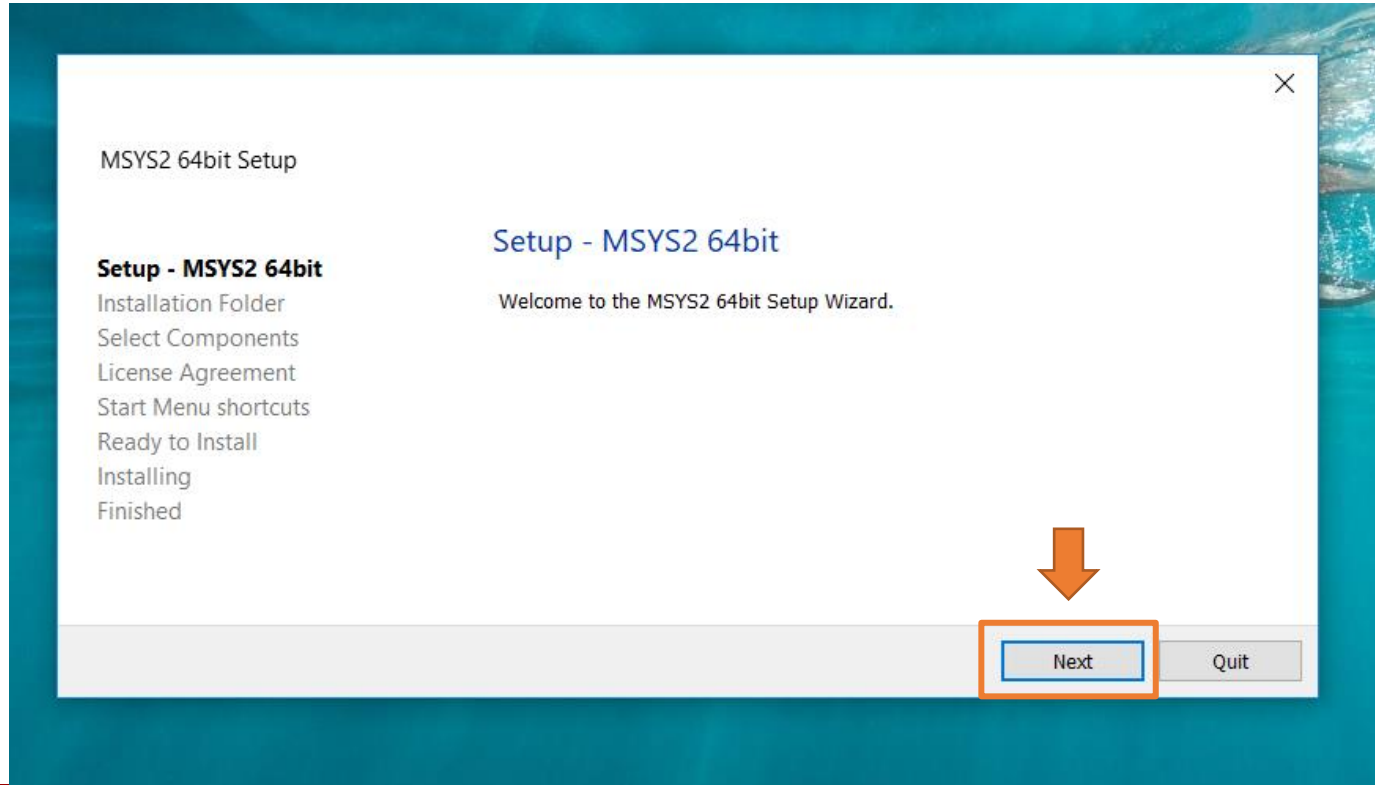
<https://www.msys2.org/>



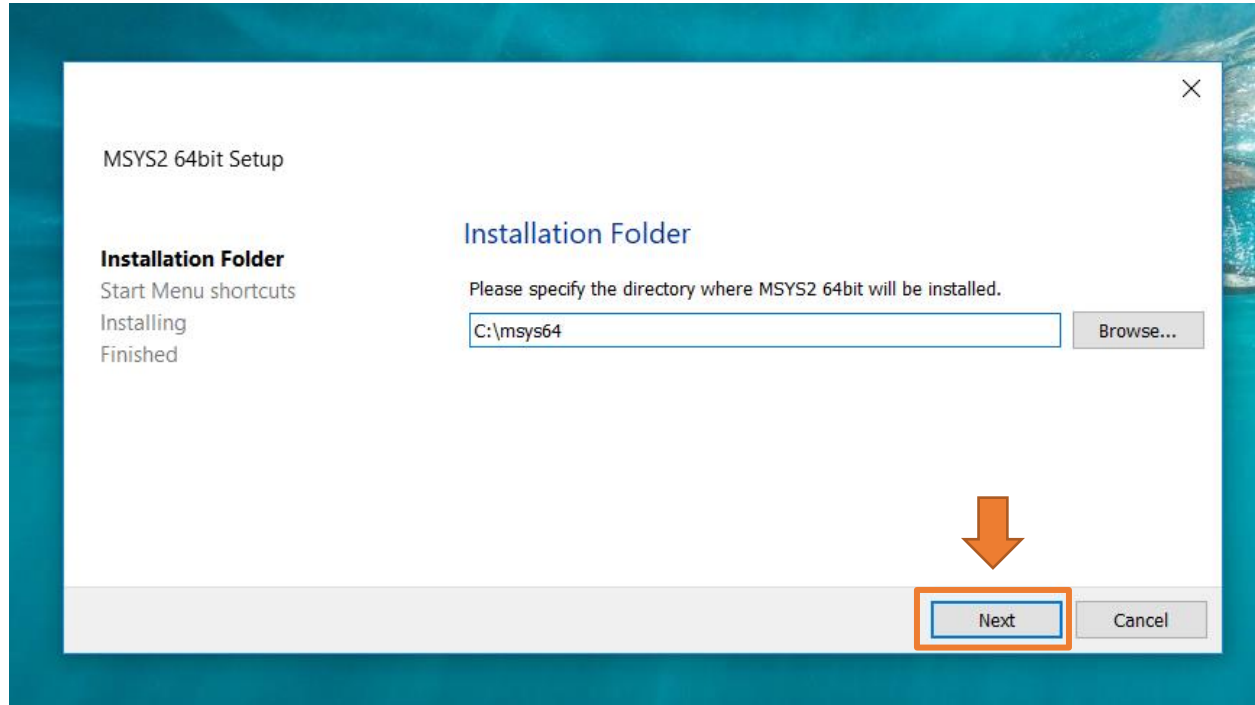
The screenshot shows the msys2.org website. The left sidebar contains links: MSYS2, Getting Started, News, Package Index, Documentation, Development, Other Topics, Support & Contact, and Code of Conduct. The main content area is titled "Software Distribution and Building Platform for Windows". It describes 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 mentions that it provides up-to-date native builds for GCC, mingw-w64, CPython, CMake, Meson, OpenSSL, FFmpeg, Rust, Ruby, just to name a few. Below this, it says "Installation" and lists three steps: 1. Download the installer (with a link to msys2-x86_64-20210604.exe), 2. Run the installer, and 3. Enter your desired Installation Folder. An orange arrow points to the installer link in step 1.

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

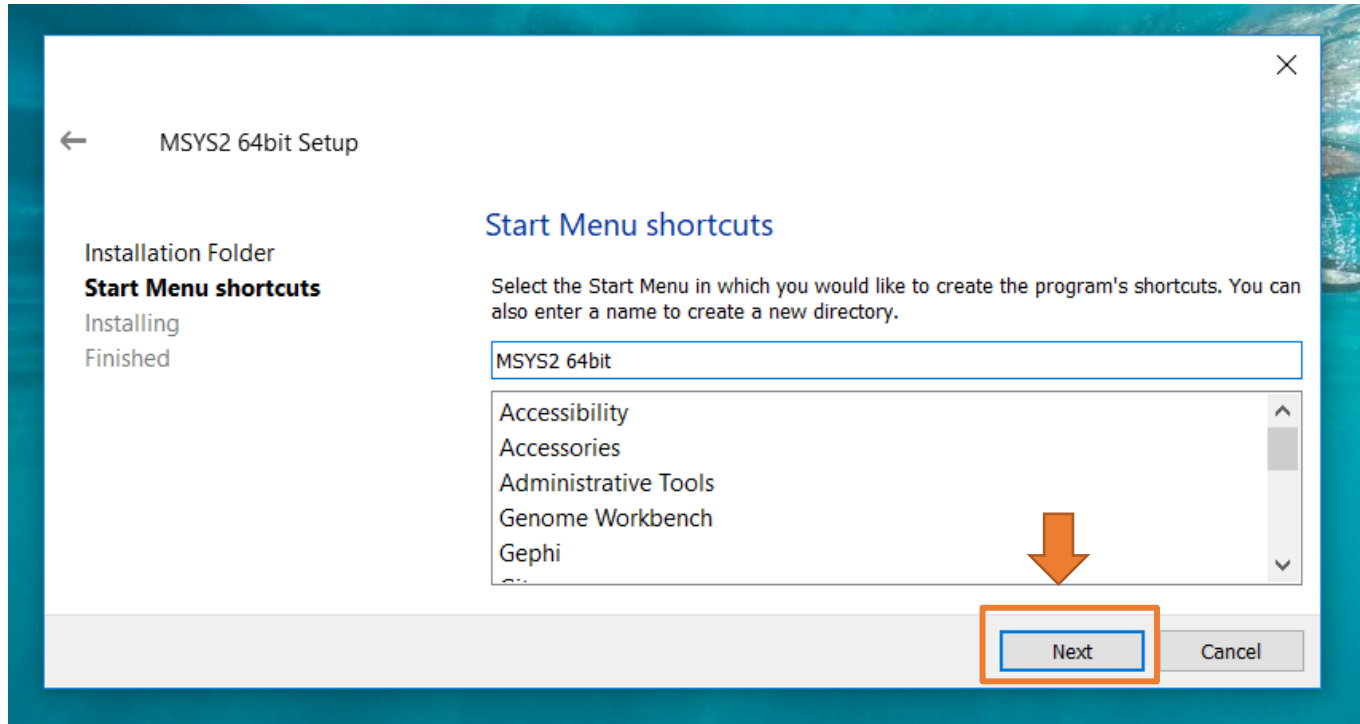
MSYS 2



MSYS 2



MSYS 2



LUDDY

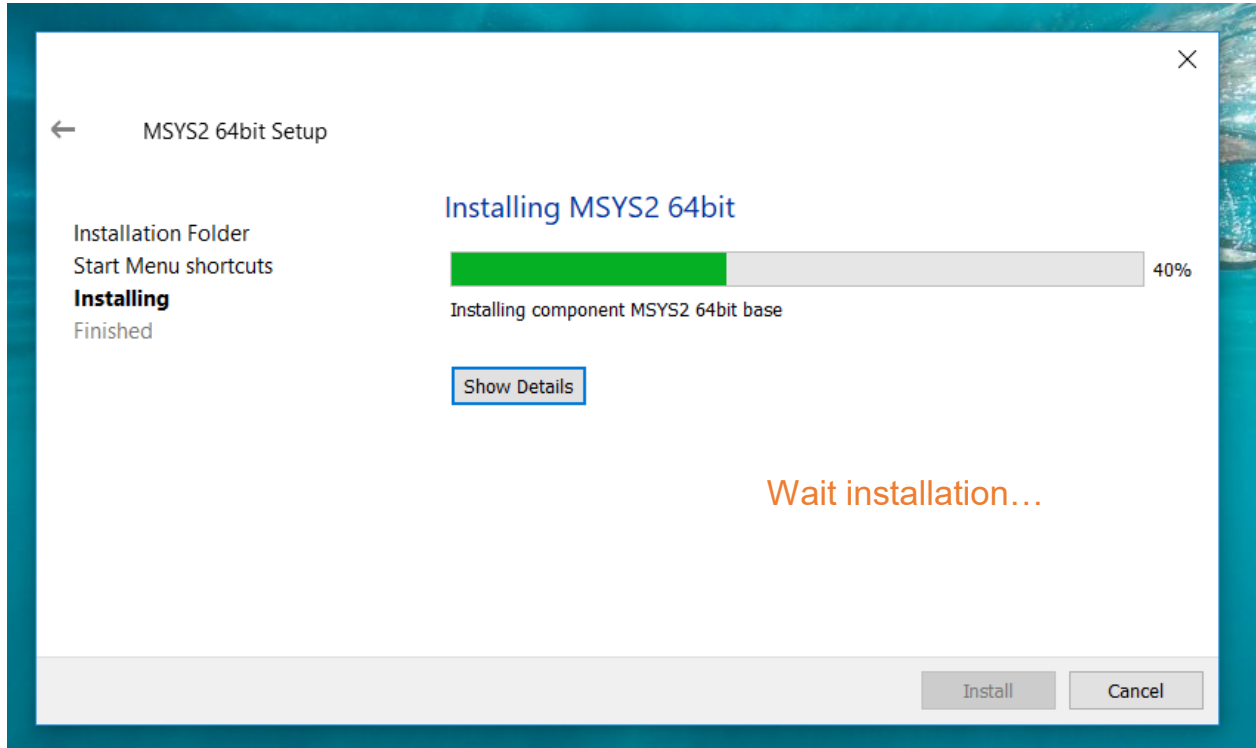
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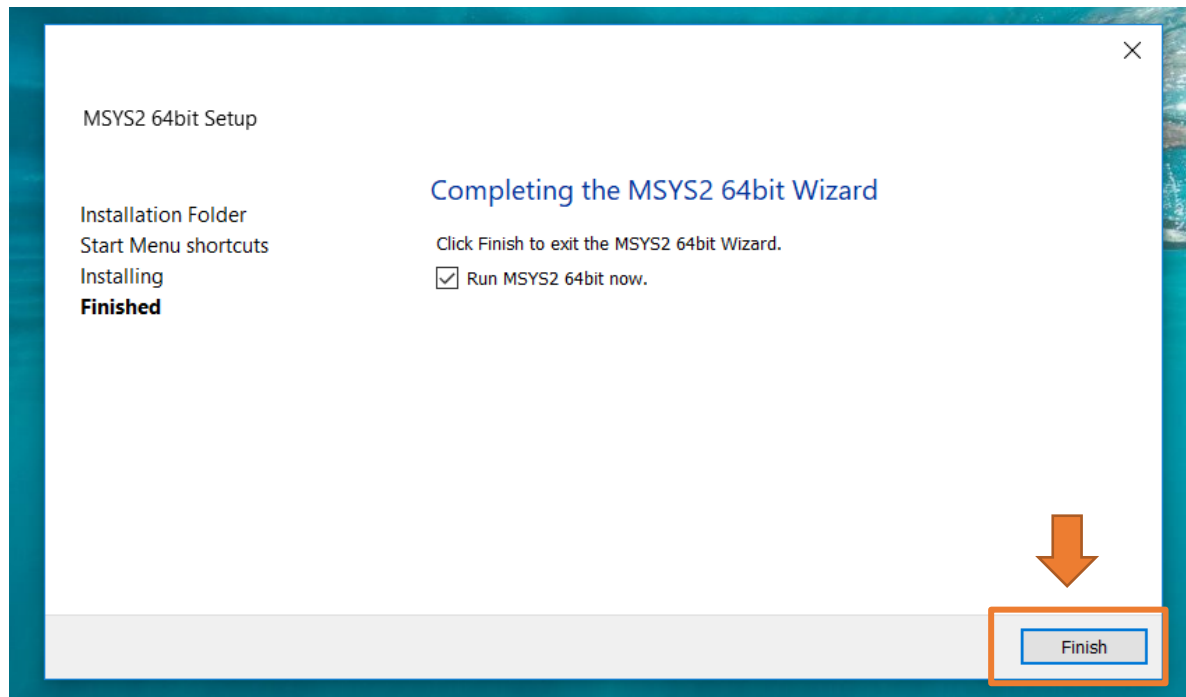
PhysiCell.org

@PhysiCell

MSYS 2



MSYS 2

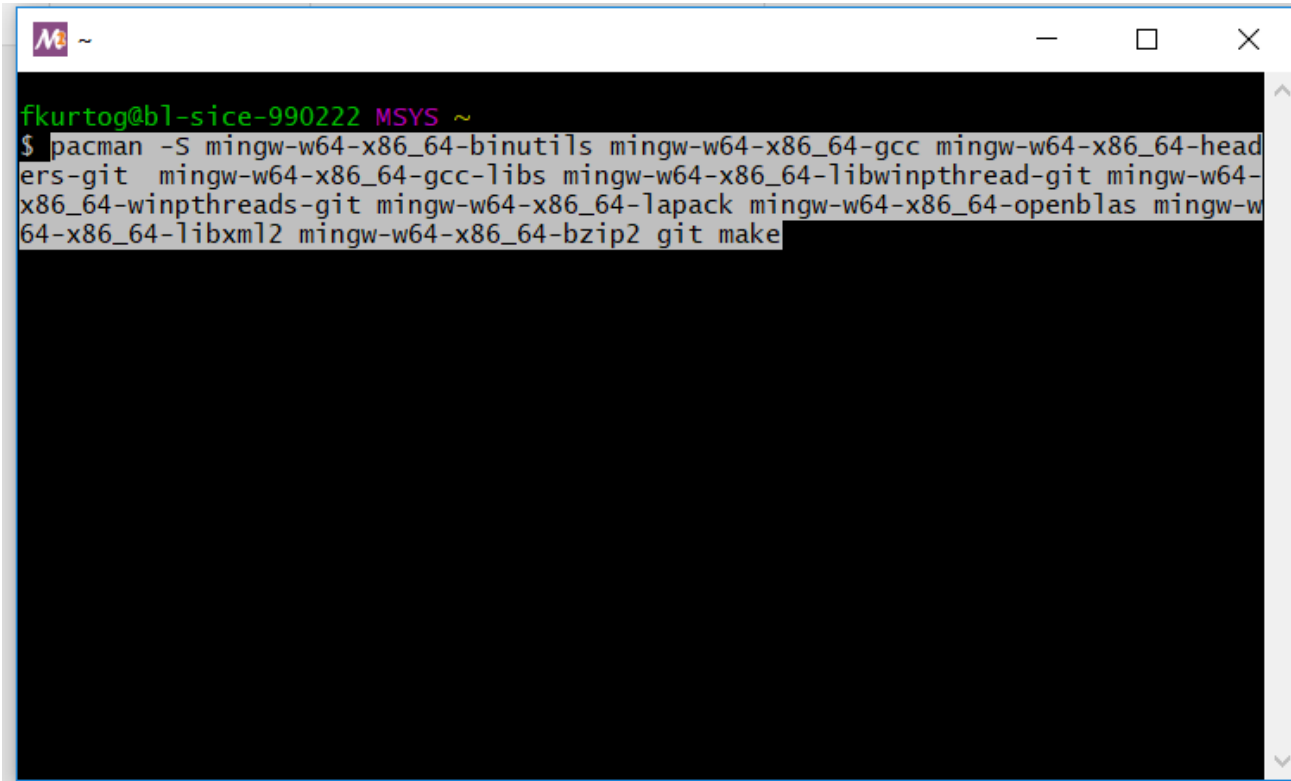


MSYS 2

- 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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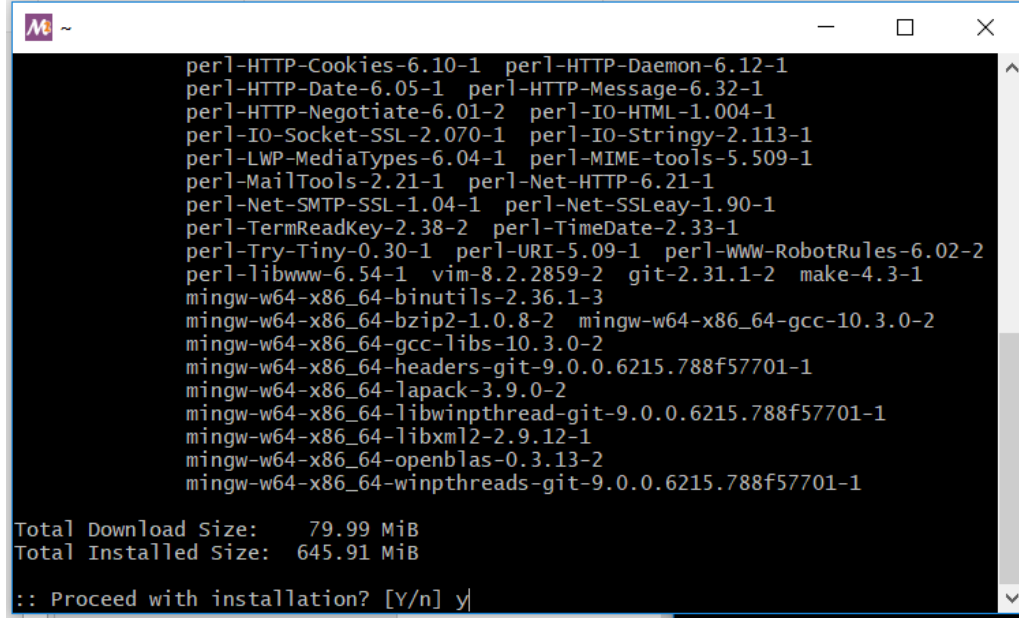
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MSYS 2

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



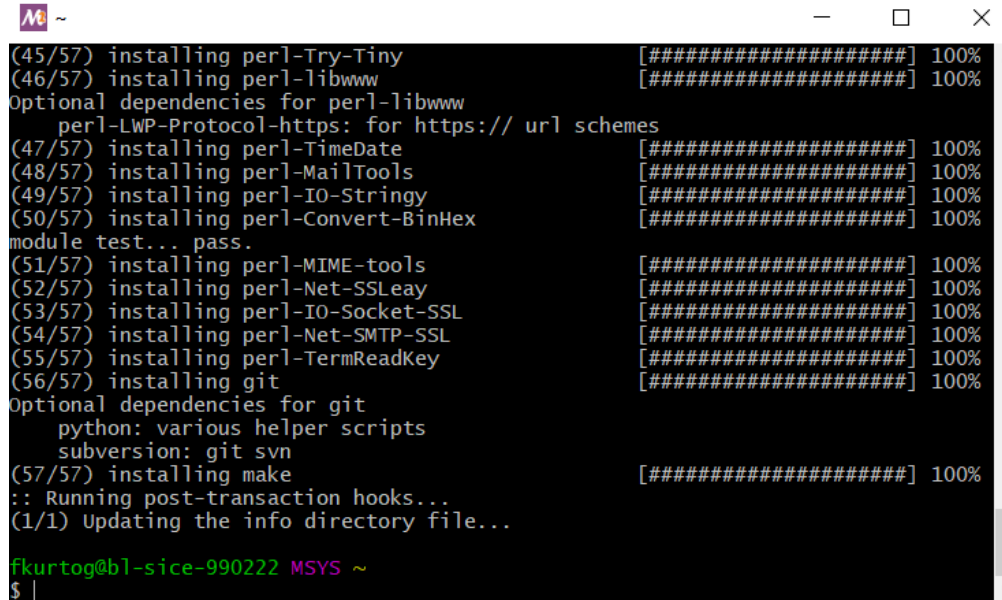
```
perl-HTTP-Cookies-6.10-1 perl-HTTP-Daemon-6.12-1
perl-HTTP-Date-6.05-1 perl-HTTP-Message-6.32-1
perl-HTTP-Negotiate-6.01-2 perl-IO-HTML-1.004-1
perl-IO-Socket-SSL-2.070-1 perl-IO-Stringy-2.113-1
perl-LWP-MediaTypes-6.04-1 perl-MIME-tools-5.509-1
perl-MailTools-2.21-1 perl-Net-HTTP-6.21-1
perl-Net-SMTP-SSL-1.04-1 perl-Net-SSLey-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 (~), 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 a percentage completion (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 Path



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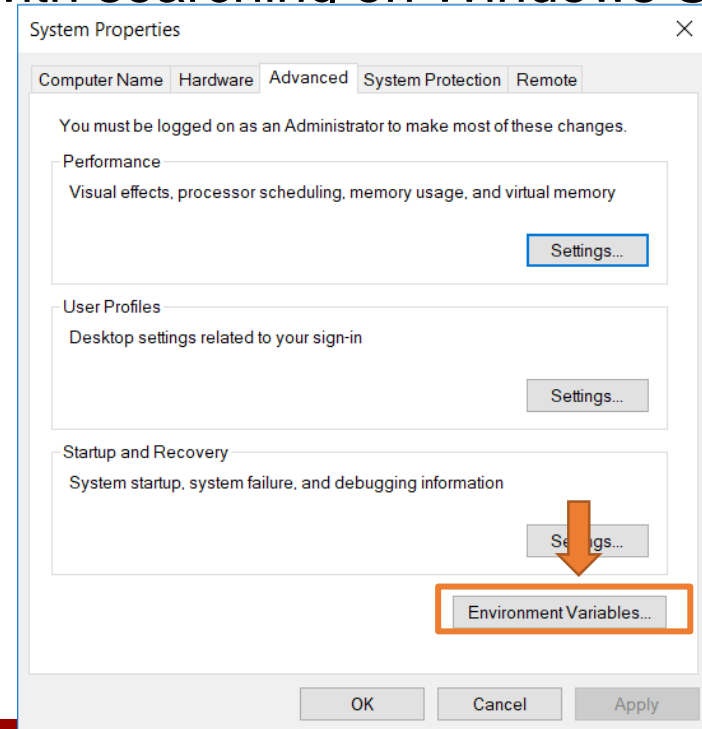
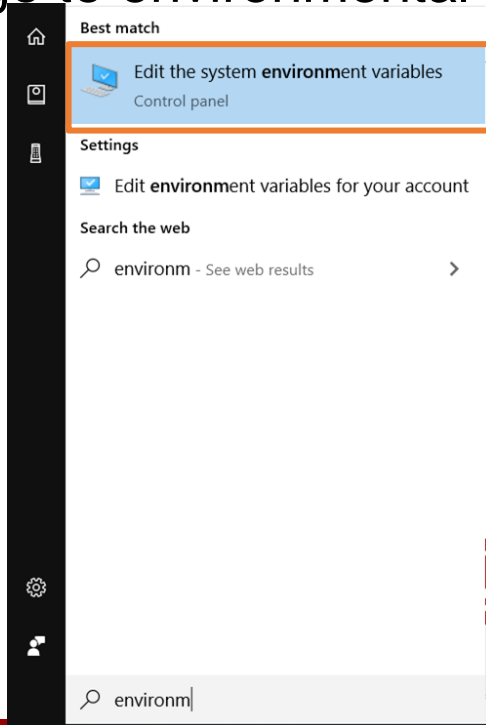
PhysiCell Project

PhysiCell.org

 **@PhysiCell**

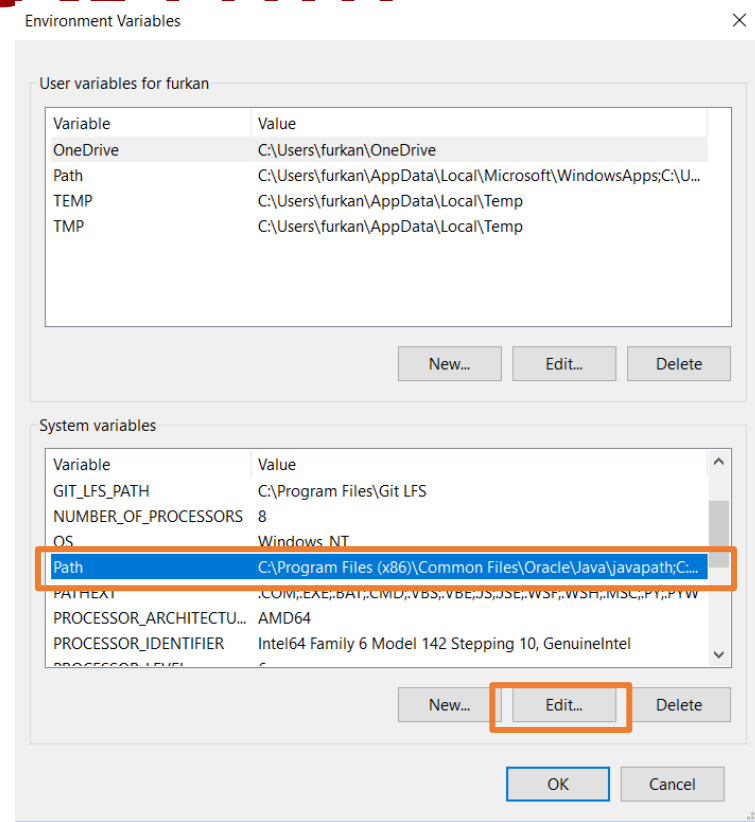
Adding directories to PATH

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



Adding directories to PATH

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



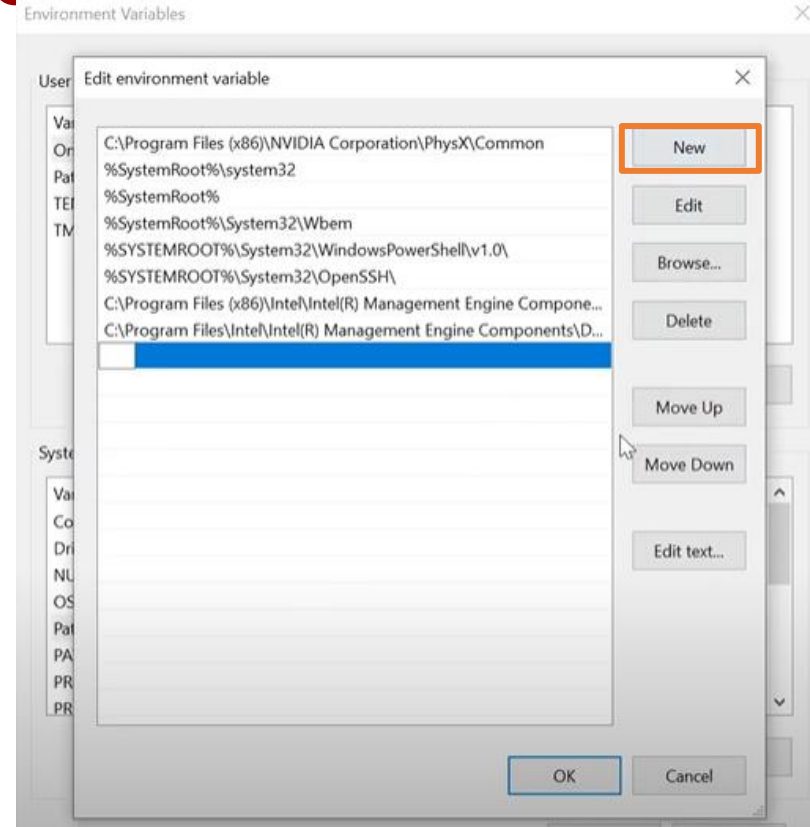
Adding directories to PATH

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

C:\msys64\mingw64\bin

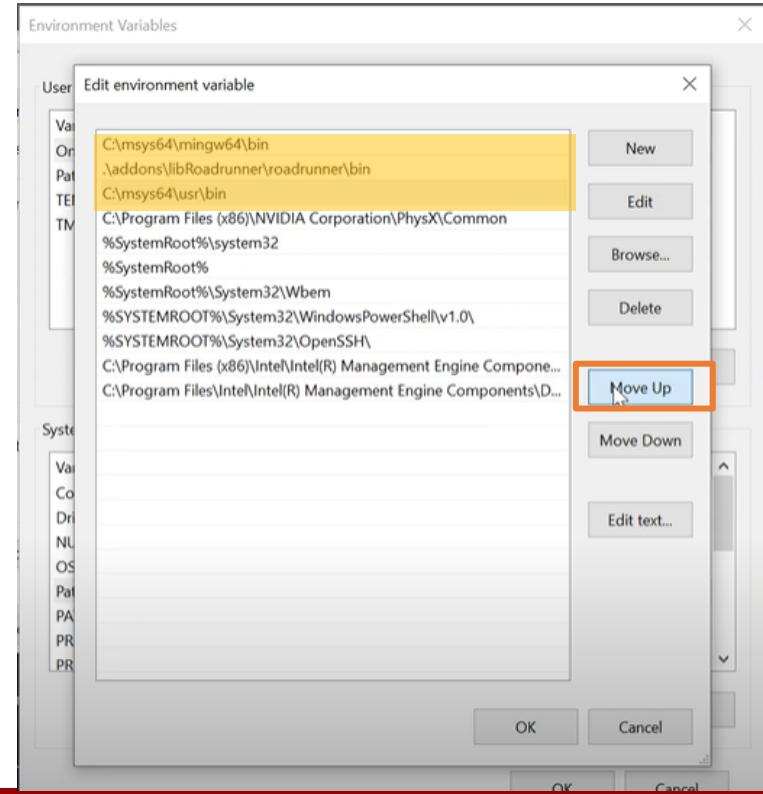
C:\msys64\usr\bin

.\addons\libRoadrunner\roadrunner\bin



Adding directories to PATH

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



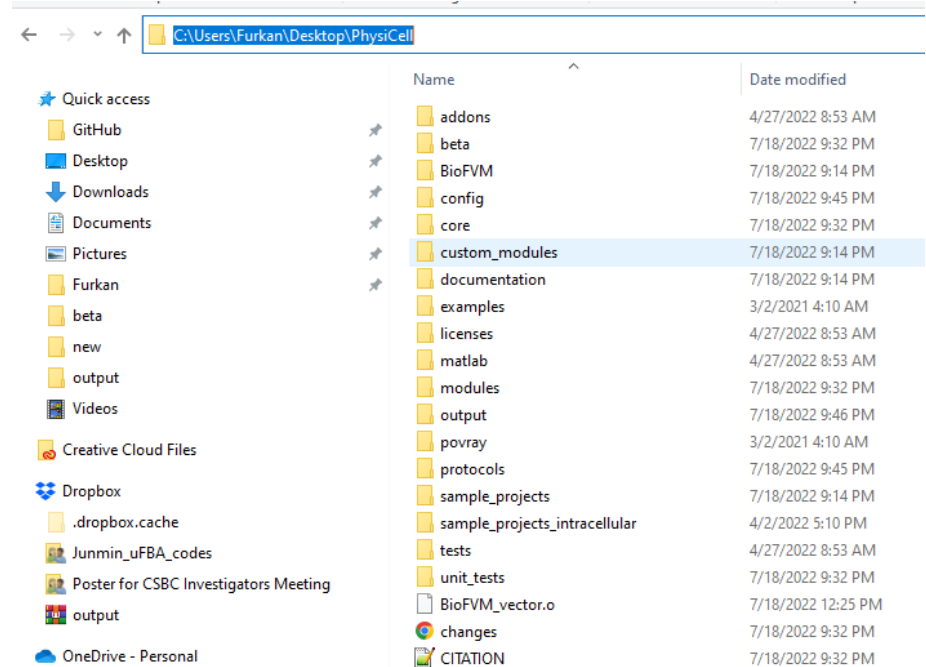
Test Module : “biorobots”

- At this moment PhysiCell is ready to work. Let's try “biorobots”, first.
- Open Anaconda Prompt



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.

Anaconda Prompt

```
(base) C:\Users\Furkan>cd C:\Users\Furkan\Desktop\PhysiCell_
```



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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...

Anaconda Prompt

```
receptor: 1 dimensionless
custom vector data:
NOTE: custom vector data will eventually be merged with custom data
Placing cells ...
  Placing 15 director cells ...
  Placing cargo cells ...
  Placing worker cells ...
done!
Using PhysiCell version 1.10.4
  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: 489
interval wall time: 0 days, 0 hours, 0 minutes, and 0.0020732 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.0031691 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: 489
interval wall time: 0 days, 0 hours, 0 minutes, and 0.122883 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.126509 seconds

^C
(base) C:\Users\Furkan\Desktop\PhysiCell>biorobots.exe_
```



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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)

```
Anaconda Prompt
3) 0
4) 0
5) 0
6) 0
7) 0.000166667
Using PhysiCell version 1.10.4
    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: 1440 min)
total agents: 144
interval wall time: 0 days, 0 hours, 0 minutes, and 0.0025547 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 0.0033957 seconds

Using method diffusion_decay_solver__constant_coefficients_LOD_2D (2D LOD with Th
current simulated time: 30 min (max: 1440 min)
total agents: 144
interval wall time: 0 days, 0 hours, 0 minutes, and 4.09297 seconds
total wall time: 0 days, 0 hours, 0 minutes, and 4.09683 seconds

----- start: librr_intracellular.cpp: start() called
----- start: doing: rrHandle = createRRInstance()
----- start: rrHandle = 0x19753616b50
```

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.

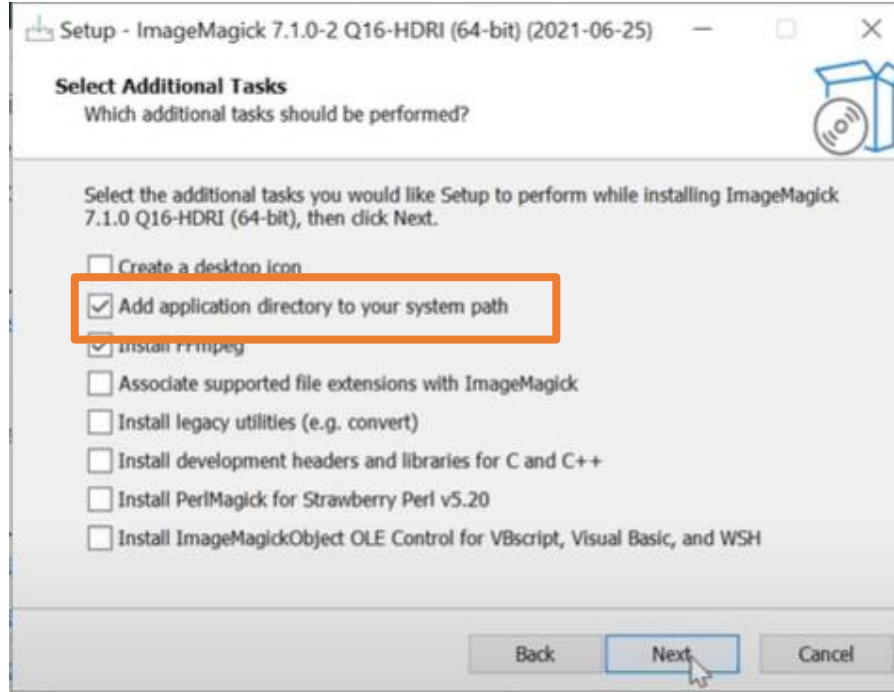
The Windows version of ImageMagick is self-installing. Simply click on the appropriate version below and it will launch itself and ask you a few installation questions. Versions with *Q8* in the name are 8 bits-per-pixel component (e.g. 8-bit red, 8-bit green, etc.), whereas, *Q16* in the filename are 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. The interface is divided into several sections with orange headers:

- Domain (micron):** Contains input fields for Xmin (-500), Xmax (500), Ymin (-500), Ymax (500), Zmin (-10), and Zmax (10). To the right are fields for dx (20), dy (20), and dz (20).
- ☐ Virtual walls
- Misc runtime parameters:** Contains fields for Max Time (7200 min), # threads (6), and output folder (output).
- Save data:** Includes checkboxes for SVG (checked) and Full (checked), with frequency fields set to every 60 min and 360 min respectively.
- Initial conditions of cells (x,y,z, type):** Includes a checkbox 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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PhysiCell Development:

- Breast Cancer Research Foundation
- Jayne Koskinas Ted Giovanis Foundation for Health and Policy
- National Cancer Institute (U01CA232137)
- National Science Foundation (1720625, 1818187)

Training Materials:

- Administrative supplement to NCI U01CA232137 (Year 2)

Other Funding:

- NCI / DOE / Frederick National Lab for Cancer Research (21X126F)
- DOD / Defense Threat Reduction Agency (HDTRA12110015)
- NIH Common Fund (3OT2OD026671-01S4)