

# Informatics Course Guide

## Viral Genomics and Bioinformatics

The Informatics Guide is your go-to resource after completing the course. It not only guides you through downloading course materials on GitHub and setting up virtual machines used in the course but also serves as a roadmap for your journey. Additionally, each section concludes with hyperlinks to extra resources that will help you with troubleshooting. Happy learning!

### Course Resources on GitHub

Our course materials, including slides, files, and essential information, have been conveniently hosted on our dedicated GitHub repository. The material shared has been licensed under a [BY-NC-SA, Attribution-NonCommercial-ShareAlike 4.0 International \(CC BY-NC-SA 4.0\)](#) and will be available for indefinitely.

Check out your course GitHub Page at [ViralBioinfoAsia24](#).

### Accessing the Virtual Machine (VM) image via Globus

Virtual Box is a cross-platform application developed by Oracle which enables you to create Virtual Machines (VMs). To streamline your learning experience, we offer access to a pre-configured virtual machine through Globus. This virtual machine comes equipped with all the necessary software used throughout the course. By downloading this VM file, you can quickly dive into the practical aspects of informatics without the hassle of individually installing software components.

### Virtual Machine Setup Guides

For users on macOS and Windows operating systems, we provide comprehensive setup guides to help you configure the virtual machine. These step-by-step guides are designed to ensure a seamless setup process, allowing you to focus on learning rather than troubleshooting technical issues.

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## GitHub and how to make most out of it

GitHub is an open source, web-based platform primarily used for version control and collaboration on software development projects. It allows users to store and manage their code, track changes made to files, and coordinate work among team members.

Within GitHub, users organize their content into repositories. A repository, often referred to as "repo," is a collection of files and folders associated with a specific project or application. These files can include source code, documentation, configuration files, and more. Repositories provide a centralized location for storing and managing project-related assets, making it easier for collaborators to access and contribute to the project.

Course materials, such as slides, files, and essential information shared during the course, are typically stored in a dedicated repository on GitHub. This repository serves as a central hub for accessing all the materials related to the course. Users can navigate through the repository's folders to locate specific files or use the search functionality to find relevant content quickly.

As a reminder, access to the Learning Management System (LMS) used during the course will be withdrawn two months post-course. However, the GitHub repository will remain accessible indefinitely, making it an invaluable long-term resource for participants. By bookmarking the repository or saving its URL, participants can continue to access course materials, review content, and engage with the community even after the course has ended.

Check out your course specific GitHub Page at [ViralBioinfoAsia24](#).

If you want to learn more about GitHub and how you can use it in your research, please refer [GitHub Docs](#).

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## Downloading Virtual Machine (VM) image via Globus

The Virtual Machine (VM) is a huge download that many users have difficulty with. As a result, we will rely on Globus software to help us.

Globus is a research-oriented file transfer software. The main advantage of using globus is that if there is an internet connection failure during downloading, it will stop and resume from the same position instead of resetting to zero percent.

**Globus website:** <https://www.globus.org>

### Globus VM Downloading Steps:

1. Make a globus connect personal account by going this webpage, and choose the download for your operating system (Mac or Windows), which will prompt you to make an account:

<https://www.globus.org/globus-connect-personal>

Choose to use globus ID to sign in (picture below)

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Log in to use Globus Web App

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Use your existing organizational login  
e.g., university, national lab, facility, project

Look-up your organization... ▼


By selecting Continue, you agree to Globus [terms of service](#) and [privacy policy](#).


Continue

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OR

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 Sign in with Google

 Sign in with ORCID iD

Didn't find your organization? Then use [Globus ID to sign in](#). (What's this?)

Then if you don't have an ID yet, select "Need a Globus ID? Sign up".

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## Log in to use Globus Web App

### Use your existing organizational login

e.g., university, national lab, facility, project

By selecting Continue, you agree to Globus [terms of service](#) and [privacy policy](#).

Continue

OR



Sign in with Google



Sign in with ORCID iD

Didn't find your organization? Then use [Globus ID to sign in](#). ([What's this?](#))

## Log In with Globus ID

[Need a Globus ID? Sign Up](#)

The client Globus Auth is requesting access to your **globusid.org** account for accessing a third-party website or application located at [auth.globus.org](#). If you approve, please log in to continue.

Username

@globusid.org

Password

Log In

[Forgot password?](#)

Then make sure you specify for research or educational purposes. And create your account. Remember your password for the later steps.

## Create a Globus ID

[Already have a Globus ID? Log In](#)

The client Globus Auth is requesting access to your **globusid.org** account for accessing a third-party website or application located at **auth.globus.org**. If you approve, please create a Globus ID account to continue.

Username  @globusid.org

Your username will be checked for availability.

Usernames may contain both letters and numbers, but must begin with a letter and be between 3 and 31 characters long. NOTE: this is an ID you are creating – not a working e-mail address

Password

☐ show password

Full Name  first and last name

E-mail  user@example.edu

This account will be used for ☐ non-profit research or educational purposes

☐ commercial purposes

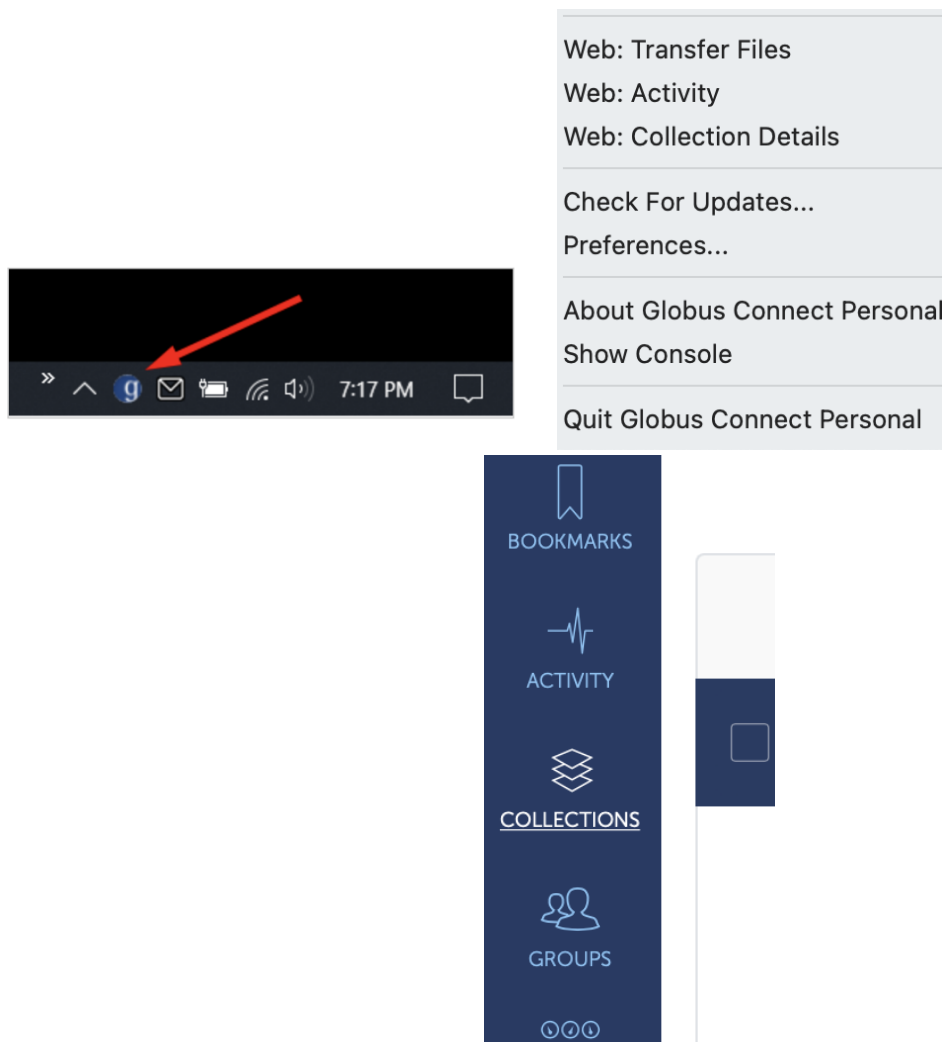
Organization

☐ I have read and agree to the Globus [Terms of Service](#) and [Privacy Policy](#)

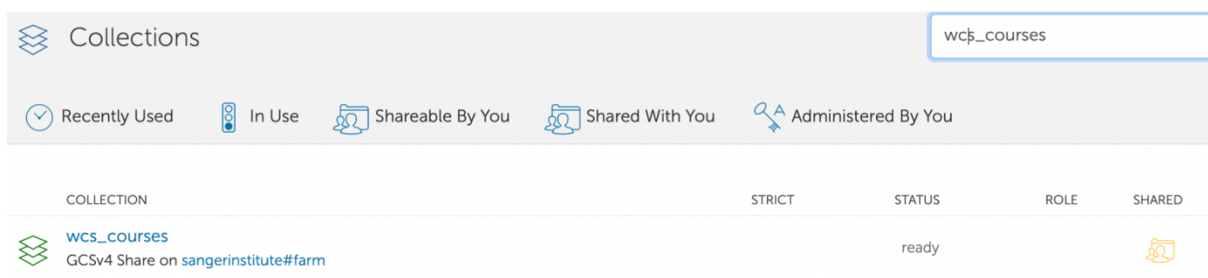
2. Then download the globus client onto your local machine (or where you intend to run the VM), allow it to install. It will ask for a collection name; give it a name you will refer to - **example** **“home\_computer”** or **“local\_mac”**. This is a name for the local folders on your computer that we will send the VM to in a later step.

3. Click on the small “g” icon on the task bar and select Web: Transfer Files. **Note:** For linux users - there may not be a shortcut. Once you start globus personal connect via command line, navigate to <https://app.globus.org/file-manager> to begin the file manager.

4. You will see your own files on this page. Your local endpoint is your computer. Click on “Collections” on the left



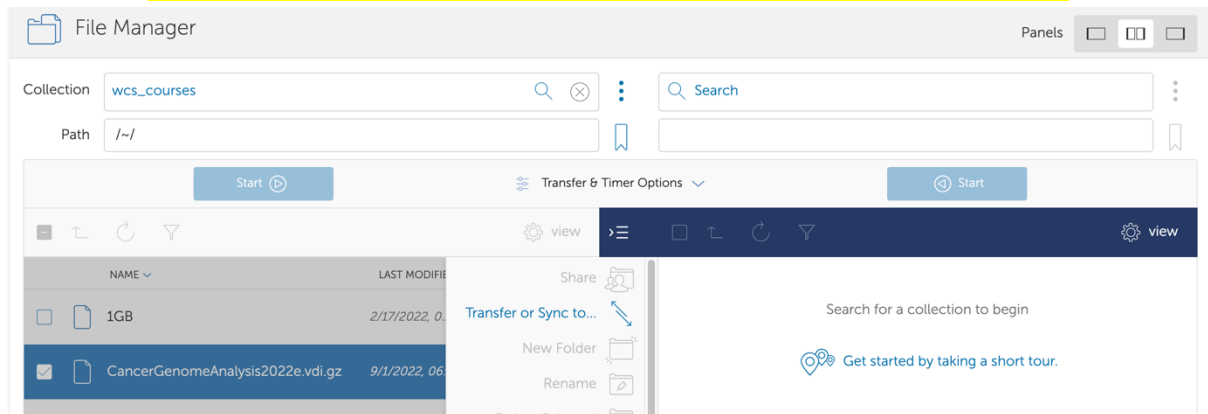
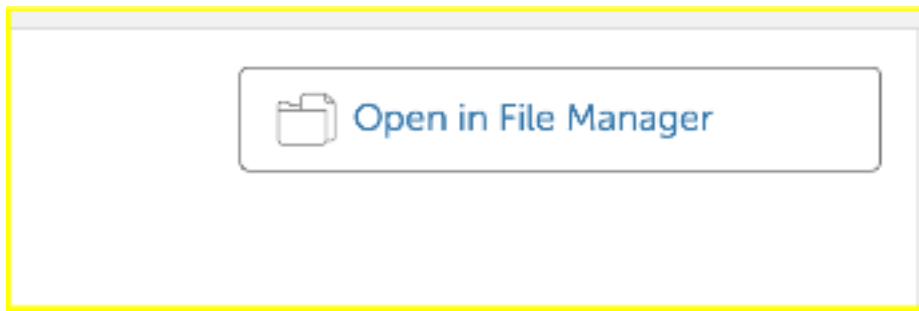
5. Search for the endpoint at [wcs\\_data\\_transfers](#)



Click on the endpoint labelled [wcs\\_data\\_transfers](#)

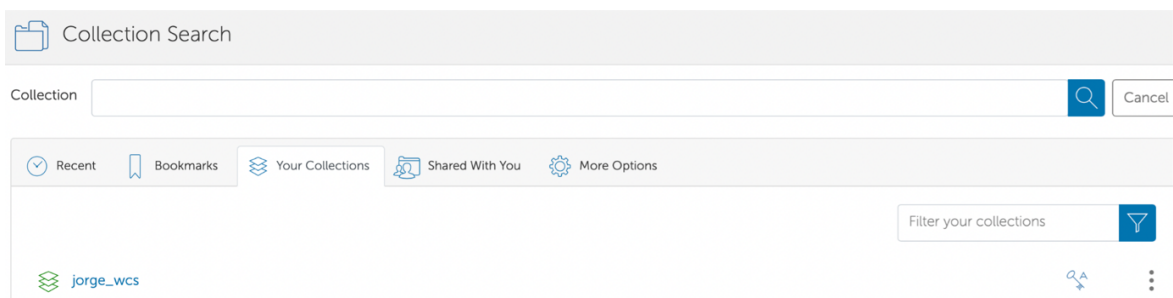
Then click on “Open in File Manager” will open a file manager

6. Then we begin the steps to transfer the VM to your local machine. First, select the VM file “**ViralGenomics24.vdi.gz**” with the check box. Then click on “**Transfer or sync to**”.



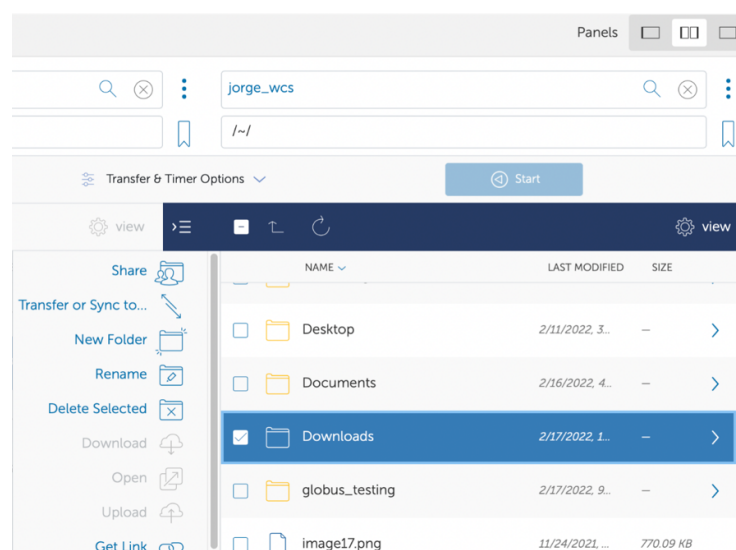
Then click on the search box in the opposite panel

7. Click on “Your Collections” and select your local endpoint (**the name will be what you gave it during the globus personal connect installation**)  
You can also browse to choose the specific directory or folder on your local machine you want the VM to be download in.



Downloads is selected in this example.





8. When you have chosen the local location, click on the “Start” button under the “[wcs\\_data\\_transfers](#)” section to begin the download to your local endpoint.

9. Wait for download completion - it will email you to the account you set up, and you can track the transfer in the “Activity” menu.

10. Run the installation of VirtualBox, then install the virtual machine you have just downloaded.

**Note:** The course data is also uploaded on Globus and can be searched as “**ViralGenomics24.vdi.gz**”.

## Additional Resources and Troubleshooting for VM image and Globus

- Globus Documentation: <https://docs.globus.org/guides/>
- Virtual Box Documentation: <https://www.virtualbox.org/wiki/Documentation>
- Virtual Box Manual: <https://www.virtualbox.org/manual/ch01.html>
- Virtual Box Forum: <https://forums.virtualbox.org/index.php> (helpful for finding similar problem queries and solutions)
- Stack overflow: <https://stackoverflow.com/> (Public Q&A platform for debugging)
- Bioinformatics (BioStars) Forum: <https://www.biostars.org/t/Forum/> (General Bioinformatics queries)

## Introduction to Virtual Box and Virtual Machine

Virtual Box is a cross-platform application developed by Oracle which enables you to create Virtual Machines (VMs). The VM generates a guest operating system (such as Linux) derived from a host operating system (The host operating system is the primary and foundational operating system that runs directly on the physical hardware of a computer.). Therefore, sufficient RAM, processors, and memory in the host operating system are essential for smooth running of VMs.

**Note:** The VM image file (.vdi) contains all the software installed for the course.

**Additional Note:** There is an error with virtual box version 7.0.16 which has been highlighted on the Virtual Box website, therefore would highly suggest downloading the 7.0.14 version if possible. If you do not see any such warnings on the Virtual Box website, it could mean they have been resolved.

### VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

**ATTENTION: PLEASE REFRAIN FROM UPGRADING TO 7.0.16 FOR NOW. THIS RELEASE HAS AN ISSUE WHICH MIGHT CAUSE HOST OS CRASH WHEN VM IS CONFIGURED TO USE BRIDGED OR HOST-ONLY NETWORKING. WE WILL SEND AN ANNOUNCEMENT TO MAILING LISTS WHEN FIX WILL BE AVAILABLE FOR DOWNLOAD.**

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## Host OS Requirements for Virtual Box

- RAM requirement: 8GB (preferably 12GB)
- Processor requirement: 4 processors (preferably 8)
- Hard disk space: 200GB
- Admin rights to the computer.

**Note:** Please be aware that Virtual Box is currently incompatible with M1/M2/M3 chips on MacBook. It is exclusively designed for use on Intel-based MacBooks. The current version in use is Virtual Box 7.0.

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## Installation of Virtual Box for Windows OS

**Please Note:** There is an error with virtual box version 7.0.16 which has been highlighted on the Virtual Box website, therefore would highly suggest downloading the 7.0.14 version if possible. If you do not see any such warnings on the Virtual Box website, it could mean they have been resolved.

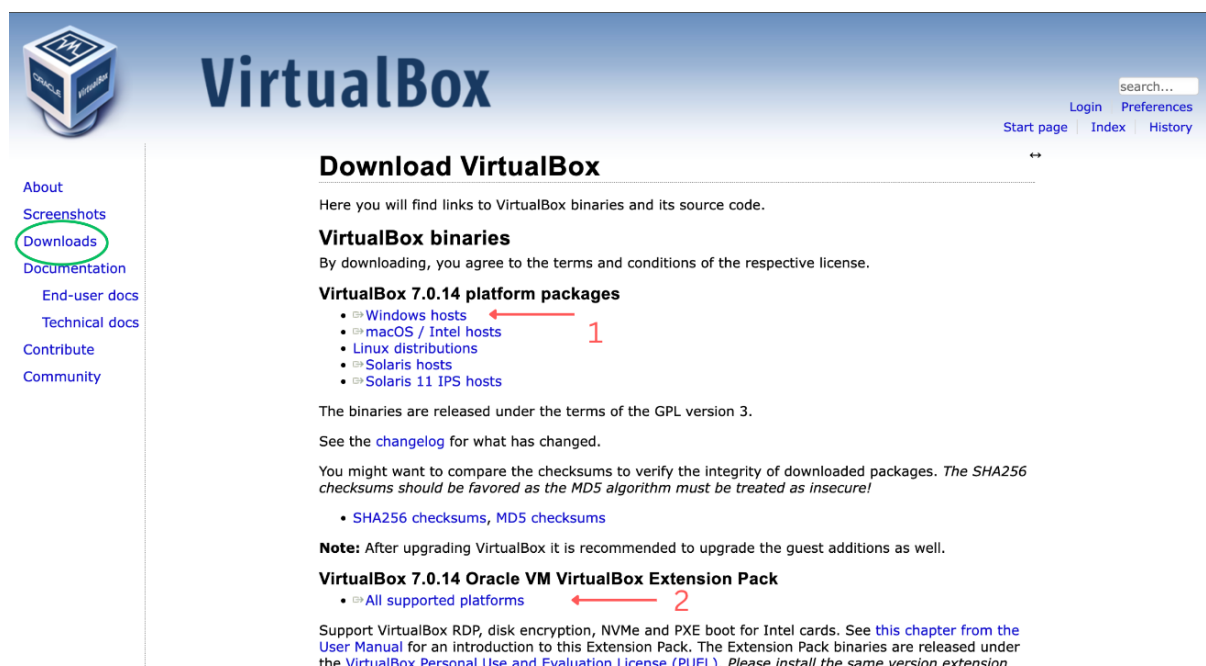
### VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

**ATTENTION: PLEASE REFRAIN FROM UPGRADING TO 7.0.16 FOR NOW. THIS RELEASE HAS AN ISSUE WHICH MIGHT CAUSE HOST OS CRASH WHEN VM IS CONFIGURED TO USE BRIDGED OR HOST-ONLY NETWORKING. WE WILL SEND AN ANNOUNCEMENT TO MAILING LISTS WHEN FIX WILL BE AVAILABLE FOR DOWNLOAD.**

#### 1. Download VirtualBox:

Navigate to the official VirtualBox website (<https://www.virtualbox.org/>) and go to the "Downloads" section. Choose the version that matches your Windows operating system (32-bit or 64-bit).

The screenshot shows the VirtualBox website's 'Downloads' page. On the left is a navigation menu with links: About, Screenshots, Downloads (highlighted with a red circle), Documentation, End-user docs, Technical docs, Contribute, and Community. The main content area is titled 'Download VirtualBox' and contains the following information: a brief introduction to the binaries, a section for 'VirtualBox binaries' with a license agreement, a list of 'VirtualBox 7.0.14 platform packages' (Windows hosts, macOS / Intel hosts, Linux distributions, Solaris hosts, Solaris 11 IPS hosts), a note about the GPL version 3 license, a link to the changelog, a warning about checksums, and a note about upgrading guest additions. Below this is the 'VirtualBox 7.0.14 Oracle VM VirtualBox Extension Pack' section, which includes a link to 'All supported platforms' and a note about the PUEL license. Red arrows and numbers '1' and '2' are added to the image to highlight the 'Windows hosts' link and the 'All supported platforms' link, respectively.

#### 2. Download Extension Pack (Optional):

If needed, download the VirtualBox Extension Pack from the same "Downloads" section. This pack provides additional functionalities like USB 2.0 and 3.0 support, VirtualBox Remote Desktop Protocol (VRDP), and more.

#### 3. Run the Installer:

Locate the downloaded VirtualBox installer file (.exe) and double-click to run it. Follow the on-screen instructions provided by the installer. Click "Next" to proceed through the setup wizard. You may customize installation options if desired.

#### 4. Install Extension Pack (Optional):

If you downloaded the Extension Pack, double-click on the file (e.g., Oracle\_VM\_VirtualBox\_Extension\_Pack-6.0.14-133895.vbox-extpack) to install it. This can be done after VirtualBox installation.

#### 5. Complete the Installation:

Once the installation is complete, click "Finish" to exit the installer.

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## Installation of Virtual Box for MacOS

**Please Note:** There is an error with virtual box version 7.0.16 which has been highlighted on the Virtual Box website, therefore would highly suggest downloading the 7.0.14 version if possible. If you do not see any such warnings on the Virtual Box website, it could mean they have been resolved.

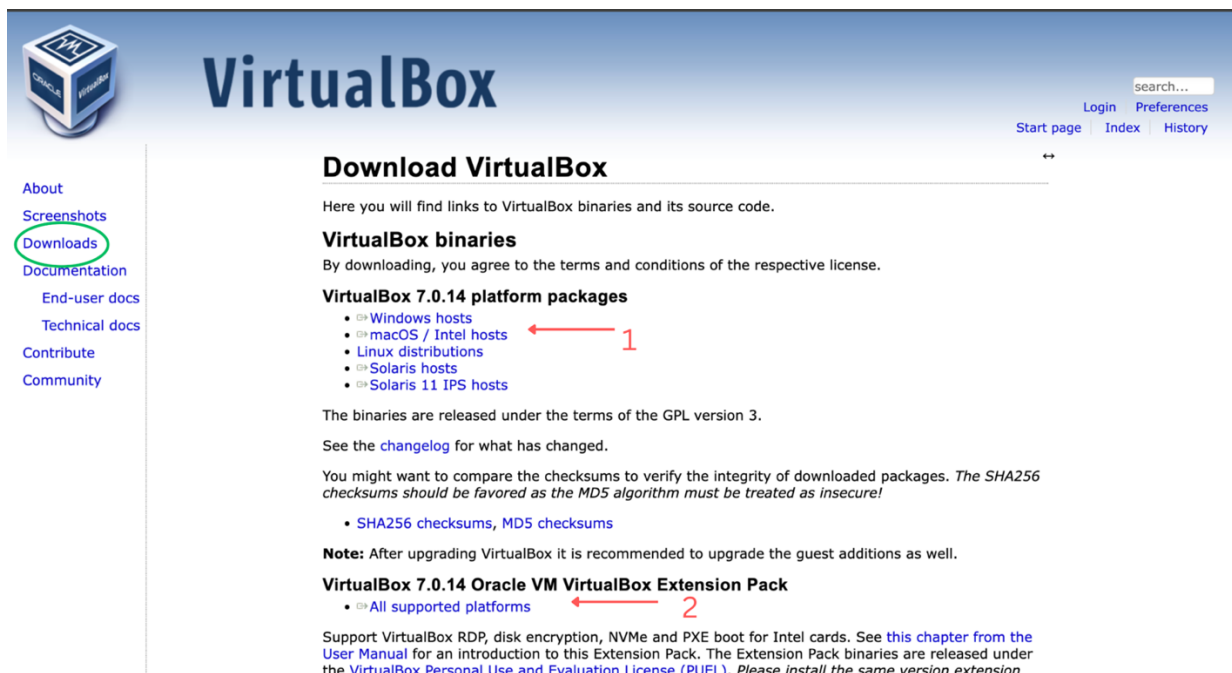
### VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

**ATTENTION: PLEASE REFRAIN FROM UPGRADING TO 7.0.16 FOR NOW. THIS RELEASE HAS AN ISSUE WHICH MIGHT CAUSE HOST OS CRASH WHEN VM IS CONFIGURED TO USE BRIDGED OR HOST-ONLY NETWORKING. WE WILL SEND AN ANNOUNCEMENT TO MAILING LISTS WHEN FIX WILL BE AVAILABLE FOR DOWNLOAD.**

#### 1. Download VirtualBox:

Navigate to the official VirtualBox website (<https://www.virtualbox.org/>) and go to the "Downloads" section. Choose the version compatible with macOS.



The screenshot shows the VirtualBox website. On the left is a sidebar with links: About, Screenshots, Downloads (circled in green), Documentation, End-user docs, Technical docs, Contribute, and Community. The main content area has a header with the VirtualBox logo and a search bar. Below the header, there's a section titled "Download VirtualBox" with a sub-section "VirtualBox binaries". Under "VirtualBox binaries", there's a list of "VirtualBox 7.0.14 platform packages" with links to Windows hosts, macOS / Intel hosts (pointed to by a red arrow labeled '1'), Linux distributions, Solaris hosts, and Solaris 11 IPS hosts. Below this, there's a "Note" about upgrading and a section for the "VirtualBox 7.0.14 Oracle VM VirtualBox Extension Pack" with a link to "All supported platforms" (pointed to by a red arrow labeled '2').

## 2. Download Extension Pack (Optional):

If needed, download the VirtualBox Extension Pack from the same "Downloads" section. This pack provides additional functionalities like USB 2.0 and 3.0 support, VirtualBox Remote Desktop Protocol (VRDP), and more.

## 3. Run the Installer:

Locate the downloaded VirtualBox installer file (.dmg) and double-click to open it. Follow the on-screen instructions to install VirtualBox on your macOS. Drag the VirtualBox icon to the Applications folder.

## 4. Install Extension Pack (Optional):

If you downloaded the Extension Pack, double-click on the file (e.g., Oracle\_VM\_VirtualBox\_Extension\_Pack-6.0.14-133895.vbox-extpack) to install it. This can be done after VirtualBox installation.

## 5. Complete the Installation:

Once installed, open VirtualBox from Applications folder. The first time you run it, macOS may ask for permission to run the application. Click "Open" to proceed.

## Installing a Virtual Machine (VM) image

Virtual Machine image (.vdi extension file) is a replication of the exact VM used during the course. Downloading and installation of the VM image would save you time from installing each software individually and can also find exercise data on the same. If for some reason you are unable to find data it should be available in the course GitHub repository (<https://github.com/WCSCourses/CompSysBio24>).

**Note:** Although the VM image file (.vdi) contains all the software installed for the course, you still need admin rights of the computer to run some sudo commands.

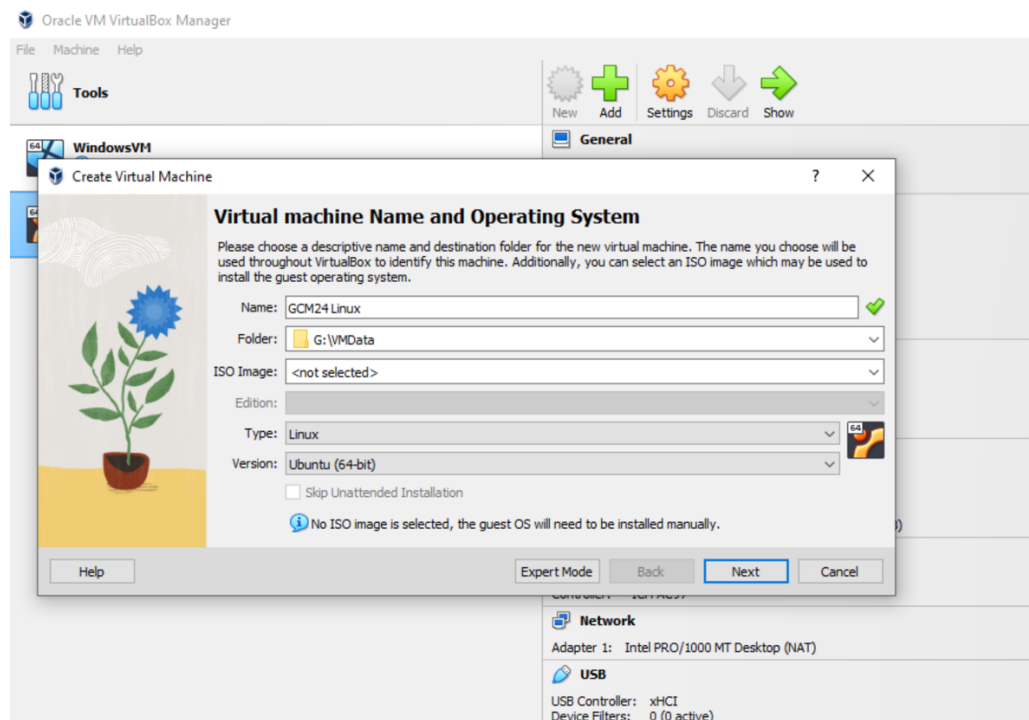
### 1. Start VirtualBox:

Locate the VirtualBox shortcut on your desktop or find it in the Start Menu. Double-click on the VirtualBox icon to launch the application.

### 2. Create a Virtual Machine:

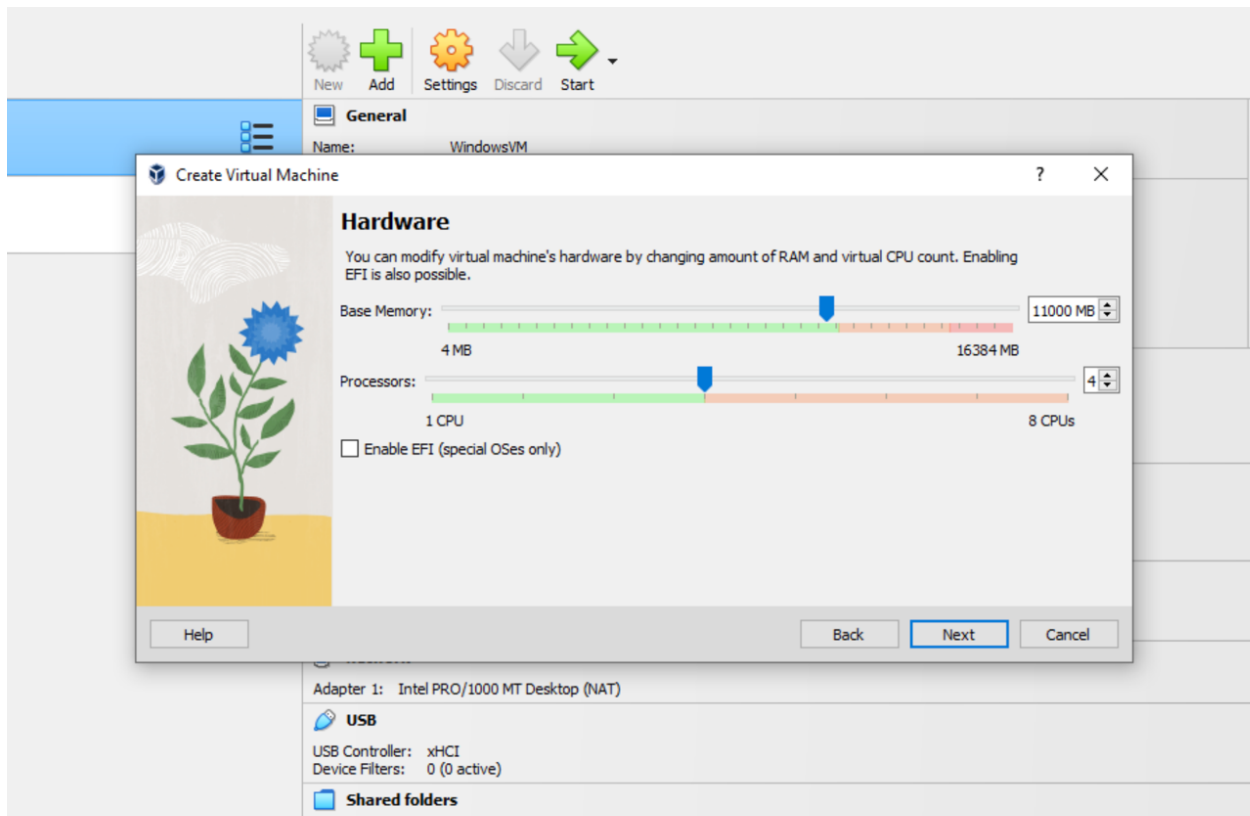
In the VirtualBox Manager, click "New" for a new virtual machine. Enter a name for your virtual machine (e.g., "CourseName 2024"). Choose "Linux" as the type and select "Ubuntu 64-bit" as the version. For example, we have taken CourseName as "GCM 24".

**Note:** Viral Genomics and Bioinformatics course is saved as "ViralGenomics24.vdi.gz".



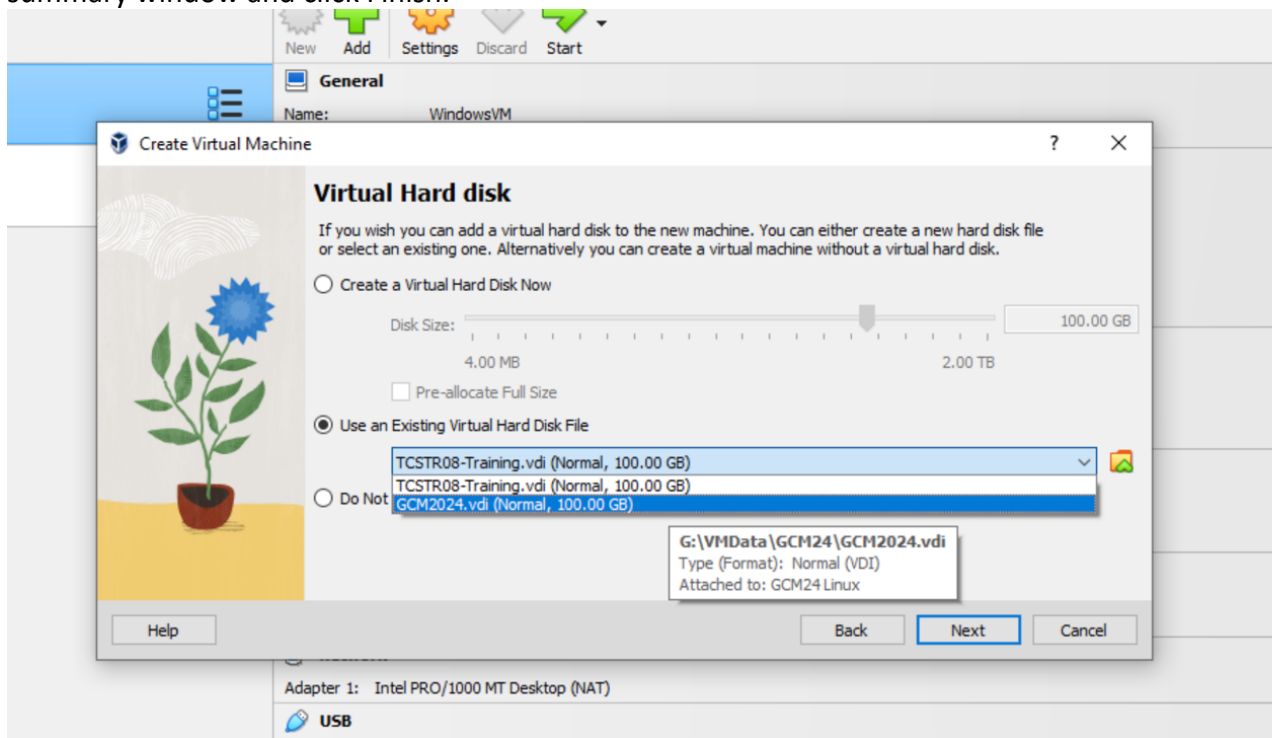
### 3. Memory (RAM) Allocation:

In the window that follows, determine the amount of RAM to allocate, keeping it close to the top of the green section on a PC. Also, adjust the number of processors, ideally half of the available ones. Click Next when settings are configured.



#### 4. Hard Disk:

Indicate the location of the virtual machine file you downloaded. Choose 'Use an existing virtual hard disk file,' click the icon next to the menu, and add the .vdi file. Confirm your selection in the summary window and click Finish.



#### 5. Follow Ubuntu Installation Wizard:

Follow the on-screen instructions to install Ubuntu. Choose language, keyboard layout, and select "Install Ubuntu." Follow the prompts for time zone, user account, and installation type.

## 6. Complete Installation:

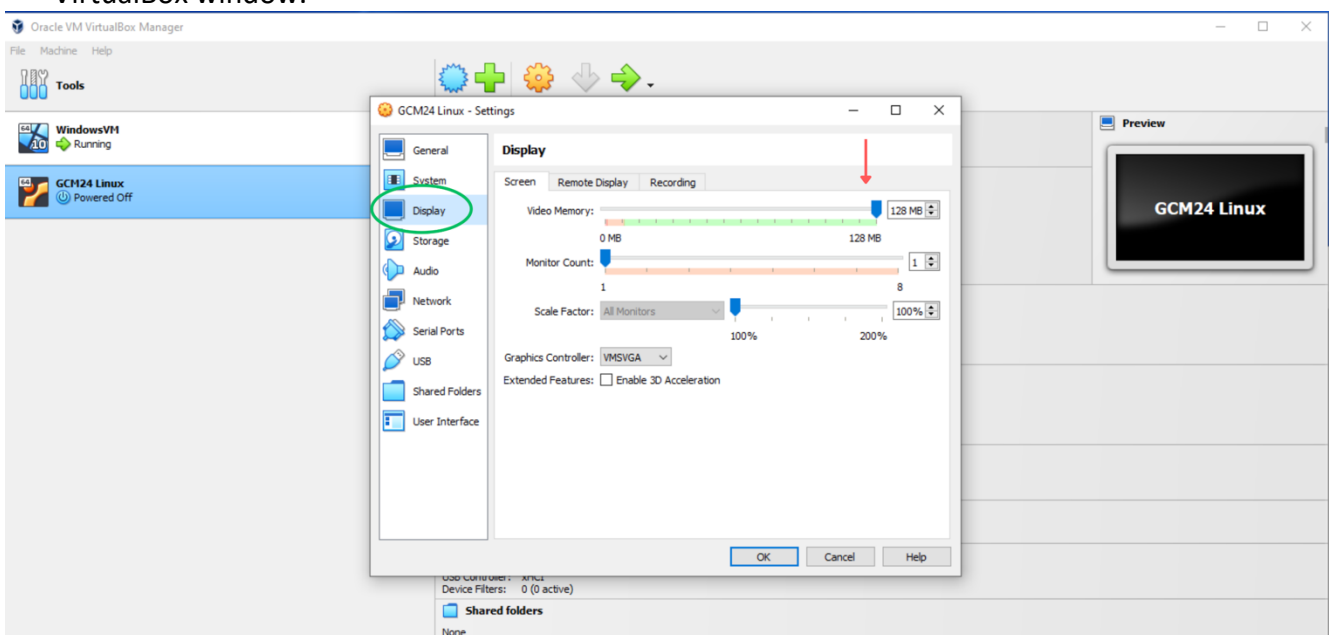
Allow the installation process to complete. Possibly, VM Box might ask you to restart the virtual machine. Double-check your choices in the confirmation window. Once satisfied, start the virtual machine by highlighting its name and clicking the 'Start' icon in the manager window.

## 7. Adjust Screen Size:

The screen resolution should automatically adjust to match your VirtualBox window size. If it doesn't, you can manually adjust the screen size in the Ubuntu VM.

Go to "Settings" > "Displays" in the Ubuntu system settings.

You should see different screen resolutions available. Select the desired resolution that fits your VirtualBox window.



## 8. Login Ubuntu:

The virtual machine will go through a boot process. After a short time, a window will appear.

**Note:** For this course, the user account is named '**manager**,' and the password, if required, is also '**manager**'.



## Running and Managing VMs (Optional)

Adjusting the screen size in an Ubuntu virtual machine (VM) within VirtualBox involves installing and configuring the VirtualBox Guest Additions. By installing VirtualBox Guest Additions, you enable features like automatic screen resizing, improved graphics performance, and seamless mouse integration between your host machine and the Ubuntu VM. Here are the steps to achieve this:

### 1. Start Ubuntu VM:

Ensure that your Ubuntu VM is running.

### 2. Insert Guest Additions CD:

In the VirtualBox menu, go to "Devices" and choose "Insert Guest Additions CD image." This action virtually inserts the Guest Additions CD into your Ubuntu VM.

### 3. Open Terminal:

Open a terminal window in Ubuntu. You can do this by pressing 'Ctrl + Alt + T' or using the application launcher.

### 4. Navigate to the CD Directory:

Change to the directory where the Guest Additions CD is mounted. This is often located in the '/media' directory. Use the following command to navigate to the directory:

```
bash
```

[Copy code](#)

```
cd /media/$USER/VBox_GAs*
```

**Note:** The directory name may vary based on your VirtualBox version.

### 5. Run Guest Additions Installer:

Run the Guest Additions installer by entering the following command in the terminal:

```
bash
```

[Copy code](#)

```
sudo ./VBoxLinuxAdditions.run
```

**Note:** You may be prompted to enter your password.

### 6. Follow Installation Wizard:

The Guest Additions installer will launch an installation wizard. Follow the prompts to complete the installation.

### 7. Reboot Ubuntu VM:

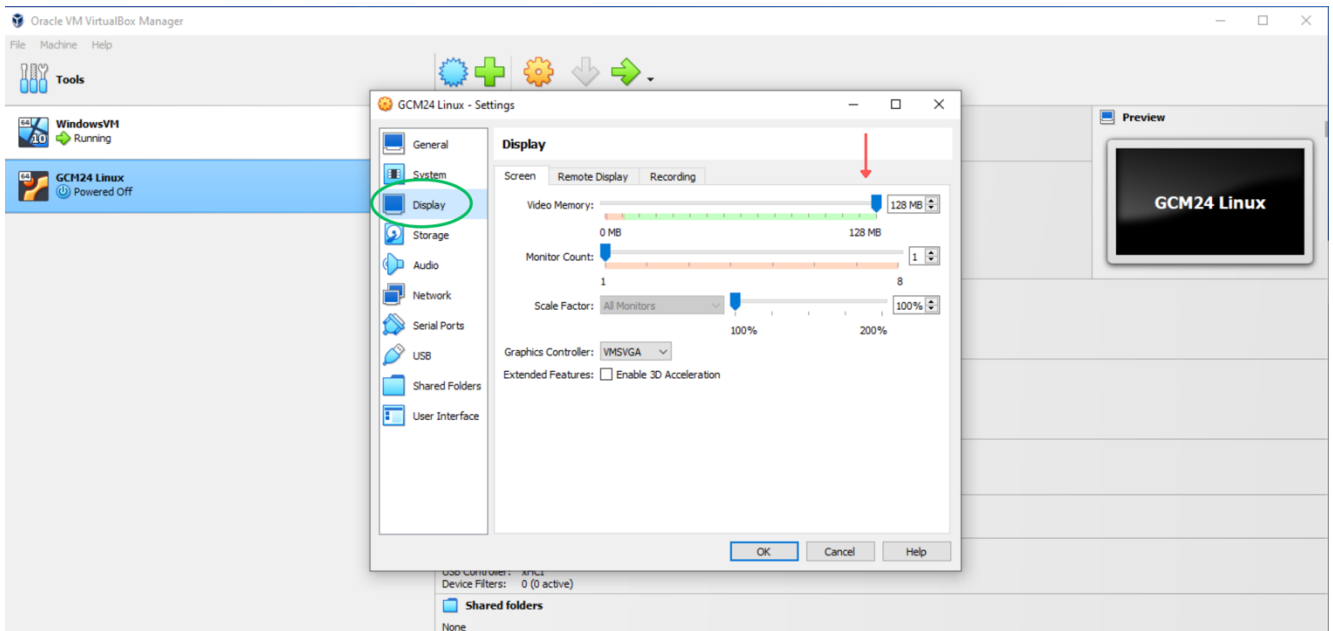
After the installation is complete, it's recommended to reboot your Ubuntu VM to apply the changes.

### 8. Adjust Screen Size:

Once the VM has restarted, the screen resolution should automatically adjust to match your VirtualBox window size. If it doesn't, you can manually adjust the screen size in the Ubuntu VM.

Go to "Settings" > "Displays" in the Ubuntu system settings.

You should see different screen resolutions available. Select the desired resolution that fits your VirtualBox window.



### 9. Verify Changes:

Confirm that the screen resolution has changed and suits your preferences.

### 10. Manage VM Settings:

In the VirtualBox Manager, you can manage VM settings by selecting the VM and clicking on "Settings." Here, you can adjust parameters such as RAM allocation, processors, and storage.

### 11. Snapshot and Clone:

VirtualBox allows you to take snapshots of your VM at different states, providing a backup mechanism. You can also clone VMs for testing or development purposes.

### 12. Shut Down and Save State:

Properly shut down your VM when finished, either by choosing "Shut Down" from within the guest OS or by selecting the VM in the VirtualBox Manager and clicking the "Close" button. Optionally, you can save the machine state to resume exactly where you left off.

**Beware:** Saving the machine in state to resume is not very robust, there is a very high chance Virtual Box might crash or not resume from the same point it was paused at, therefore it is advised to save all file and then "shut down" the VM.

## Additional Resources and Troubleshooting for Virtual Box

- Virtual Box Documentation: <https://www.virtualbox.org/wiki/Documentation>
- Virtual Box Manual: <https://www.virtualbox.org/manual/ch01.html>
- Virtual Box Forum: <https://forums.virtualbox.org/index.php> (helpful for finding similar problem queries and solutions)

- Ubuntu Documentation: <https://help.ubuntu.com/>
  - Ubuntu Community Support: <https://ubuntu.com/support/community-support>
  - Stack overflow: <https://stackoverflow.com/> (Public Q&A platform for debugging)
  - Bioinformatics (BioStars) Forum: <https://www.biostars.org/t/Forum/> (General Bioinformatics queries)
-