



IDEAS FOR SCIENCE FAIR PROJECTS

Jr/Sr Research Project Ideas

This document includes ideas for projects that can be performed at home or school.

ISEF Presentation: [Research at Home: Life Science Edition](#)

Process for Conducting Research at Home: ACCESS

- Ask good questions
- Choose an appropriate model organism
- Collect quantitative data
- Explore simple and available technology
- Seek the use of statistical analysis programs
- Share and pursue scientific thinking

A good place to start students thinking about research topic ideas is by using [“Science News”](#)

Ideas for Model Organisms

Animals

- [Pill bugs](#) (learning and memory, classical association)
- [Fruit flies](#) (developmental biology, behavior)
- [Planaria](#) (cell proliferation)
- [Bean Beetles](#) (ecological resource sharing – bean to beetle ratio; behavior, development)
- [Brine shrimp](#) (environmental science)
- [Lumbriculus worms](#) (Youtube: <https://youtu.be/3xd1bnx42dM?feature=shared> ; NIH article: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8380063/>)

Fungi

- [Yeast](#) (cell division, cell science)
- [Slime molds](#) (behavior)
- Edible mushrooms ([American Chemistry Society article](#))

Plants

- [Scallion onions](#) or [Garlic](#) (root tip experimentation)
- [Red Peppers](#) (health, biomedical)
- [Citrus](#) (ascorbic acid)
- [Legumes](#) (health benefits, biomedical)
- [Wisconsin Fast plants](#) (growth, cell development)
- [Herbs](#) (medicinal)
- [Radishes](#) (enzymes)

Examples of Experiments

- Cell regeneration (plant hormones) using phototropism, chemotropism, gravitropism/geo, hydrotropism, thigmotropism, chromotropism
- Plant Physiology- research membrane transport system of plants, guard cell metabolism (observe guard cells by lifting imprint off leaves with tape and nail polish)
- Seed development- growing seeds for drought tolerance, turf grasses, various yard grasses, crops
- Choice chambers with petri dishes or bottles with PVC connector- allow flies to make choice using chambers, collect flies and then see if offspring have the same behaviors
- Can extract pigments and do chromatography experiments
- Can use Wisconsin Fast plants for genetic studies
- Cell phones can be used for photo microscopy (ex. planaria)
- Can photograph onion cells with cell phone through microscope
- Math modeling- Ex. pollution analysis, organ/tissue modeling, modeling of protein networks inside cells, GIS of hazard areas like where tornadoes are most likely or if impenetrable cover happens, what flood risk arise,- use open source data
- [WeatherSTEM app](#)- soil moisture, water temperature
- Water analysis- relate to algal blooms, river ecology, erosion, plant life barriers, soil invertebrate biodiversity

- Environmental survey projects– put down a measuring tape 1 m long in a wooded area and identify every plant (and how many of each plant) within 10 cm of either side of the tape. Repeat in a nearby area “claimed” by humans, and on the transition zone between the two areas (riparian). Do a species diversity analysis.
- Collect ball moss from trees and from the ground. Dunk each ball moss in a bucket of water and collect all the little invertebrates that come out of the ball moss. Identify all the invertebrates (and how many of each kind) for each ball moss. Compare ones on the ground to ones from the trees.
- Sit quietly in a park. Count how many people do certain activities. Change times of day and repeat.
- Sit quietly in a park. Count how many people come/go over the same time as how many birds come/go.

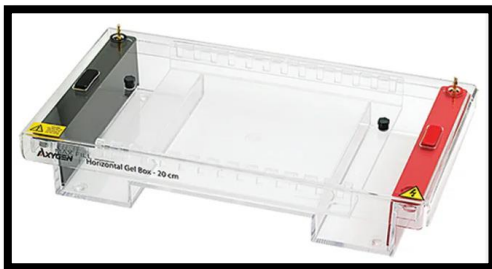
Some schools might be able to help students with resources for projects at home by starting a lending program for supplies – microscopes, balances, plasticware, petri dishes, safe chemicals, fruit fly vials, test tubes, etc.

Mississippi State University office of K-12 Outreach has the following items that can be loaned for a student’s science fair project. The **teacher MUST check out the items** for the student. Application [here](#)

- Vernier spectrophotometers (wavelength/spectral analysis)



- Gel Electrophoresis kit for testing dyes/stains



- Binoculars (bird/environmental research)



- Neuron SpikerBox (<https://backyardbrains.com/products/spikerbox>)



- [Vernier Go Direct Sound Sensor](#)



ISEF Presentation: [Research At Home: Big Data and Engineering Edition](#)

Challenge your students to use big data and interpret it using online resources in a way that is new.

- Data Sources: Earth Explorer- geological and geographical data- <https://earthexplorer.usgs.gov/>
- NASA Geoscience Data- <https://pds-geosciences.wustl.edu/>
- NASA Image Data- <https://photojournal.jpl.nasa.gov/>
- NOAAData- oceans, weather, climate- <https://data.noaa.gov/datasetsearch/>

- CDC Disease Data- <https://data.cdc.gov/>
- Infrared Astronomy Data- <https://irsa.ipac.caltech.edu/frontpage/>
- TinkerCAD: This is a free online app for 3D design, electronics, and coding. <https://www.tinkercad.com/>
- Mike Carapezzo shared links to worksheets he uses with his students to work with [TinkerCAD](#), [engineering design](#), and [Arduino](#) activities.
- [KEGG Pathway Database](#)
- [NIH Human Microbiome Project](#)
- [Tidy Data Formatting](#)
- [The Educational Opportunity Project at Stanford University](#)
- [Mississippi State University Libraries](#)
- [Harvard Dataverse](#)
- [HIV NIH Database](#)
- [United States Census Bureau](#)
- [Springer Nature Biomed Central](#)
- [Springer Journals](#)
- [US Department of Energy](#)
- [Google Scholar](#)
- [Wolters Kluwer/Medknow open access journal](#)
- [United States Environmental Protection Agency](#)
- [PLOS Open Access journals](#)
- [National Library of Medicine](#)
- [Science](#)
- [EBSCO Free Database](#)
- [Science Daily](#)
- [National Academies](#)
- [JSTOR](#)
- [Vertebrate Genome](#)
- [ATCC Genome Portal](#)
- [GenePattern Portal](#)
- [Our World in Data](#)
- [Protein Database](#)
- [America's Health Rankings](#)
- [ISEF Large Data Sets](#)
- [Eureka Alert!](#)
- [New England Journal of Medicine \(work on this\)](#)
- [Teach Thought Search Engines](#)
- [Rasmussen University Education Search Engines](#)
- [Pacific University Search Engines](#)

- [List of Academic Databases and Search Engines](#)
- [CDC Morbidity and Mortality Weekly Report](#)
- [IEEE Publications](#)
- [Genetic Engineering and Biotechnology News](#)

ISEF Research at Home Web Page:

<https://www.societyforscience.org/research-at-home/>

Additional Resource Suggestions

Zotero— free citation manager plugin that integrates with Microsoft Word and Google- <https://www.zotero.org/>

Life Sciences

- Image J- Freeware that can be used to analyze images (coverage or band intensity)
- Plant Snap Phone App- <https://www.plantsnap.com/> (plant identifier)
- Google Lens- <https://lens.google.com/> (plant and animal identification)
- Cardiograph- heart rate app
- GenomicScape- <http://www.genomicscape.com/> and Expression Atlas- <https://www.ebi.ac.uk/gxa/home> (These are just a few of the gene expression data sets and analysis tools that are available online. Students can research about a disease/condition of interest, learn how to use the analysis tools and then mine the available data sets to discover new information or test a theory they come up with during their research. There are DNA, RNA, miRNA and protein data sets available and more data is added all the time. These are most likely high school level projects.)
- Biological buffers pKa calculator- <http://www.reachdevices.com/Protein/BiologicalBuffers.html>
- Systems Biology Graphical Notation Information- <https://sbgn.github.io/>
- The virtual cell software— used for graphically and/or mathematically depicting cell physiology or intracellular signaling- <https://vcell.org/run-vcell-software>
- Compound (including commonly use fluorophores) spectral database- [University of Texas Libraries](#)
- MouseGenome Informatics- <http://www.informatics.jax.org/>
- RatGenome Database- <https://rgd.mcw.edu/>
- Genomic epidemiology of coronavirus- <https://nextstrain.org/ncov/global>

- Genotype Tissue Expression Portal (GTEx)- Recently updated for 54 tissue types, students can analyze patterns of gene expression by tissue <https://gtexportal.org/home/>
- Neuron SpikerBox Bundle to measure electrical spikes (action potentials) in invertebrates PBS Special on Slime Molds <https://backyardbrains.com/products/spikerboxBundle>
- [Abuzz Mosquito monitoring project](#)
- Research At A Distance Opportunity- [Real World Wolbachia Project](#)
- Livecams of different ecosystems and organisms: [Smithsonian National Zoo](#), [Aquarium of the Pacific](#) , [The Nature Conservancy](#), [Open Oceans](#), [South African National Parks](#), [Kruger National Park South Africa](#)
- PBS Special on Slime Molds <https://www.kpbs.org/news/2020/sep/15/nova-secret-mind-slime/>
- [Cornell Lab Merlin Bird app](#)
- [CDC Web-based Injury Statistics Query and Reporting System](#)

Physical Sciences

- PhyPhox- <https://phyphox.org/> (sensors for physics experiments)
- EchoEarth International- www.earthecho.org
- Citizen Science- www.citizenscience.gov/# (U.S. Government Website with numerous citizen scientist projects)
- ISTE- International Society for Technology in Education- www.iste.org (search citizen science, numerous resources including using smart phone for project)
- NASA- science.nasa.gov/citizenscience
- National Geographic- www.nationalgeographic.org/idea/citizen-science-projects/
- [Arduino Kits](#)
- [Raspberry Pi](#)
- Book on Chemistry of Cooking- [Chemical reactions: everyday chemistry of cooking](#)
- Book on Chemistry of Cooking- [What einstein told his cook](#)
- Virtual Chemistry and Simulations <https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html>
- PhETSimulations <https://phet.colorado.edu/en/simulations/filter?subjects=physics&sort=alpha&view=grid>
- Modeling Environment for Simulations <https://ccl.northwestern.edu/netlogo/>
- [Girls Who Code Club](#)

Motivational stories

- [Our Hypochlorous Story](#) (warning: graphic wound pictures)
- [Three Awesome High School Science Projects](#)
- [Let the Science Fair Begin Science Fair: The Series](#)
- [Science Fair Documentary](#)
- [NASA Jet Propulsion Laboratory 'How to do a Science Fair Project'](#)
- [The Science Fair Effect - how youths are reinventing our world](#)
 - [Jessie MacAlpine Website](#) and [Early Career Leadership Spotlight: Jessie MacAlpine](#) (also on Research Gate: <https://www.researchgate.net/profile/Jessie-Macalpine>)
- [Sustainable Development Goals](#)

Phone apps

- [Turbo Future science apps](#)
- [Popular Science science apps](#)
- [Arduino Science Journal](#)
- [Exploratorium Science Journal](#)