



## GENIUS Science – Student Guide

GENIUS Science challenges students to investigate environmental problems through scientific research and develop evidence-based understanding, solutions, technologies, or innovations.

Strong projects identify a clear problem or research question, use appropriate scientific or engineering methods, collect and analyze evidence, and reach meaningful conclusions.

GENIUS Science projects must include **original experimental results or the development and testing of an engineering solution or prototype**; projects based only on hypothetical research questions, proposed experiments, or untested solutions will not be accepted.

Students may submit projects in one of five categories:

- **Environmental Quality**
  - **Ecology and Biodiversity**
  - **Resources and Energy**
  - **Human Ecology and Social Sciences**
  - **Innovation**
- Some projects naturally overlap categories. When you are not sure which category to choose, select the category that best represents the main research question and primary work performed by the student. Category selection in science discipline does not impact your evaluation.
  - Every GENIUS Science project must have a meaningful connection to the environment or sustainability.
    - Medical projects are accepted if there is an environmental connection with the medical issue researched.
  - **What Makes a Strong GENIUS Science Project?**
    - A clearly defined environmental problem or research question
    - Appropriate background research
    - A logical scientific, engineering, or social-science methodology
    - Original student investigation or design
    - Data, observations, testing, or measurable results
    - Analysis and interpretation of results
    - Understanding of limitations
    - Evidence-based conclusions

### SCIENCE | Environmental Quality

- This category focuses especially on environmental pollution, how it can be measured or controlled, and how it may affect human health, ecosystems, or quality of life.
- Most **chemistry or medical** related projects might be submitted under this category.
- **Choose environmental quality category** if your project primarily investigates pollution, environmental contamination, environmental health, monitoring, treatment, or remediation.
- Projects may study (this list serves as an example, but not limits other related topics):

- Air Quality
- Water Quality
- Soil Quality
- Noise and Radiation
- Pollution Management and Remediation
- Impact of pollutants on humans, animals, and plant life

### SCIENCE | Ecology and Biodiversity

- Ecology and Biodiversity projects explore plants, animals, microorganisms, ecosystems, habitats, and the relationships among living organisms and their environments.
- Most **biological science** related projects might be submitted under this category
- **Choose ecology and biodiversity category** if your project primarily investigates organisms, populations, habitats, ecosystems, ecological relationships, or biodiversity.
- Projects may study (this list serves as an example, but not limits other related topics):
  - Populations and Communities
  - Examples include:
    - Population size, changes, relations
    - Ecosystems, health, productivity, nutrient movement
    - Biodiversity, genetics, microbiome, etc
    - Human impacts on ecosystems, overfishing, overfarming, urban development,
    - Climate Change and Biodiversity, migration, habitat loss, ocean changes, food webs,

### SCIENCE | Resources and Energy

- This category includes renewable and non-renewable resources and research aimed at improving efficiency while reducing environmental impacts.
- Most **physics, geology, and material science** related projects might be submitted under this category.
- **Choose resources and energy category** if your project primarily investigates energy, water, soil, minerals, natural resources, efficiency, conservation, or sustainable resource use.
- Projects may study (this list serves as an example, but not limits other related topics):
  - Energy sources, production, storage, efficiency, conservation, or environmental impact.
  - Natural resources, minerals, fossil fuels,
  - Reducing energy consumption
  - More efficient transportation
  - Improved energy storage
  - Waste-energy recovery
  - Environmental impacts of extraction
  - Reducing waste during production
  - Water reuse, water management, and soil resources
  - Soil degradation, erosion, restoration,

### SCIENCE | Human Ecology and Social Sciences

- Human Ecology and Social Sciences projects investigate the dynamic relationships between humans and their natural, social, economic, and built environments.
- **Psychology, behavioral economics, anthropology, sociology, education, public policy, economics, urban studies, human geography, sustainability studies** related projects can be submitted under this category.

- **Choose human ecology and social sciences category** if your project primarily investigates human behavior, society, economics, education, policy, culture, or environmental decision-making.
- Projects involving human subjects should use appropriate ethical procedures and protect participant privacy. When human subjects are used (interviews, surveys, observational or behavioral experiments), **IRB is required and must be included as part of the research paper.**
- Projects might study (this list serves as an example, but not limits other related topics):
  - Consumer behavior
  - Reuse and waste-reduction practices
  - Environmental attitudes
  - What motivates sustainable behavior
  - Environmental Education
  - Social Justice and Sustainability
  - Food security
  - Environmental health disparities
  - Quality of life
  - Environmental justice
  - Business, Economy, and Sustainability
  - Environmental Policy and Public Opinion
- Human Ecology and Social Sciences projects may use methods such as:
  - Surveys
  - Interviews
  - Behavioral experiments
  - Observational studies
  - Statistical analysis
  - Economic analysis
  - Comparative studies
  - Existing public datasets

## SCIENCE | Innovation

- Innovation projects focus on creating a new or significantly improved tangible product, device, system, or process that makes life better, healthier, more efficient, or more environmentally friendly.
- **Choose Innovation category** if your project primarily involves designing, building, and testing a new or significantly improved tangible product, technology, device, or process.
- Innovation begins with identifying a real problem and developing a practical solution.
- Students should not simply propose an idea. They should design, build, test, and evaluate their innovation whenever possible.
- Students should compare their innovation with an existing method, product, or baseline whenever possible.
- Depending on the project, students may test performance, energy efficiency, water efficiency, accuracy, speed, waste reduction, cost, user experience, environmental impact
- Projects may study (this list serves as an example, but not limits other related topics):
  - New devices, Tools, or Equipment
  - Engineering systems
  - Environmental technologies



- Waste-reduction systems
- Water-saving devices
- Energy-saving technologies
- Sustainable materials
- Improved household products
- Workplace solutions
- Agricultural technologies
- Monitoring devices
- Pollution-control technologies
- Healthier or safer alternatives to existing products
- Improve or redesign an existing process or products more efficient, less wasteful, healthier