

# Thinking About Continuation Projects & Making Adjustments for Remote Research

## Eligibility Requirements for All Projects (2020-2021)

4. Each student is only allowed to enter one project. That project may include no more than 12 months of continuous research and may not include research performed before January 2020. NOTE: Projects that were conducted between January 2020 and March 2020 that competed at an ISEF-affiliate fair, may not be presented in 2021 without meeting the continuation criteria.

## Teacher Supplemental Information:

Many students have worked on projects that they started in 2019, and because of COVID-19, were unable to submit and/or present their project at a local or regional fair or ISEF. They have questions about whether they can submit the same project to 2021 fairs, or how they can develop a new project without access to lab facilities and/or mentors from various institutions. The short answer is that they may not submit the same project but may wish to expand on their 2020 project. Although there are many projects, such as culturing bacteria, that may **NOT** be done at home or in the field, there are many that may be done in these places. Below is a discussion and some suggestions about continuation projects.

## Overall Benefits

1. Students have a “jumping-off” point and are not overwhelmed by the thought of developing something completely new.
2. Judges like to see progress in a field and respect the thinking that goes into expanding on an idea.
3. It is an opportunity to think about strengthening a project by doing additional research, adding a new variable, doing a more sophisticated statistical analysis.
4. It provides a fair competition for all students who chose to conduct research and compete in science fair in the 2020-2021 school year.

## Challenges

1. Students may want to try something new.
2. Some may need help in finding appropriate extensions of previous work.

## Data Collection

1. What type of data will be collected?
  2. How will the data be analyzed? Teachers may have to provide more background on statistics.
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### Rules Regarding Continuation Projects

1. As in the professional world, research projects may be built on work performed previously. Students will be judged only on experiment/data collection performed over 12 continuous months, from January 2020 to May 2021.
2. A continuation/research progression project must document that the new research is a considerable expansion from prior work.
3. The display board and abstract must reflect the current year's work only, but the previous year's laboratory notebook may be present at your display table.
4. New forms must be completed for ISEF 2021, and must include Form 7 as well as the 2020 abstract and research plan.
5. Examples of acceptable and unacceptable continuation projects follow:

ACCEPTABLE CONTINUATIONS	UNACCEPTABLE CONTINUATIONS
Testing a new variable	Using the same research question and methods, but with a larger sample size
Testing a new line of investigation	Using the same data, but including more charts and/or a more detailed discussion of results
A longitudinal ( multi-year study) in which TIME is a critical variable. Ex: Change in the amount of air, water, or soil pollution after a factory opens/closes; effect of very high rain or drought on soil in a given area	
Using a new methodology. Ex: Previous methods counted the number of cells produced; new methods did a chemical analysis.	

**Are these acceptable continuation projects?** For each project described below, decide whether it is acceptable, and answer all questions.

**A. Microbial Fuel Cell Project:**

**Note:** Microbial fuel cells (MFCs) create electricity through the use of microorganisms. These microorganisms may be found in mud found in small lakes or other moist areas. It is easy to find directions to build inexpensive fuel cells. There are many interesting research questions that can be asked and explored regarding microbial fuel cells.

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Last year, Chris built a microbial fuel cell, producing electricity from anaerobic bacteria found in mud in a small local fresh water lake. With the help of an adult sponsor, Chris built the apparatus, collected some mud, and measured the amount of electricity that was produced.

For a continuation project, Chris wants to compare the results of last year's project to the mud from a small fresh water lake that is close to a factory that makes electronics.

1. Is this an acceptable project? Why or why not?
2. Can this project be done at home?
3. What is one weakness or limitation of this project?
4. What are some unanswered questions that you have about microbial fuel cells?

**Answers:**

1. Yes, this is acceptable because a new variable (lake that was close to a factory) was added.
2. This project may be done at home. Studies involving microbial fuel cells are exempt from Potentially Hazardous Biological Agents (PHBA) rules. The bacteria are not being cultured.
3. Weaknesses /limitations include
  - a. It is not known whether the composition of bacteria in the first lake may have changed since last year, making it difficult to determine the cause of any differences in results. If possible, the student should test both lakes this year, with distance of the lake from the factory as a new variable.
  - b. You cannot draw conclusions that go beyond the data. For example, one cannot say that "Chemical pollution from the factory caused the differences in results." On the other hand, the student can describe the type of experimentation/data that is needed to explain the differences.
4. Unanswered questions about microbial fuel cells include::
  - a. Are there different types?
  - b. How can the efficiency be improved?
  - c. Which microorganisms work best?

## **B. Environmental Sciences Projects:**

1. For last year's project, Leslie grew lima bean plants in school, and compared the results of plants grown in uncontaminated soil to plants grown in soil contaminated with three different percentages of lead ions. In each of the four test groups, there were three plants, each grown in its own pot of soil.

As a continuation, Leslie would like to repeat last year's experiment, increasing the number of \_\_\_\_\_ plants in each group to twenty. No other changes would be made.

- a. Is this an acceptable continuation? Why or why not?
- b. What are some unanswered questions that you have about the effects of heavy metals on plants?
- c. If Leslie still had an interest in the effects of heavy metals on plants, what are some research questions that could be asked?

### **Answers:**

- a. This is not an acceptable continuation because nothing new is being tested; only the sample size is increased.
- b. Some unanswered questions about the effects of heavy metals on plants are;
  - i. What metals, other than lead, have an effect on plants?
  - ii. Which cells (or organelles, or tissues) in plants are most affected by these metals?
  - iii. How is photosynthesis (or respiration, or any other life process) affected?
- c. Some research questions about the effects of heavy metals on plants
  - i. How can bioremediation reduce the amount of heavy metals in soil?
  - ii. How does the heavy metal concentration in soil affect the invertebrates living in the soil?

2. For last year's project, Alex measured the amount of lead pollution in soil in various locations in a large city. Due to the presence of Covid-19, many factories have closed, and there are fewer vehicles on the streets. Alex would like to retest the same areas, and compare the results.

- a. Is this an acceptable project? Why or why not?
- b. What is a major difference between this project and the one above?

### **Answers:**

- a.. Yes, this is an acceptable project because it is a longitudinal project, in which time is the variable.
- b. In the project above, the environment was not changed. It was done in a lab, with the condition of the soil manipulated by the addition of various concentrations of lead ions. For this project, it was unknown whether the concentration of lead in the soil was changed by the closing of factories and change in the number of vehicles on the streets.

### **C. Engineering Project:**

In Avery's previous project, a voice-activated controller for a wheelchair was designed, constructed and tested. The wheelchair was able to follow directions to start, move in a straight line, make right and left turns, and stop.

For this year's project, Avery wants to use different materials to construct the controller, so that although no new motions will be added, it will be done as efficiently, but at a cheaper cost.

1. Is this an acceptable continuation? Explain.
2. What are some additional research questions that could be asked?

#### **Answers:**

1. This is an acceptable project, because the variables tested (new materials) will be different.
2. In addition to adding new motions, new types of controllers, such as those that are light-activated, could be explored.