

Slides, videos, links and more:

<https://github.com/physicell-training/ws2023>

Setting up PhysiCell on Windows

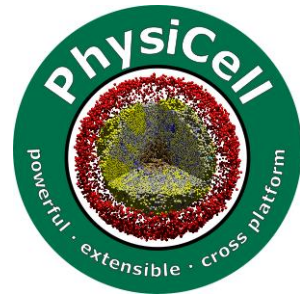


Furkan Kurtoglu

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

PhysiCell Project

July 2023



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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.

- Anaconda
- MSYS 2
- Adding them to path
- Test building “biorobots”

Minimum
setup

Studio
setup

Hackathon
setup +
additional
options

-
- Test building “ode-energy-sample”
 - PhysiCell Studio
 - ImageMagick

-
- pcDataLoader
 - COPASI
 - C++ code editor
 - Git and GitHub



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Anaconda Installation



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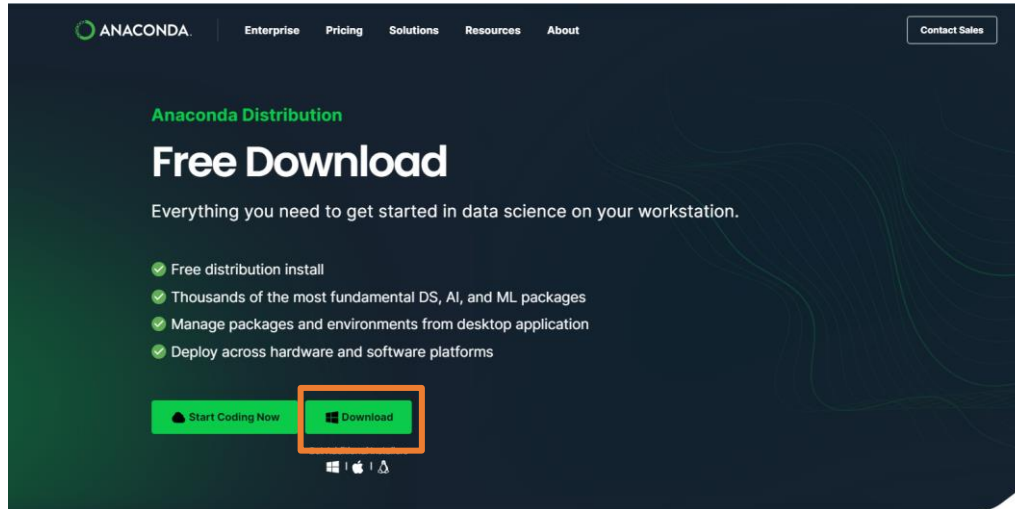
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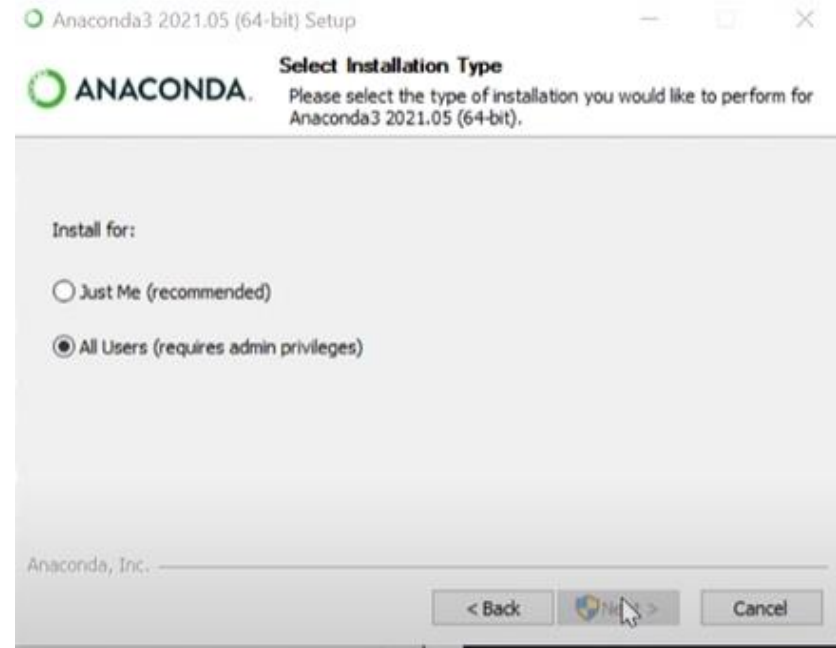
Anaconda

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



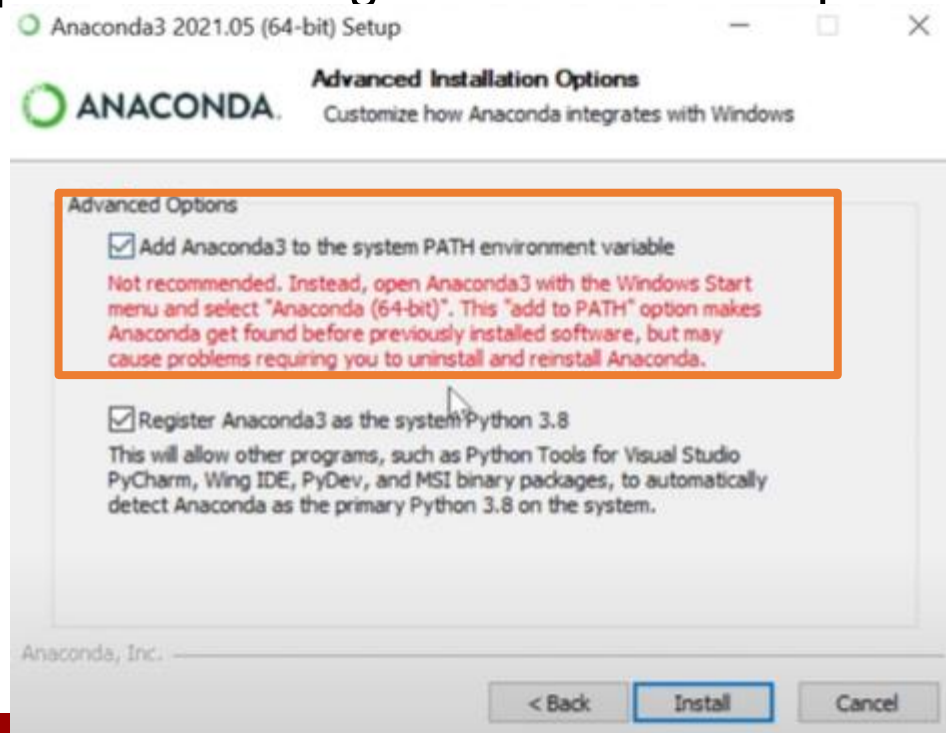
Anaconda

- 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)



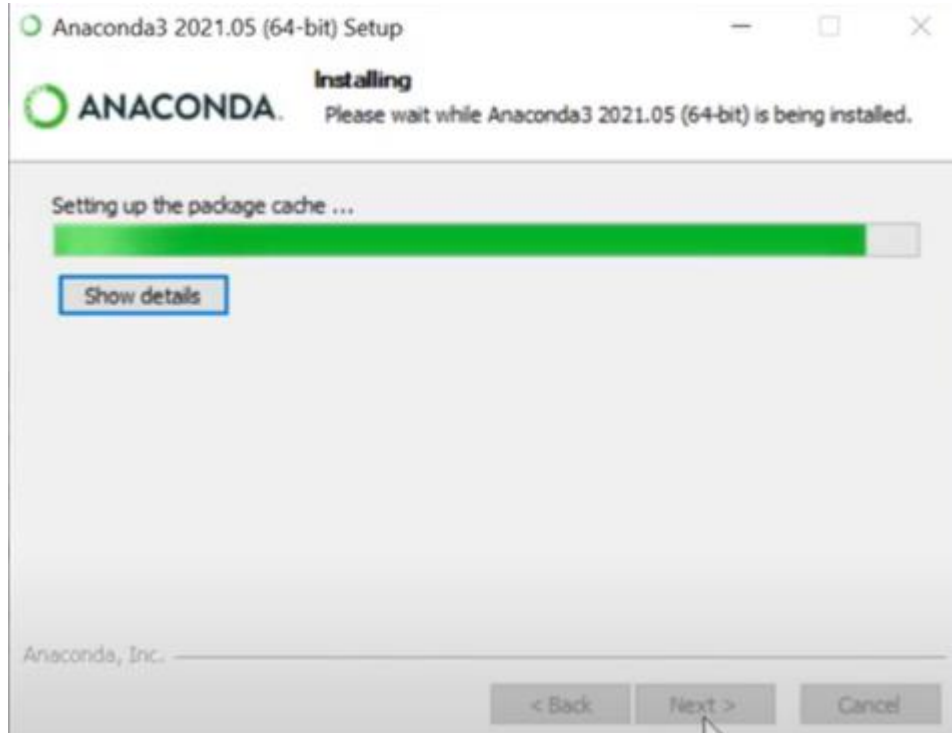
Anaconda

- Please select option for adding Anaconda to the path.



Anaconda

- Installation...



MSYS2 Installation



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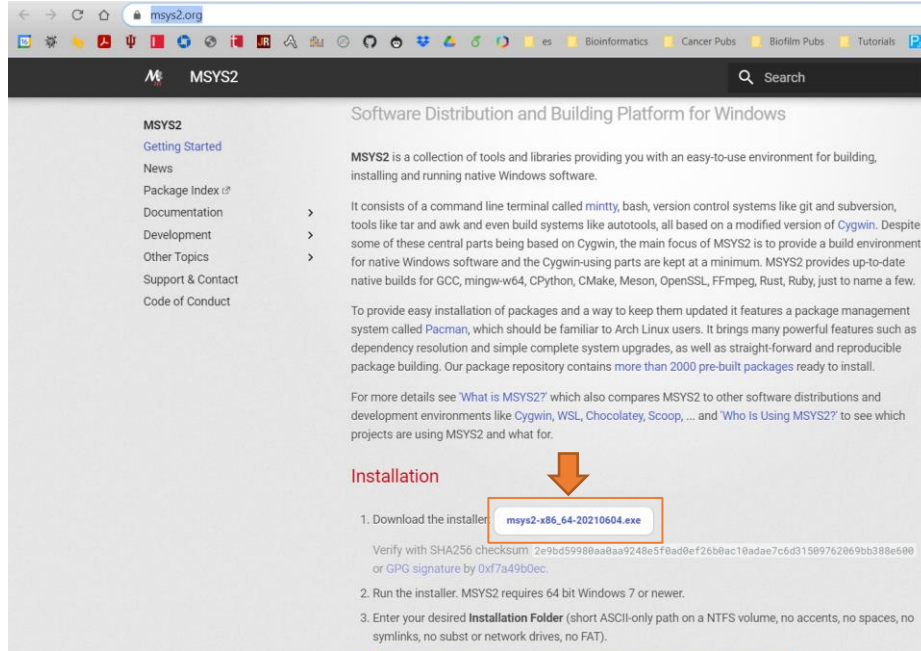
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MSYS 2

- Please proceed following link:

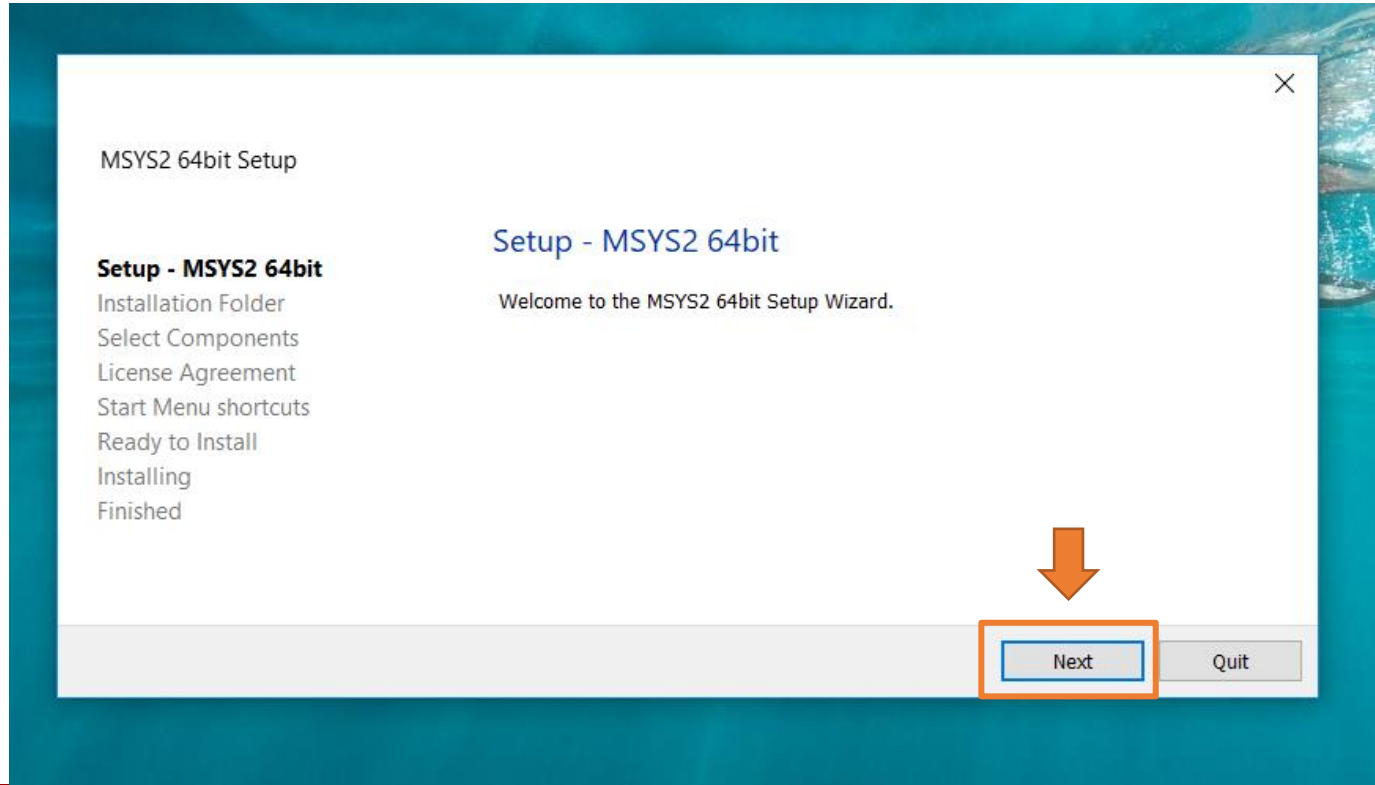
<https://www.msys2.org/>



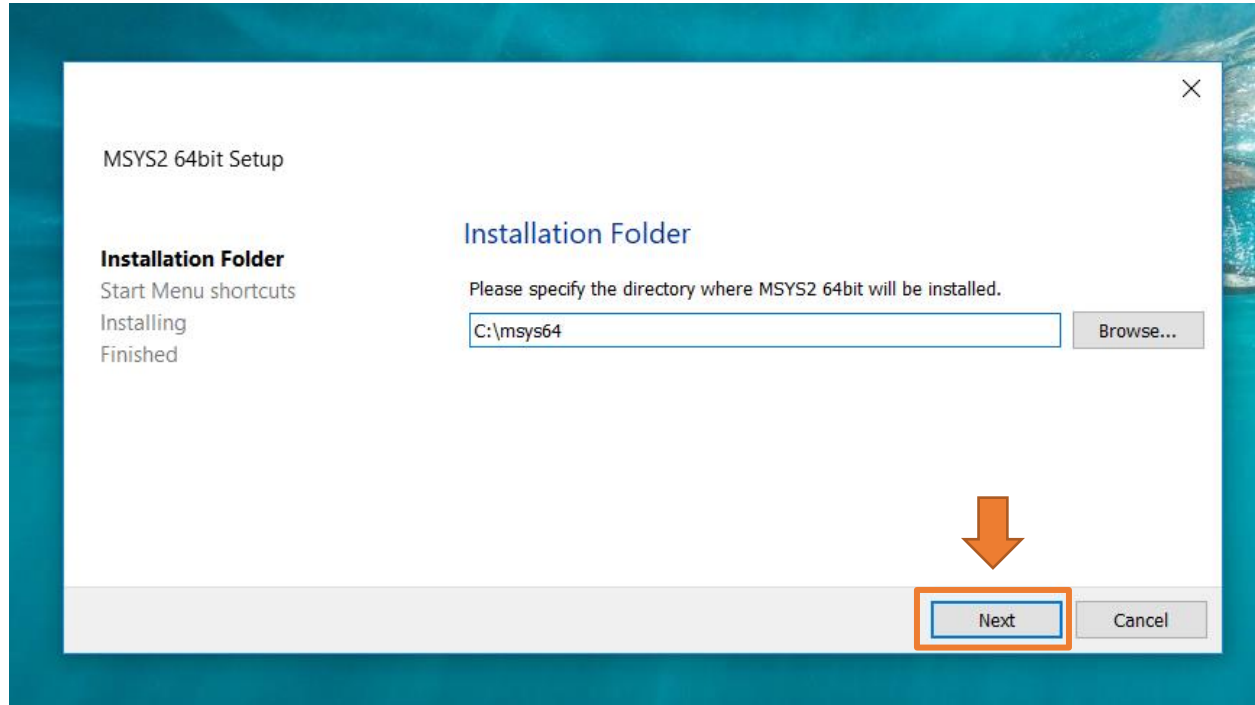
The screenshot shows the msys2.org website. The left sidebar contains a navigation menu with links: MSYS2, Getting Started, News, Package Index, Documentation, Development, Other Topics, Support & Contact, and Code of Conduct. The main content area is titled "Software Distribution and Building Platform 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 various build systems like autotools. It also notes that MSYS2 provides up-to-date native builds for GCC, mingw-w64, CPython, CMake, Meson, OpenSSL, FFmpeg, Rust, Ruby, etc. Below this, it mentions a package management system called Pacman. An orange arrow points down to the "Installation" section. Under "Installation", step 1 says "Download the installer" and shows a button labeled "msys2-x86_64-20210604.exe". Below the button, 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.

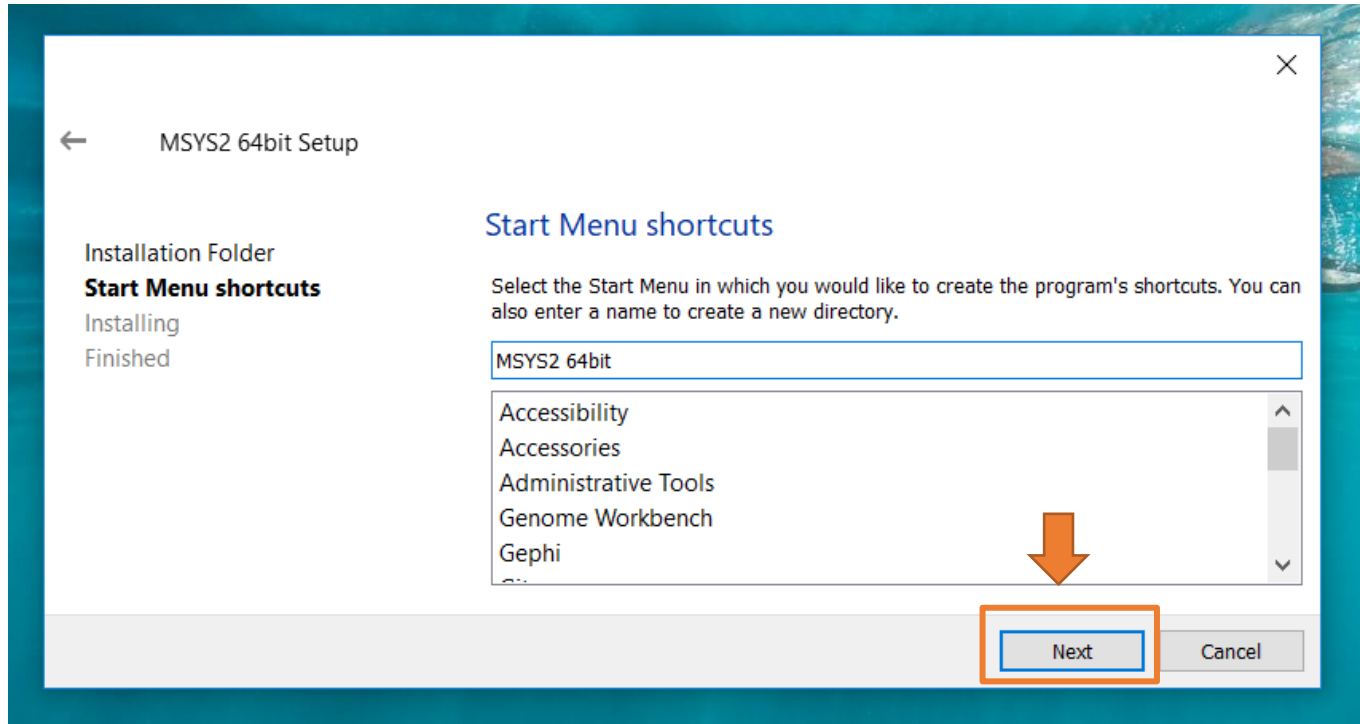
MSYS 2



MSYS 2



MSYS 2



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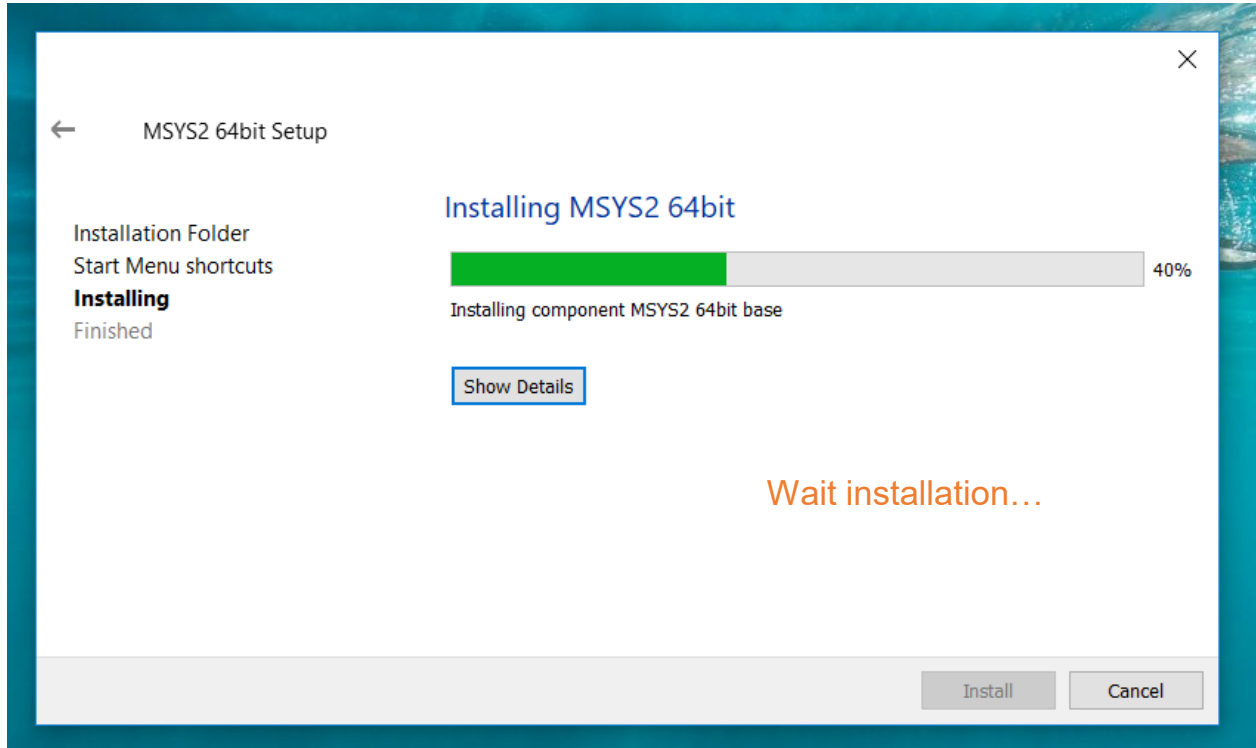
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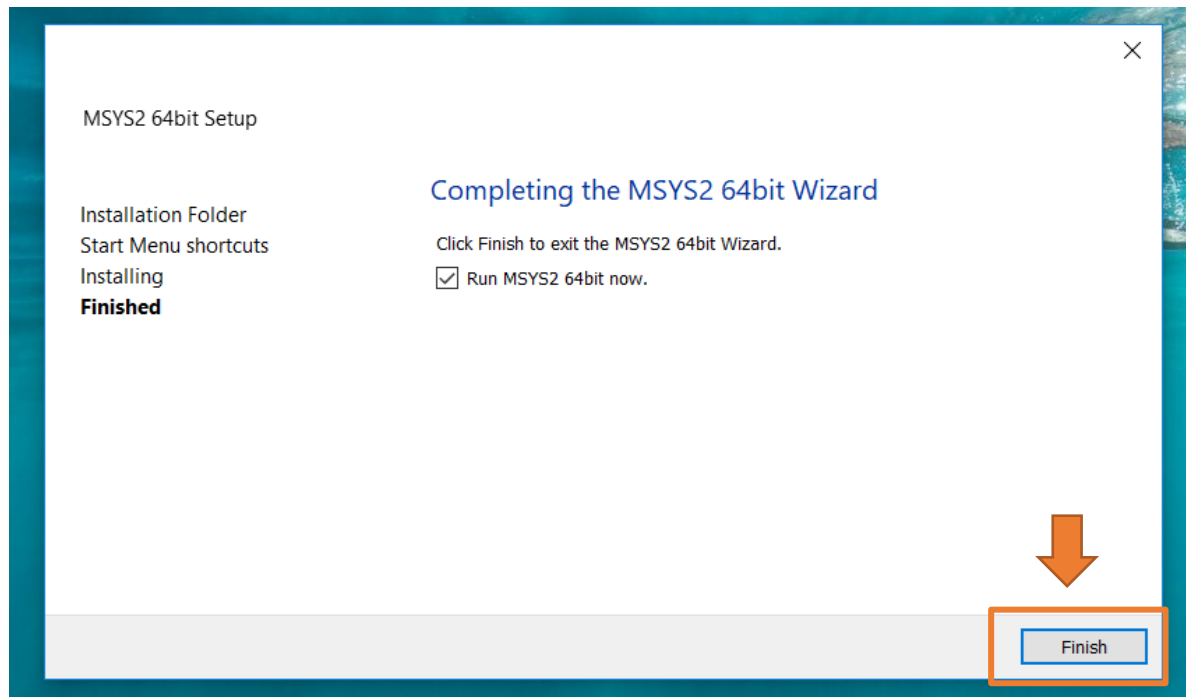
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MSYS 2



MSYS 2

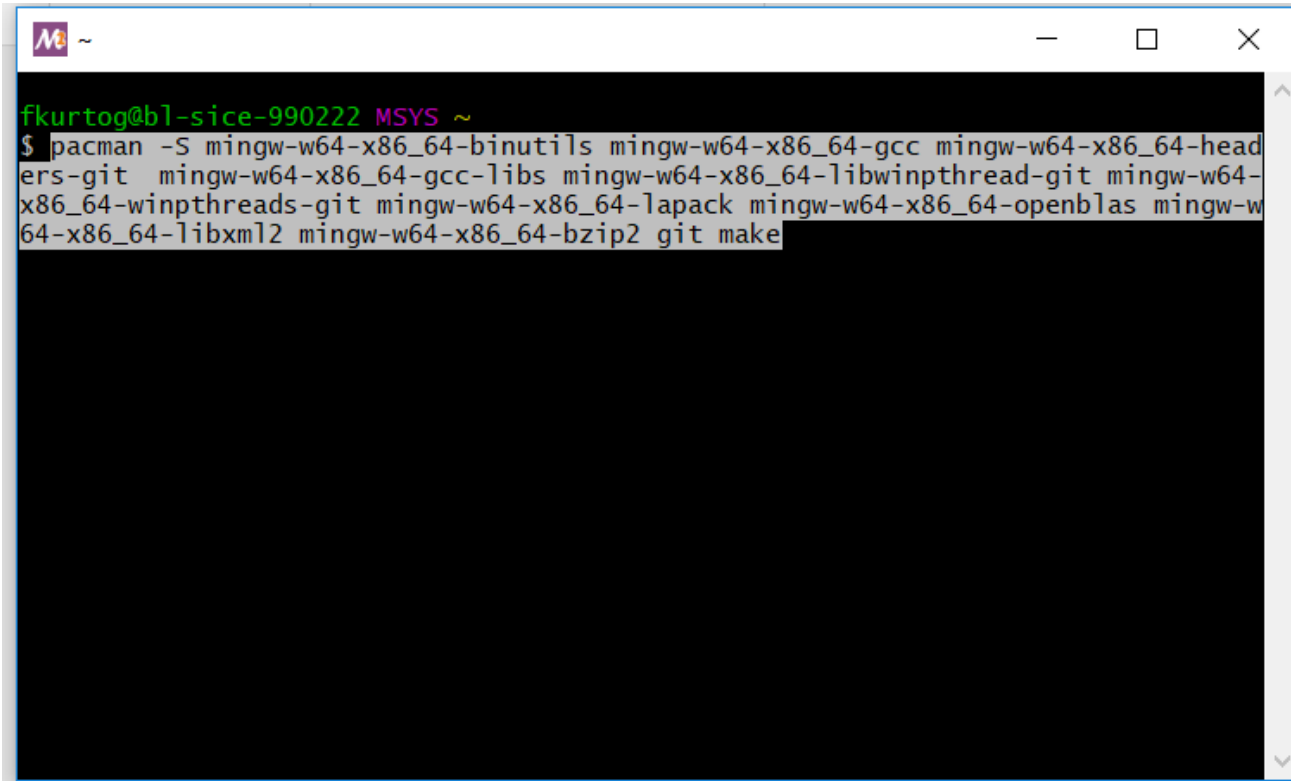


MSYS 2

- 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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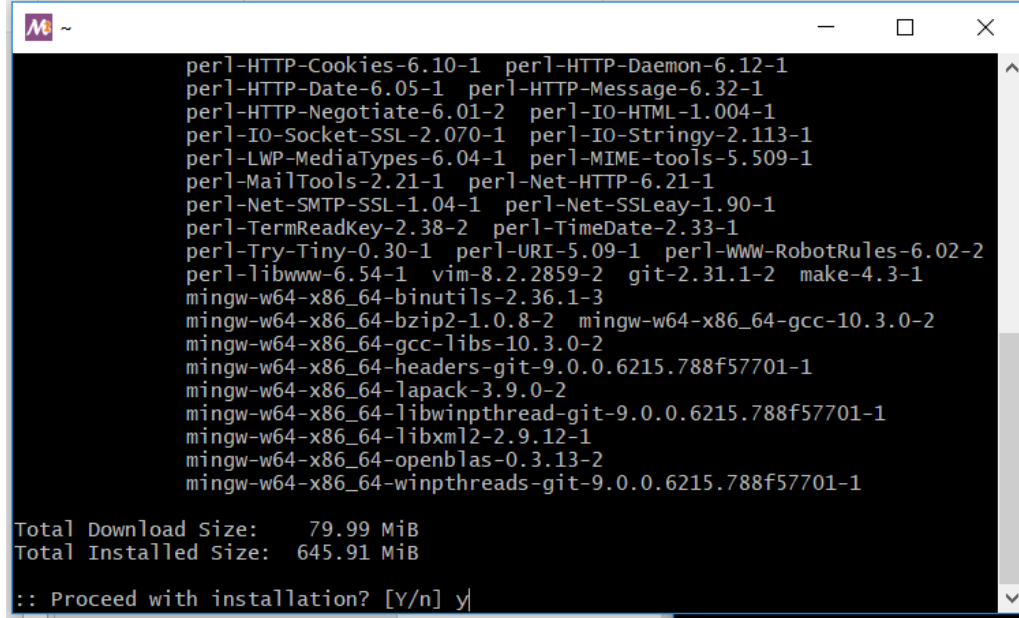
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MSYS 2

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



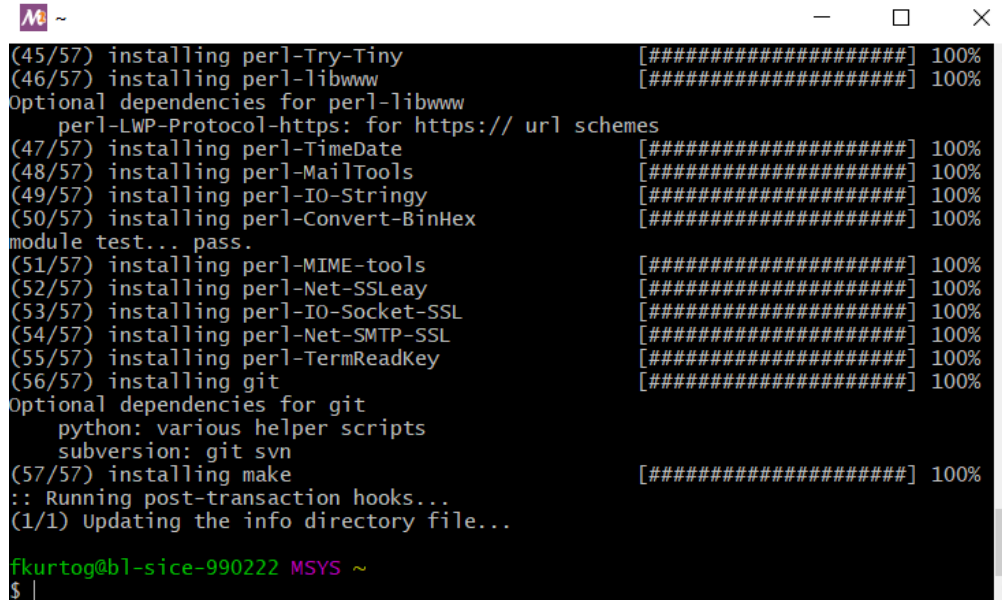
```
perl-HTTP-Cookies-6.10-1 perl-HTTP-Daemon-6.12-1
perl-HTTP-Date-6.05-1 perl-HTTP-Message-6.32-1
perl-HTTP-Negotiate-6.01-2 perl-IO-HTML-1.004-1
perl-IO-Socket-SSL-2.070-1 perl-IO-Stringy-2.113-1
perl-LWP-MediaTypes-6.04-1 perl-MIME-tools-5.509-1
perl-MailTools-2.21-1 perl-Net-HTTP-6.21-1
perl-Net-SMTP-SSL-1.04-1 perl-Net-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 (~), and standard window controls (minimize, maximize, close). The terminal output shows the progress of installing 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 (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, and make. The terminal also shows optional dependencies for perl-libwww and git, and a final status message indicating the info directory file is being updated. The prompt at the bottom is fkurto@bl-sice-990222 MSYS ~, followed by a dollar sign (\$) on a new 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...

fkurto@bl-sice-990222 MSYS ~
$
```

Adding Path



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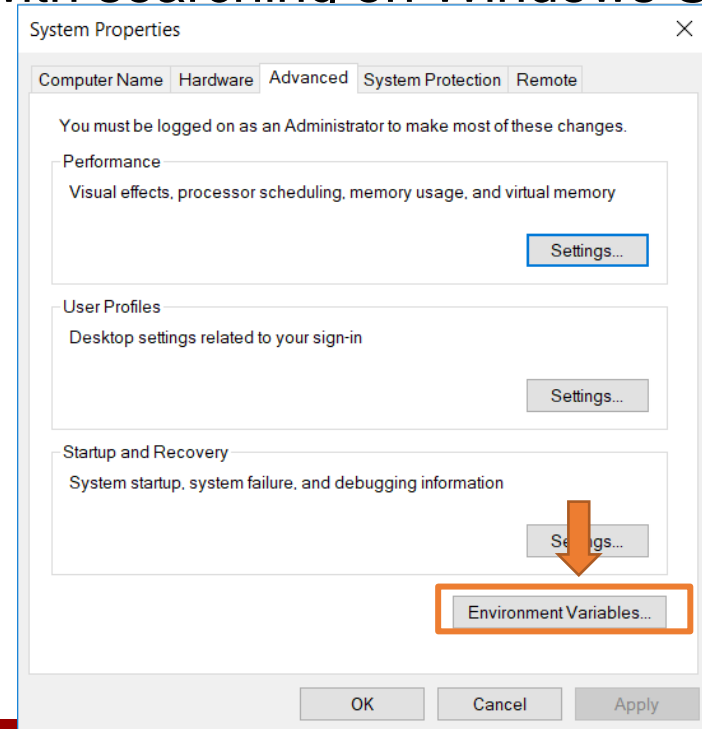
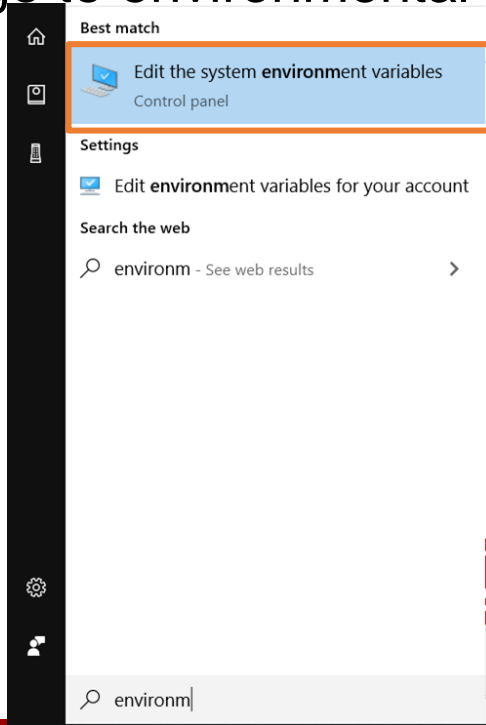
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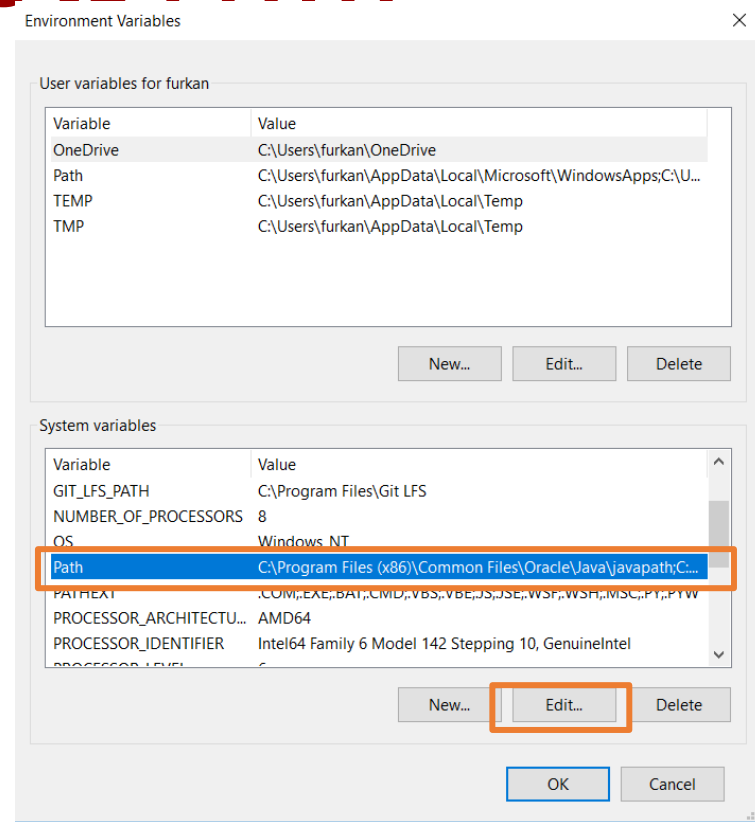
Adding directories to PATH

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



Adding directories to PATH

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



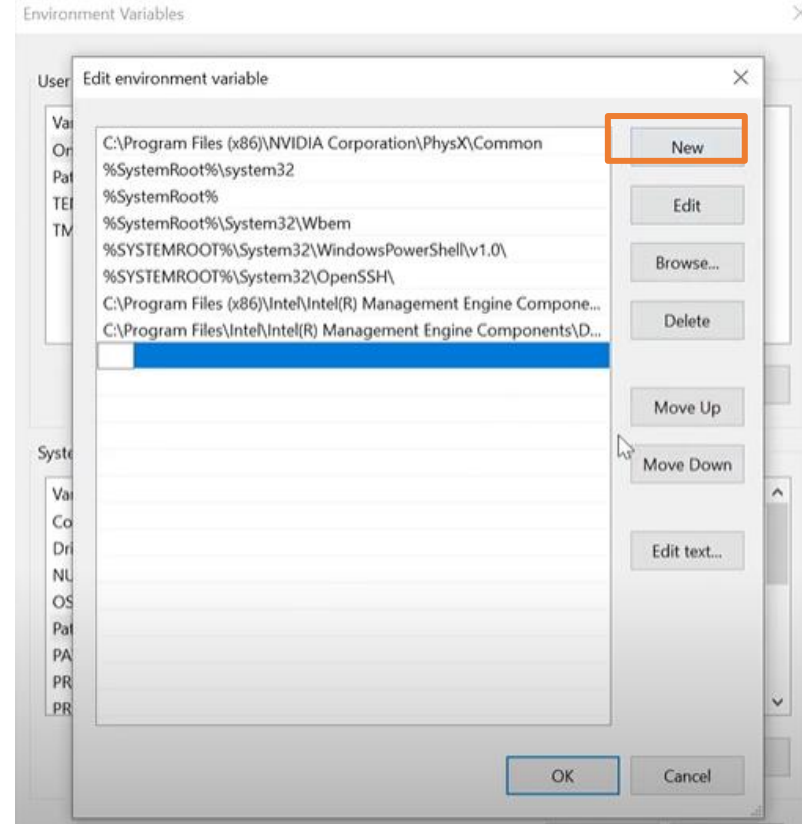
Adding directories to PATH

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

C:\msys64\mingw64\bin

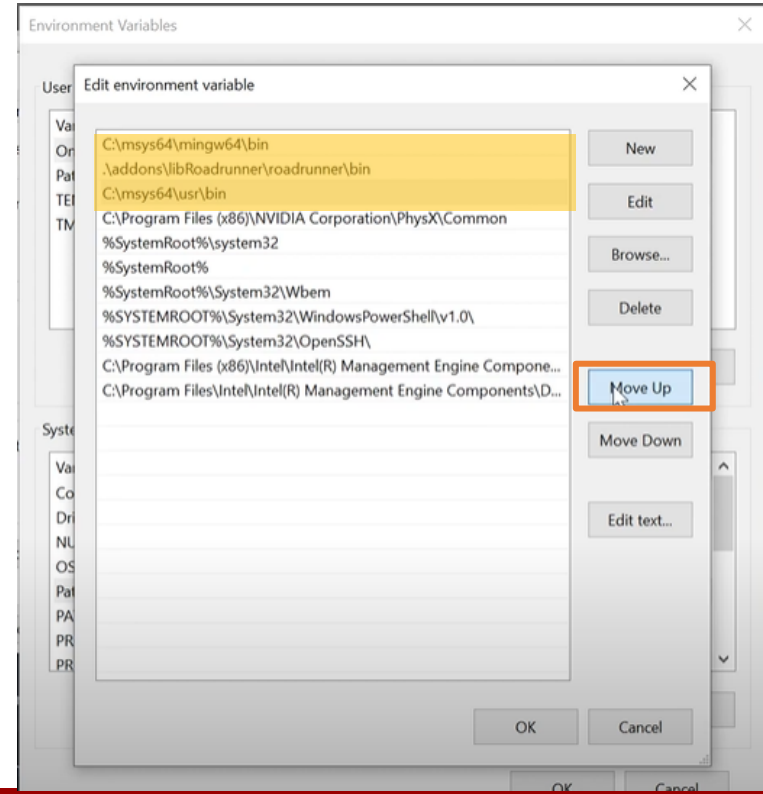
C:\msys64\usr\bin

.\addons\libRoadrunner\roadrunner\bin



Adding directories to PATH

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



get_physicell.py

- We will use following python script

https://github.com/physicell-training/ws2023/blob/main/setup/get_physicell.py



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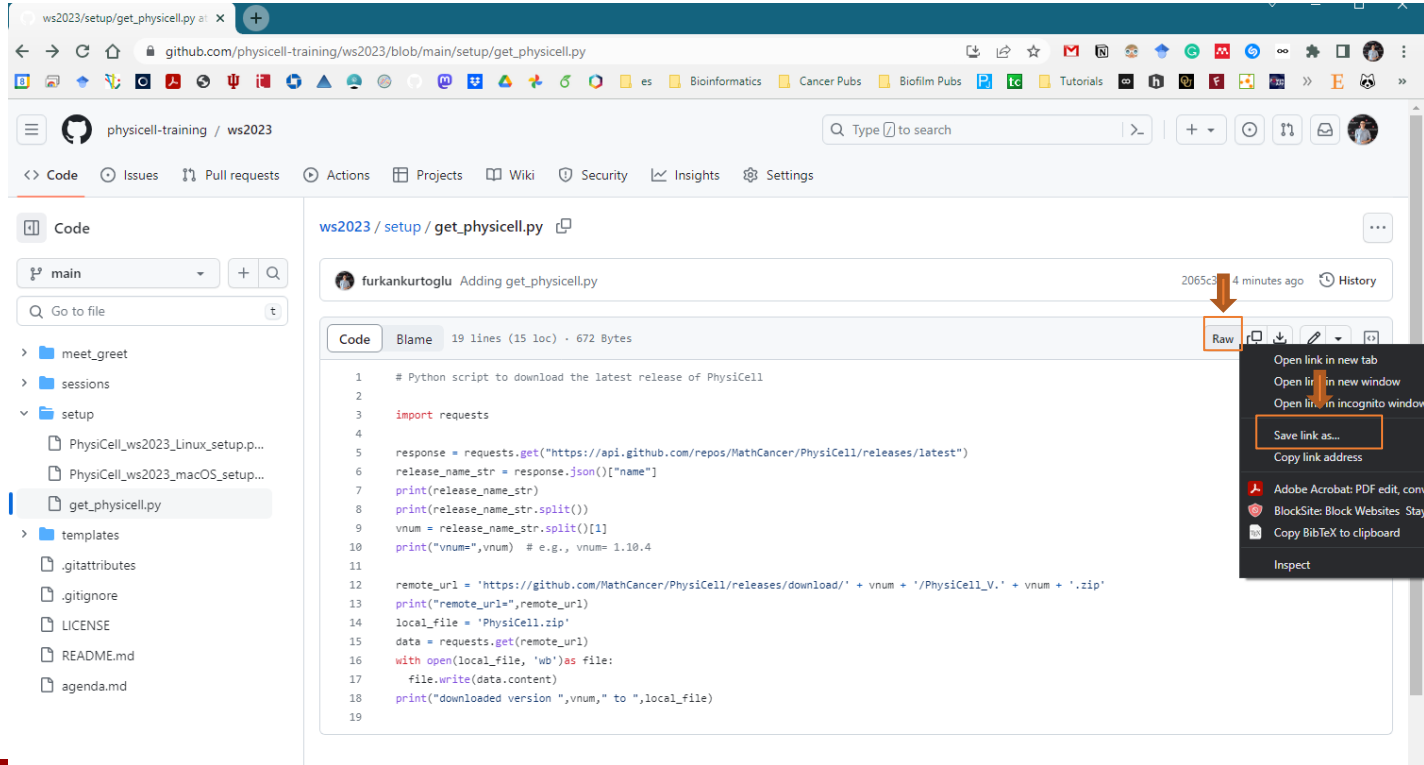
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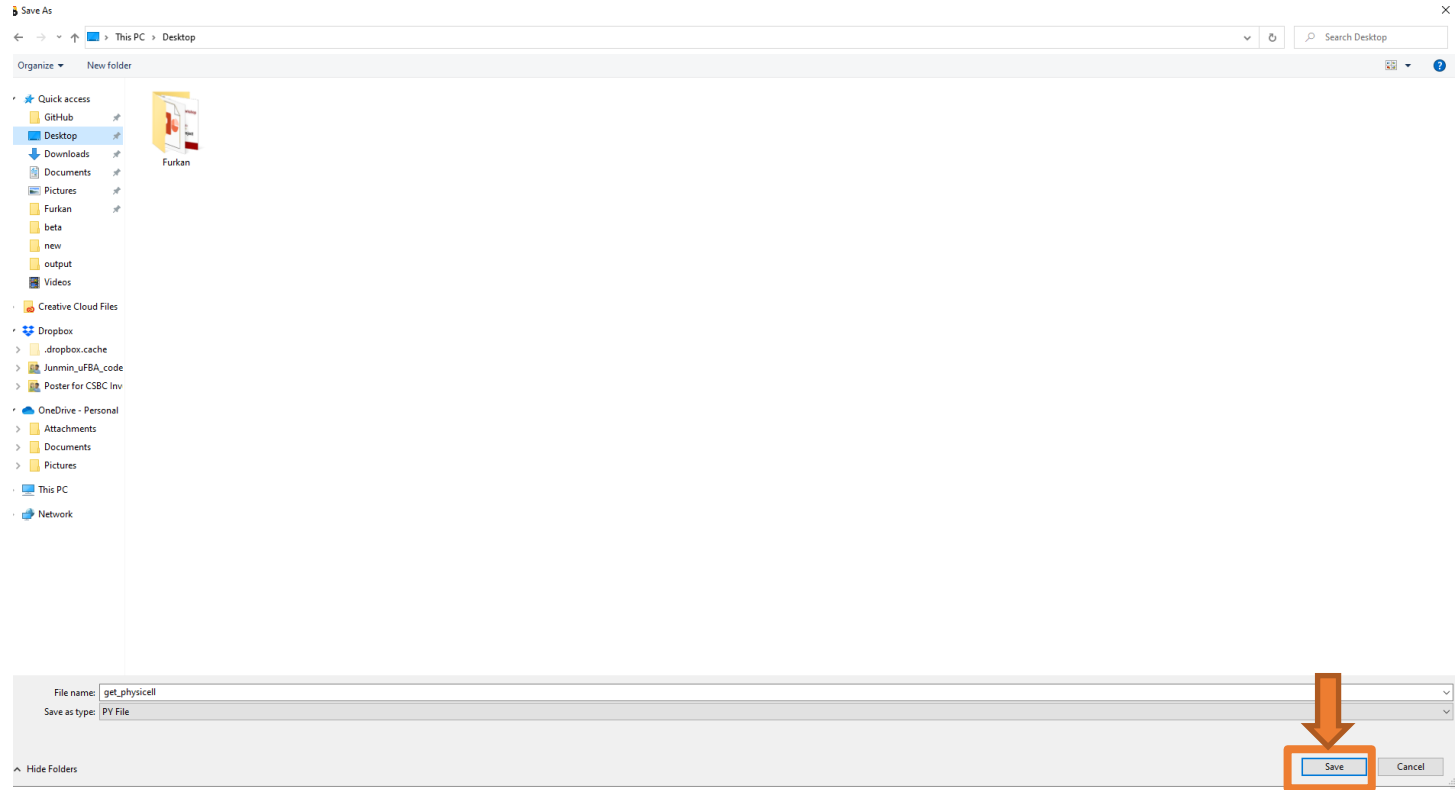
PhysiCell.org

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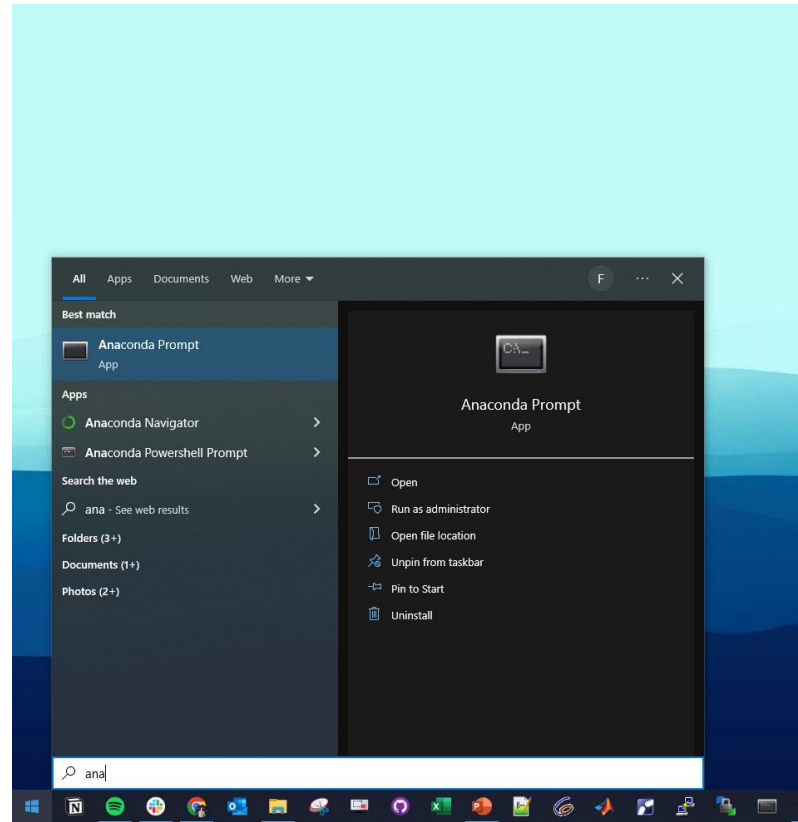
- Right click on “Raw” and “Save link as...”



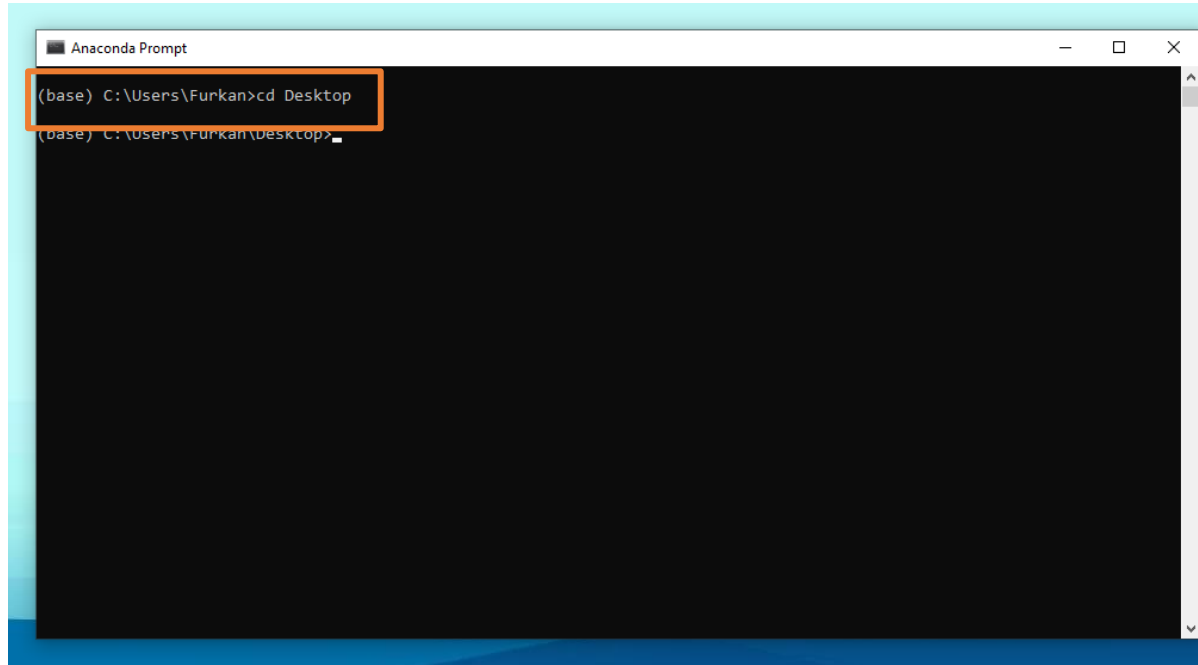
- Save to desired path



- Open Anaconda Prompt



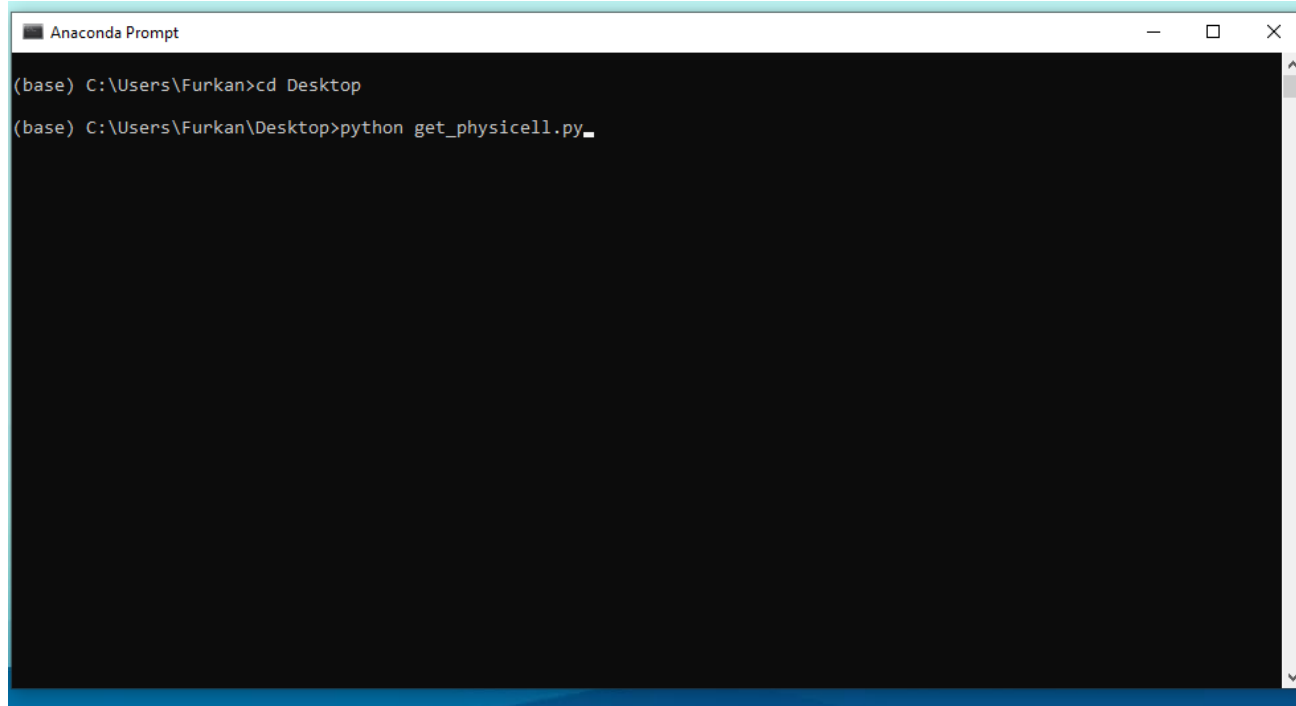
- Change Directory to where it is downloaded
“cd” is used to change directory.



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>". The command "cd Desktop" has been entered and is highlighted with an orange box. The prompt is "(base) C:\Users\Furkan\Desktop>".

- Execute following command and press enter

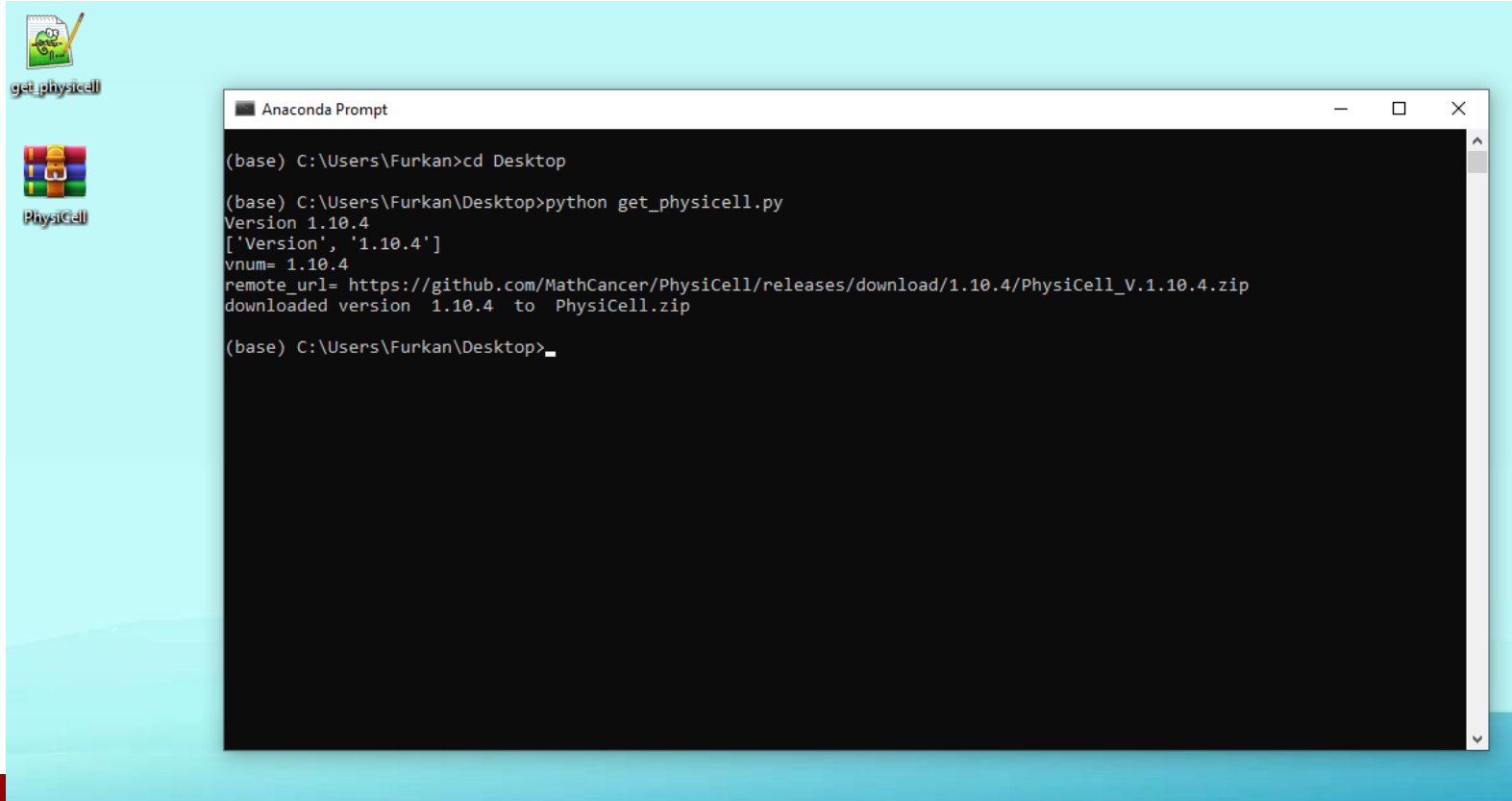
```
python get_physicell.py
```



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

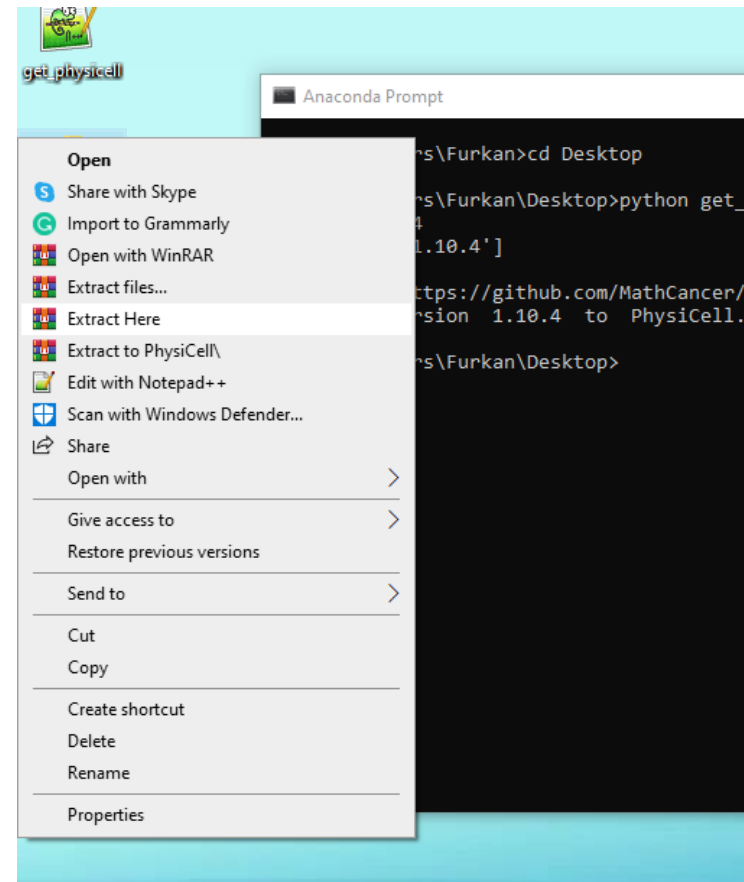


```
(base) C:\Users\Furkan>cd Desktop

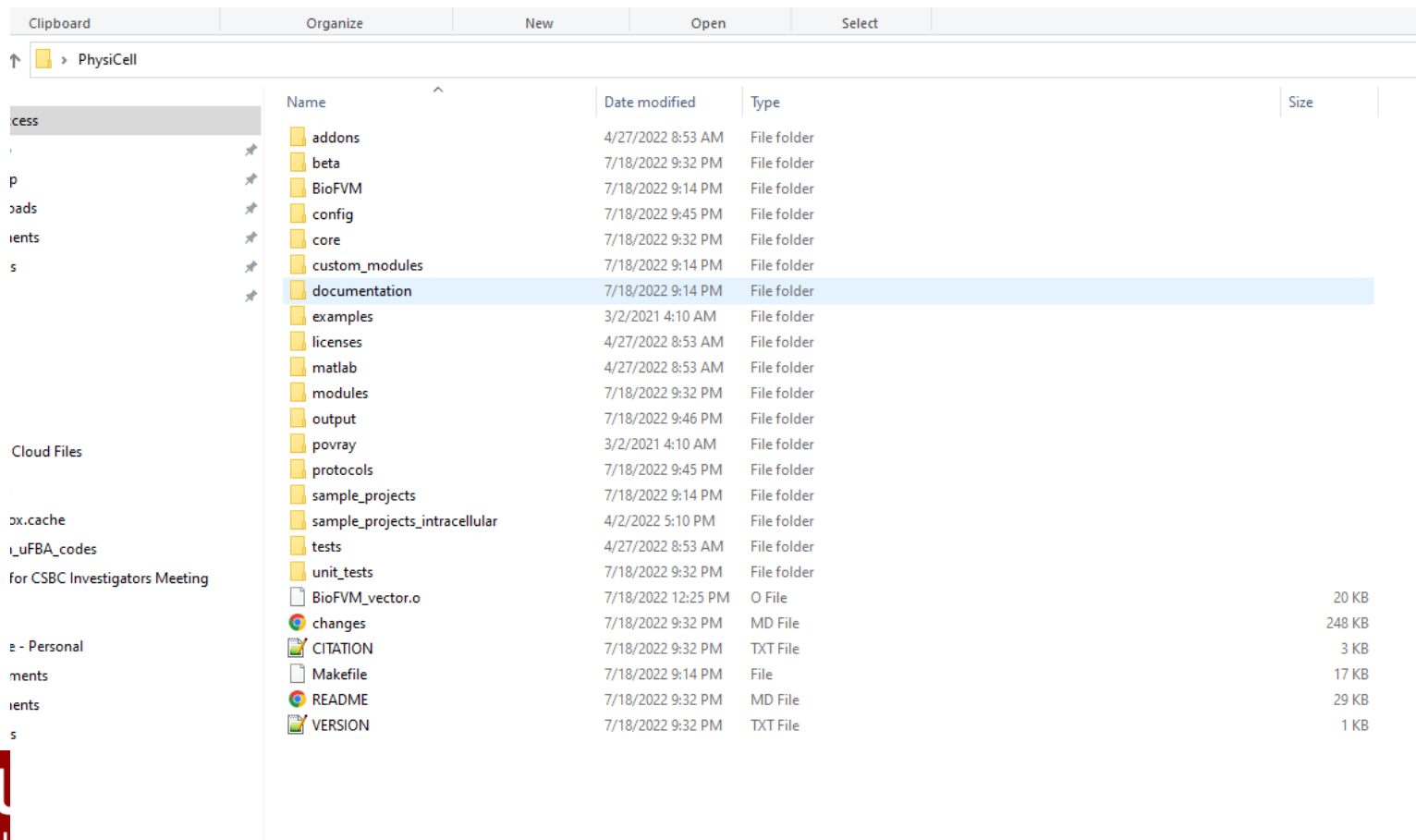
(base) C:\Users\Furkan\Desktop>python get_physicell.py
Version 1.10.4
['Version', '1.10.4']
vnum= 1.10.4
remote_url= https://github.com/MathCancer/PhysiCell/releases/download/1.10.4/PhysiCell_V.1.10.4.zip
downloaded version 1.10.4 to PhysiCell.zip

(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. The table below represents the data shown in the main pane.

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

Obtaining PhysiCell

- Number of ways to obtain PhysiCell
 - Using "get_physicell.py"
 - ◆ This installation guide will use this method.
 - Git clone
 - ◆

```
$ git clone https://github.com/MathCancer/PhysiCell
```
 - GitHub Desktop

Using `get_physicell.py`

- `get_physicell.py` is script to install PhysiCell easily.
- It will download PhysiCell to desired path using Python.
- Therefore, we need python installed.
- We recommend Anaconda for python

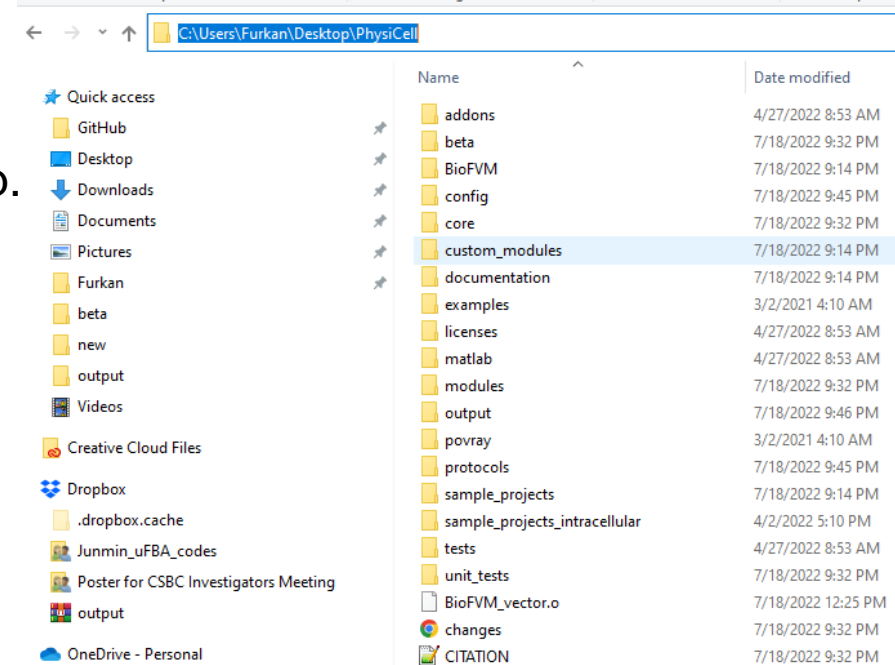
Test Module : “biorobots”

- 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.
- Right-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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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.

- Anaconda
- MSYS 2
- Adding them to path
- Test building “biorobots”

Minimum
setup

Studio
setup

Hackathon
setup +
additional
options

-
- Test building “ode-energy-sample”
 - PhysiCell Studio
 - ImageMagick

-
- pcDataLoader
 - COPASI
 - C++ code editor
 - Git and GitHub



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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
```

PhysiCell Studio (1)

- PhysiCell Studio is a desktop graphical tool to let you create/edit a .xml configuration file that defines a PhysiCell model. The Studio also lets you run a simulation, plot results, and more.
- Download the latest release at:
https://github.com/PhysiCell-Tools/PhysiCell-Studio/blob/main/get_studio.py
- Copy or move the .zip into your PhysiCell root directory, unzip it, and run the Studio, e.g.:

This should display the Studio (next page):

PhysiCell Studio (2)

The screenshot shows the PhysiCell Studio configuration window with the following sections and settings:

- Domain (micron):**
 - Xmin: -500, Xmax: 500, dx: 20
 - Ymin: -500, Ymax: 500, dy: 20
 - Zmin: -10, Zmax: 10, dz: 20
- Times:**
 - Max Time: 7200 min
 - Diffusion dt: 0.01 min
 - Mechanics dt: 0.1 min
 - Phenotype dt: 6 min
- Misc runtime parameters:**
 - # threads: 6
 - output folder: output
 - Save data (intervals): ☒ SVG 60 min, ☒ Full 60 min
- Initial conditions of cells (x,y,z, type):**
 - ☐ enable
 - folder: ./config, file: cells.csv,
- Cells' global behaviors:**
 - ☒ virtual walls, ☐ disable springs

A draft User Guide for the Studio is at
<https://github.com/PhysiCell-Tools/Studio-Guide>

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.

- Anaconda
- MSYS 2
- Adding them to path
- Test building “biorobots”

Minimum
setup

Studio
setup

Hackathon
setup +
additional
options

-
- Test building “ode-energy-sample”
 - PhysiCell Studio
 - ImageMagick

-
- pcDataLoader
 - COPASI
 - C++ code editor
 - Git and GitHub



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pcDataLoader

- Used to load PhysiCell data
 - Python based data loader
 - Facilitates post-simulation analysis
- Additional information (tutorials, reference guide etc.) and latest releases at <https://github.com/PhysiCell-Tools/python-loader>
- From terminal you need to

```
pip install pcdl
```
- pcDataLoader should now be available for import



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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.

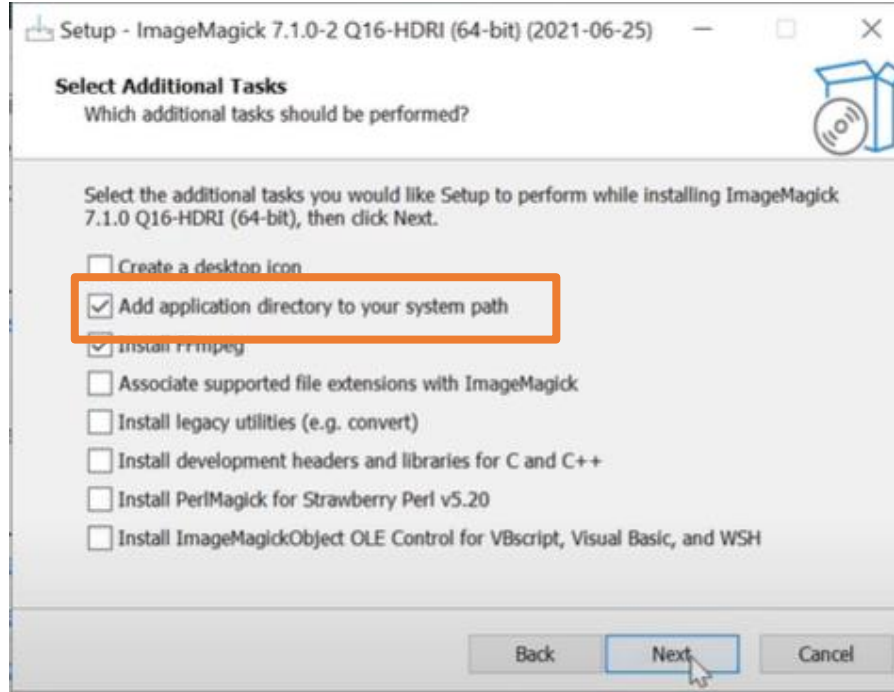
The Windows version of ImageMagick is self-installing. Simply click on the appropriate version below and it will launch itself and ask you a few installation questions. Versions with *Q8* in the name are 8 bits-per-pixel component (e.g. 8-bit red, 8-bit green, etc.), whereas, *Q16* in the filename are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



C++ code editor

- When you get to the point of editing the custom C++ code for your model, you will want a decent code editor. If you're already using one (for C or C++), great! - keep using it. But if you are new to programming, we recommend keeping it simple.
- There are famous code editors like
 - Notepad++ : <https://notepad-plus-plus.org/downloads/>
 - Sublime Text : <https://www.sublimetext.com/>
 - Visual Studio Code editor : <https://code.visualstudio.com/Download>
- Please be sure that they are in the path like we did it before

Version control

When you get to the point of editing the custom C++ code, python scripts for analysis, etc, it is common to use version control for your code and to share with collaborators. If you are already using version control great! - keep using it. If you are new to programming, we recommend using git.

Once you have git, github.com is a common place to share code. There are also many graphical interfaces for git (GitHub has one for example.)

Support

- We encourage you to join and actively use the [PhysiCell community Slack channel](#). There, you can post questions ([#troubleshooting](#)), answer questions, and (hopefully) share successful modeling stories.
- Alternatively, you can submit problem tickets at <https://sourceforge.net/p/physicell/tickets/>
- Finally, please follow us on Twitter [@PhysiCell](#) and [@MathCancer](#).

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