

Virtual labs, Simulations or Interactive Learning Objects

General

- Merlot virtual labs (Biology, Chemistry, Physics, Environmental Science, Engineering, Math) <https://virtuallabs.merlot.org/>
- PHET simulations (Physics, Chemistry, Earth Science, Math, Biology): https://phet.colorado.edu/_m/

Astronomy

Introduction to Astronomy:

- Astronomy Simulations and Animations: Flash animations and simulations for astronomy education. Topics include seasons, moon phases, coordinate systems, light, and more. These animations require the flash player <https://astro.unl.edu/animationsLinks.html>
- A Compilation of Free Laboratory Activities for Astronomy 101 Courses: <https://www.oercommons.org/authoring/18513-a-compilation-of-free-laboratory-activities-for-as/vi>
[ew](https://www.oercommons.org/authoring/18513-a-compilation-of-free-laboratory-activities-for-as/vi)

Biology

Introduction to Biology:

- Lab safety: www.ncbionetwork.org/iet/labsafety
- Microscope: <https://www1.udel.edu/biology/ketcham/microscope/scope.html>
- Cell size and scale: <https://learn.genetics.utah.edu/content/cells/scale/>
- Biology corner provides a list of virtual labs by Glencoe https://www.biologycorner.com/worksheets/virtual_labs_glencoe.html
- General: Virtual Labs Biology Collection: https://learningcenter.nsta.org/mylibrary/collection.aspx?id=IdPT0QtY/w_E

Chemistry of Life

- Organic molecules (carbohydrate, lipid, protein) <http://www.occc.edu/biologylabs/Documents/Organic%20Compounds/Organic%20Compounds.htm>

Cell and membrane:

- Membrane channels: <https://phet.colorado.edu/en/simulation/membrane-channels>

- Osmosis and Diffusion: http://www.phschool.com/science/biology_place/labbench/lab1/intro.html

Metabolism:

- Enzyme controlled reaction: http://glencoe.mheducation.com/sites/dl/free/0078759864/383930/BL_11.html

Photosynthesis:

- Effects of light on plant growth: http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS12/LS12.html

Cell division

- Mitosis: https://bio.rutgers.edu/~gb101/lab2_mitosis/index2.html

Sexual reproduction

- Meiosis: https://bio.rutgers.edu/~gb101/lab10_meiosis/meiosis_web/index10.html

Patterns of inheritance

- Mendelian genetics: <http://star.mit.edu/genetics/index.html>

Molecular biology

- DNA extraction: <https://learn.genetics.utah.edu/Content/labs/extraction/>
- DNA microarray: <https://learn.genetics.utah.edu/content/labs/microarray/>
- Gel Electrophoresis: <https://learn.genetics.utah.edu/content/labs/gel/>
- RNA: <https://www.pbs.org/wgbh/nova/labs/lab/rna/research#/vlab/home>

Chemistry

- Open learning initiative: <https://oli.cmu.edu/?s=COVID-19>
- The Virtual Lab is an online simulation of a chemistry lab. It is designed to help students link chemical computations with authentic laboratory chemistry. The lab allows students to select from hundreds of standard reagents (aqueous) and manipulate them in a manner resembling a real lab: http://chemcollective.org/activities/type_page/1
- Phet chemistry: <https://phet.colorado.edu/en/simulations/category/chemistry>
- Oxford virtual chemistry: <http://www.chem.ox.ac.uk/vrchemistry/labintro/newdefault.html>
- *Virtual Chemistry Experiments* are a collection of interactive web-based chemistry tutorials. The current generation of tutorials (currently in development) are based upon HTML5 and run on most modern web browsers: <https://www.chm.davidson.edu/vce/>

Computer Science

- <https://www.netacad.com/courses/packet-tracer>
 - CCNA R&S Curriculum
 - CCNA Security
 - Cybersecurity Essentials
 - Introduction to IoT

- Introduction to Packet Tracer
- IoT Fundamentals
- IT Essentials
- Mobility Fundamentals
- Networking Essentials
- <https://developer.cisco.com/docs/sandbox/>
 - DevNet Sandbox makes Cisco's free spread of technology available to developers and engineers by providing packaged labs we call Sandboxes.
 - There are two types of sandboxes, Always-On and Reservation. Each sandbox typically highlight one Cisco product (think, CallManager, APIC, etc). Sandboxes can be used for development, testing APIs, learning how to configure a product, training, hack-a-thons, and much more!

Environmental Science

- UCAR provides a a directory of educational **games**, **simulations**, and **virtual labs** related to **Weather**, **Climate**, **Atmospheric Science**, and the **Sun and Space Weather**: <https://scied.ucar.edu/games-sims-weather-climate-atmosphere>
- Edumedia's environmental science and ecology: <https://www.edumedia-sciences.com/en/node/51-ecosystems>

Geology

- Geology online labs: <https://www.sciencecourseware.org/GLOL/>
- <http://onlinelabs.in/geology>
- Teaching Geoscience Online: https://serc.carleton.edu/NAGTWorkshops/online/lab_activities.html

Human Anatomy

- <https://www.visiblebody.com/en-us/anatomy-and-physiology-apps/human-anatomy-atlas>
- eSkeleton: <http://www.eskeletons.org/>
- Virtual open heart surgery: <http://www.abc.net.au/science/lcs/heart.htm>
- Zygote body: <https://www.zygotebody.com/>
- Arcade anatomy: <http://www.anatomyarcade.com/>
- Amrita Rodent Anatomy: <http://vlab.amrita.edu/?sub=3&brch=295>
- The Howard Hughes Medical Institute (HHMI) is an independent science philanthropy that invests in biomedical scientists and science educators to advance both human health and our fundamental understanding of biology: <https://www.biointeractive.org/>
- The Virtual Labs Project began in 1998 with funding from the Howard Hughes Medical Institute to create online interactive media which help students learn difficult concepts in human biology: <http://virtuallabs.stanford.edu/>
- At home labs: <https://learning-center.homesciencetools.com/article/heart-dissection-project/>

- An Online Examination of Human Anatomy and Physiology
<http://www.getbodysmart.com/>
- <https://www.innerbody.com/html/body.html>
- Study tool <http://www.anatomyarcade.com/>
- Resource site for teachers and students of Anatomy and Physiology. Find quizzes, diagrams, and slide presentations on structures, functions, and systems.
<http://anatomycorner.com/main/>

Oceanography

- Characteristic of the ocean floor:
http://www.glencoe.com/sites/common_assets/science/virtual_labs/ES18/ES18.html
- Ocean current: <https://spaceplace.nasa.gov/ocean-currents/en/>
- Plate tectonics: <https://phet.colorado.edu/en/simulation/legacy/plate-tectonics>
- A "Virtual" Tour of On-Line Resources for Earth Science Education (land topography, ocean bathymetry, ocean tides, ocean temperature, weather & climate etc. :
<https://archive.bigelow.org/virtual/index.html>

Physics

- Phet physics: <https://phet.colorado.edu/en/simulations/category/physics>
- Amrita physic virtual labs: <https://vlab.amrita.edu/?sub=1&brch=195>
- [Daniel V. Schroeder Physic](http://physics.bu.edu/~duffy/HTML5/index.html) simulations: <http://physics.bu.edu/~duffy/HTML5/index.html>