

## **Independent Research Resources**

[\*\*Independent Generation of Research \(IGoR\)\*\*](#) - IGoR provides a platform for people to pool their knowledge, resources, time, and creativity so that everyone can pursue their own scientific curiosity.

[\*\*Virginia Junior Academy of Science Resource Library\*\*](#) - Extensive collection of open-access resources for students in Biology & Medicine, Botany, Ecology, Environmental Sciences, Chemistry, Engineering and Physics

[\*\*The Society for Science and the Public Science Project Resources\*\*](#) - A catalog of science resources that can support your quest to learn and do science

[\*\*Science Buddies\*\*](#) - Ideas for science projects

## **Teacher resources**

[\*\*National Center for Science Education Scientist in the Classroom\*\*](#) - Platform allows teachers to request classroom visits from scientists

[\*\*Genetics Education Outreach Network \(GEON\)\*\*](#) - Network of genetics professionals

[\*\*HHMI BioInteractive Data Points\*\*](#) - Explore and interpret primary data from published research

[\*\*Biotech in a Box Loan Kits\*\*](#) - Shipped to your school from Fralin Life Sciences Institute at Virginia Tech

## **Demonstrations/Simulations**

[\*\*Genetic Science Learning Center\*\*](#)- Simulations, videos and interactive activities that explore genetics, cell biology, neuroscience, ecology and health

[\*\*Remotely Accessible Instruments for Nanotechnology \(RAIN\)\*\*](#) - Access and control nanoinstruments over the Internet in real-time with the assistance of an experienced engineer

[\*\*PhET Simulations\*\*](#) - Interactive STEM simulations for all grade levels

[\*\*HHMI BioInteractive Interactive Media\*\*](#) - Recommendations: *Virus Explorer*, *Exploring Trophic Cascades*; *Alzheimer's Disease: Piecing Together the Evidence*; *CSI Wildlife*; *WildCam Lab*; *Electrical Activity of Neurons*; *The Eukaryotic Cell Cycle and Cancer*; *Earth Viewer*, *Sampling and Normal Distribution*

[\*\*Virtual Microscopy\*\*](#) - 17 virtual microscopes students can use to view specimens

[\*\*Interactive METEOSAT\*\*](#) - web-based interactive application, developed for ESA's Earth Observation educational activities, for the teaching of satellite meteorology

[\*\*Xplore Health\*\*](#) - 8 disease simulation games

## Virtual labs (by field)

### Multiple fields

[SAS Curriculum Virtual Labs](#) - In depth labs covering [Biology](#), [Physics](#), [Chemistry](#), [Earth & Space](#)

[Math, Physics and Engineering Applets](#) - Java applets designed to help students visualize important concepts in mathematics and physics

### Astronomy

[Circumstellar Habitable Zone Simulator](#) - Explore basic conditions necessary for life to exist in the universe

[Galaxy Crash](#) - Make predictions on how galaxies form and evolve

[The Faulkes Telescope Project \(free but requires booking\)](#) - Provides access to a global network of robotic telescopes

[Blackbody Radiation Lab](#) - allows users to perform real experiments from a remote location

[Star in a Box](#) - Interactive webapp which animates stars with different starting masses as they change during their lives

[WorldWide Telescope](#) - Allows you to explore real images obtained from some of the world's most advanced telescopes

[The Nebraska Astronomy Applet Project](#) - 15 astronomy labs

### Biology

[Learn.Genetics](#) - 4 core labs that teach basic genetics and molecular biology techniques

[HHMI BioInteractive Virtual Labs](#) - Collection of excellent labs covering genetics, evolution and physiology

[WOW Biolab - ClassZone](#) - Simple labs that cover a wide range of topics. Recommend: *Investigating Bacterial Growth & Bacterial Transformation*; *Breeding Mutations in Fruit Flies*; *Gel Electrophoresis*; *Testing Antibacterial Agents*; *Exploring Plant Responses*

[Virtual Urchin](#) - Learn about microscopy, development and environmental influences with these detailed sea urchin lab

[Biology Labs Online](#) - 12 excellent interactive labs Recommendations: *FlyLab*; *EnzymeLab*; *EvolutionLab*; *MitochondriaLab*

[McGraw Hill Virtual Lab Exercises](#) - 21 biology labs covering genetics, anatomy and physiology, ecology, and experimental design

[Pearson LabBench Activities](#) (requires login) - 12 biology labs with detailed descriptions and animations of concepts and experimental design

[Stanford Virtual Labs Media Library](#) - Set of virtual biology labs to help students learn difficult concepts

[WISC Online Biology Labs and Simulations](#) - Recommendations: *How to Use a Microscope*; *How the Brain Develops*; *Metabolic Pathways*; *Microbial Flora in Body Sites*; *Correlation of Colony Morphology with Gram Stain Results*; *12 Cranial Nerves*; *The Anatomy of the Heart*

[CSHL Virtual DNA Labs](#) - From the DNA Learning Center at Cold Spring Harbor

[pHET Biology Simulations](#) - Recommendations: *Neuron*; *Gene Expression - The Basics*; *The Lac Operon*

## Virtual labs (by field)

### Biology - continued

[Osmotic Power Lab](#) - This lab can be used to grasp the concepts of power generation in an osmotic power plant. It is based on a simple model which incorporates geographical parameters

[DNA to Protein](#) - Explore how the code embedded in DNA is translated into a protein

[Protein Folding](#) - Explore how hydrophobic and hydrophilic interactions cause proteins to fold into specific shapes

[How are drugs developed?](#) - Drug development from its initial design up to when it is brought onto the market

[Neuronal Stimulation](#) - Stimulate a neuron and observe the ions as they move across the neuron membrane

### Chemistry

[Virtual Chemistry](#) - Labs covering multiple chemistry topics including Atomic Structure, Kinetics, Crystal Structure, and Thermodynamics

[ChemCollective Virtual Labs](#) - Labs to help students link chemical computations with authentic laboratory chemistry

[ChemCollective Simulations](#) - Interactive simulations help to visualize difficult chemistry concepts and phenomena

[Chemistry Solutions](#) - Series of 10 chemistry simulations from the American Association of Chemistry Teachers

[Building Atomic Orbitals](#) - Build atomic orbitals according to the general principles involved and you will also be able to visualize their shapes

[Building Organic Molecules](#) - Build molecules from atoms and visualize them in 3D

[Naming Organic Molecules](#) - Using the naming organic molecules lab you can select from a list of numbered molecules and practice in naming them

[Reactivity of Metals](#) - Use salt solution to study the relative reactivity of metals

[Chemical Equilibrium](#) - Study the shift in equilibrium between ferric and thiocyanate ions by altering concentrations

[Properties of Acids and Bases](#) - Perform experiments to observe the properties of acids and bases

[Use NMR Spectroscopy to determine molecular structure](#) - In the applet, NMR spectra are correlated with a rotatable 3D molecular structure, showing how to connect the resonances, or peaks, in a spectrum with the sets of C atoms that are in unique environments in a molecule.

[General Chemistry Interactive Simulations](#) - Basic chemistry simulations from SUNY Oneonta

[Chemistry Experiment Simulations and Conceptual Computer Animations](#) - Chemistry simulations from Iowa State University

[Chemistry Experiment Simulations](#) - Provided by Missouri University of Science and Technology

[WISC Online Chemistry Labs and Simulations](#) - Recommendations: *Energy in Chemical Reactions; Shapes of Simple Molecules - Part 1 & 2*

[pHET Chemistry Simulations](#) - Recommendations: *States of Matter; Isotopes and Atomic Mass; Molecule Shapes; Nuclear Fission*

## Virtual labs (by field)

### Mathematics

[Academo Maths Simulations](#) - Collection of 22 virtual math demonstrations

[pHET Math Simulations](#) - Recommendations: *Trig Tour*; *Calculus Grapher*; *Curve Fitting*; *Equation Grapher*; *Graphing Lines*

### Physics

[Simple pendulum](#) - An interactive demonstration of a simple pendulum

[Electric field line simulator](#) - An interactive demo showing the behaviour of electric field lines around positive and negative point charges

[ATLAS-MINERVA](#) - Tool developed to help students learn more about the ATLAS experiment and particle physics at CERN

[The Photoelectric Effect](#) - The applet permits data acquisition for simulated photoelectric effect experiments.

[pHET Physics Simulations](#)

[Physics Interactives](#) - From the online Physics Classroom

## Remote & Citizen Science Projects

[Bat Detective](#) - Identify and classify bat calls to track bat populations around the world

[Bee Germs](#) - Map sites of ground nesting bees and monitor their diseases

[Chimp&See](#) - Watch, annotate and discuss camera trap videos to help identify African species, their behaviors & unique chimpanzees

[Colony B](#) - Help analyzing microbiome data from the American Gut project by identifying clusters of bacteria

[Cyclone Center](#) - Analyze tropical storms to help create a new database of information about cyclones, which will help climatologists better estimate the intensity of future storms

[Disk Detective](#) - Help sort out which stars have debris disks, which can be confused by computers with other astronomical objects

[Floating Forests](#) - Help to find these kelp forests in pictures from space

[Galaxy Zoo](#) - Help understand how galaxies formed by classifying them according to their shapes. If you're quick, you may even be the first person to see the galaxies you're asked to classify

[Globe.gov](#) - A worldwide community of students, teachers, scientists, and citizens working together to better understand, sustain, and improve Earth's environment at local, regional, and global scales.

[Higgs Hunters](#) - Uncover the building blocks of the universe

[iNaturalist](#) - Online social network of people sharing biodiversity information to help each other learn about nature

[Meteorological Phenomena Identification Near the Ground \(mPING\)](#) - A project to collect weather information from the public

[NASA Terra Citizens and Remote Sensing Observation Network \(CARSON\)](#) - explore satellite data to make wide-scale environmental observations

[Penguin Watch](#) - Exactly as delightful as it sounds

[Planet Four](#) - Help map the exotic terrains of Mars' south pole with our new project

[Planet Hunter](#) - help inspect and confirm possible unknown planetary candidates from Kepler observations

[Plankton Portal](#) - Identify plankton in images taken by an underwater imaging system

[Snapshot: Serengeti](#) - Assist with the Serengeti Lion Project's conservation efforts

[WildCam Gorongosa](#) - Contribute to conservation efforts by identifying Gorongosa's animals in trail camera photos

## Remote & Citizen Science Projects

### [Zooniverse Live Projects](#)

- [Amazon Aerobotany](#) - Help hunt for isolated hot stars in nearby galaxies using Hubble Space Telescope
- [Comet Hunters](#) - Help discover new comets hidden in our Solar System's asteroid belt
- [Fossil Finder](#) - Join in the search and discovery of fossils at Lake Turkana, Kenya.
- [Gravity Spy](#) - Help scientists at LIGO search for gravitational waves, the elusive ripples of spacetime.
- [Hubble's Hot Stars](#) - Help monitor the biological rhythms and life cycles of rainforest trees
- [Jungle Rhythms](#) - Transcribe hand recorded observations of a trees' rhythmic life cycle
- [Mapping Change](#) - Use over a century's worth of specimens to map the distribution of animals, plants, and fungi
- [Microscopy Masters](#) - Help build detailed models of biological molecules by marking electron microscopy images
- [Milky Way Project](#) - Find and measure infrared "bubbles" in images from the Spitzer Space Telescope and WISE satellite observatory
- [Planet Four: Terrains](#) - Help planetary scientists characterize surfaces on Mars by examining images taken with the Context Camera
- [Popping Galaxy](#) - Measure the amplitude and identify the type of galactic warp to help better understand how galaxies evolve on different environment
- [Radio Meteor Zoo](#) - Help identify meteors in radio data
- [Supernova Hunters](#) - Help improve our understanding of supernovae and improve detection algorithms by classifying detections as real or false
- [Western Shield Camera Watch](#) - Help keep a watchful eye on Western Australia's conservation efforts
- [Whales as Individuals](#) - Help identify individual humpback whales by clueing computer algorithms into patterns on their tails