



Pittsburgh Regional Science & Engineering Fair

Teacher and Student Guide to the Scientific Review

83rd Pittsburgh Regional Science &
Engineering Fair

March 22-25, 2022

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Overview – Pittsburgh Regional Science and Engineering Fair (PRSEF) Scientific Review

PRSEF's Scientific Review Committee (SRC) reviews all projects, research plans and accompanying forms (over 1,000 projects each year) to ensure the following:

- Protect the rights and welfare of the student researcher(s) and human subjects
- Protect the health and well-being of vertebrate animal subjects
- Follow federal regulations governing research
- Use safe laboratory practices
- Address environmental concerns
- Maintain consistency with Regeneron International Science and Engineer Fair requirements

More than half of the projects reviewed require further information or corrections before they are approved by the SRC. Common issues include:

- Incomplete research plan
- Bibliography formatting problems
- Approval dates and project start dates
- Lack of detail or conflicting information on forms
- Studies requiring additional review and pre-approval - Potentially Hazardous Biological Agents, Human Participants, Vertebrate Animals, Hazardous Chemicals, Activities or Devices

Note: PRSEF's SRC and IRB has final approval of all projects submitted to the competition.

[STEMisphere.org/PRSEF](https://www.STEMisphere.org/PRSEF)

All information and forms to be reviewed by the SRC must be submitted through

<https://www.STEMisphere.org/PRSEF>.

Each form and each project is assigned a status at <https://www.STEMisphere.org/PRSEF>

Form statuses include: Required (red), Pending Completion (yellow), Ready for Review (purple), Approved (green), Not Approved (Blue) and Pending Approval. The SRC will not review a project until all of the forms associated with the project are Ready for Review (purple) status. Additional reviews may be conducted when some forms are in Approved or Pending Approval status.

Project statuses include: Ready for Review, Approved, Conditionally Approved, Additional Review Required, and Unacceptable. A project which is not yet ready for review has no status listed. A project will not be reviewed by the SRC until it is in Ready for Review status. Only students whose projects are in Approved or Conditionally Approved status may compete at the fair. Unapproved forms for projects which are in Additional Review Required or Unacceptable status must be corrected and resubmitted to the PRSEF SRC for additional review before the student may compete in the fair.

See the Adult Sponsor User Manual at <https://www.STEMisphere.org> for additional guidance.

Definitions

- 1) Adult Sponsor (AS) – Teacher/Homeschool Parent/Club leader who registered the student for PRSEF
- 2) Research Plan (RP) – A Research Plan written by the student(s) which contains, at a minimum the following sections:
 - a. Rationale
 - b. Research Question, Hypothesis or Engineering Goal, Expected Outcome
 - c. PROCEDURE
 - d. Risk & Safety
 - e. Data Analysis Procedure
 - f. Bibliography
- 3) Regulated Research Institution (RRI) – an institution, other than the student’s school, where the student will conduct their research. Examples are: an industrial laboratory, professional research/teaching institution which is regularly inspected by the USDA, college/university laboratory, hospital or medical center, federal laboratories like those of the NIH, CDC and veteran’s affairs, pharmaceutical and biotechnology company laboratory, or research institution that utilizes research animals which is not covered by the Animal Welfare Act but has an operational Institutional Animal Care and Use Committee (IACUC) and is in compliance with U.S. federal laws.
- 4) Qualified Scientist (QS) – an individual with a doctoral/professional degree or extensive experience and expertise in the student’s area of research. The Adult Sponsor is rarely a Qualified Scientist as defined by ISEF, but may also serve as the Qualified Scientist if these qualifications are met.
- 5) Designated Supervisor (DS) – the person who will be supervising the student during the experimentation:
 - a. Teacher is the Designated Supervisor if the work is done at school
 - b. Parent or guardian is the Designated Supervisor if the work is done at home
 - c. Qualified Scientist or their designee is the Designated Supervisor if the work is done at a Regulated Research Institution.
- 6) Scientific Review Committee (SRC) – group of volunteer scientists and engineers who review EVERY submitted project for safety and adherence to PRSEF rules
- 7) International Science & Engineering Fair (ISEF) – The “parent” fair that PRSEF is associated with. The PRSEF rules are based on the International Rules for Pre-college Science Research: Guidelines for Science and Engineering Fairs published by Society for Science & the Public which runs ISEF.

Research Plan

Detailed instructions for completing the research plan can be found at <https://www.STEMisphere.org/PRSEF> under Form 1A or at <https://www.societyforscience.org/isef/forms/> on the second page of Form 1A.

The research plan must include

- Rationale/background information
- Research question(s)
- Hypothesis
- Methodology/procedure
- Proposed method of data analysis
- Risk assessment
- Bibliography with at least 5 high-quality scientific references

The most common reasons research plans are not approved by the Scientific Review Committee (SRC) are:

- Incomplete procedure
- Safety precautions are not identified
- Incomplete bibliography
- Incorrectly formatted bibliography
- Violation of PRSEF/ISEF rules
- Statements which conflict with information on other forms
- Lack of pre-approval for projects which require pre-approval

Tips on how to improve research plans based on the list above

Incomplete procedure – The research plan must be detailed enough that the review committee can confidently evaluate the safety of the project and determine if it falls within the rules of the competition. If the research plan includes only the rationale and background research without an explanation of the actions a student will take to complete their experiment, the SRC is unable to evaluate the safety of the project and will not approve it.

In most instances, the SRC does not need a step-by-step procedure. For projects which involve Potentially Hazardous Biological Agents, Vertebrate Animals, and Hazardous Materials, the procedure should include more detail than for projects which involve less risk.

Safety precautions are not identified – The primary objective of the review process is to keep students safe. Risks associated with the project and actions taken to minimize those risks (including personal protective equipment and environmental protections like fume hoods etc.) must be addressed in the research plan and on Form 3 Risk Assessment. If the project appears to put the student at undue risk and protective measures are not identified in the research plan, the project will be returned for revision.

Incomplete bibliography or incorrectly formatted bibliography – The research plan must include at least five (5) major high-quality scientific sources. To help students find high-quality sources beyond what

they can find through a Google search, reference <https://www.WLNonline.org/PRSEF>. This is a webpage which was developed specifically for PRSEF students by the Westmoreland County Libraries using the PA Power Library online research database. This database is free for all Pennsylvania residents. You or your student will need a library card number to access the site. If you do not have a library card, you can apply for an eCard on the site.

In some cases, websites are acceptable high-quality sources; in others they are not. Sources like google.com, ask.com, sciencebuddies.com and Wikipedia.com are not high-quality sources. A list of criteria to help you determine if a website or other reference is credible or not at can be found at <https://www.WLNonline.org/PRSEF>.

All references must be cited in APA, MLA or another recognized format. Bibliographies consisting of only web site addresses (urls) will not be accepted. The information at <https://www.WLNonline.org/PRSEF> can help you format sources, including websites, correctly.

Violation of PRSEF/ISEF rules – Review the rules for the PRSEF competition at <https://www.pittsburghsciencefair.org> under Teachers and Students and the rules for the ISEF competition at <https://www.societyforscience.org/isef/international-rules/> **BEFORE** submitting a project to the SRC. If you are unsure if a project falls within the rules of the competition, send an email with an overview of the project to PRSEF@CarnegieScienceCenter.org.

To protect the welfare of the students and those around them, projects which violate the rules of the competition will not be approved. The student is still welcome to compete at the science fair if they 1) re-design their project so that it does not violate the rules or 2) choose a new topic for their research.

Statements which conflict with information provided on other forms – The information provided in the research plan must be consistent with the information provided on the other forms and the identities of the people who sign those forms. Common examples of conflicting information include:

- The research plan states that the project will be completed in the student's home, but Form 1 indicates that they are working at a regulated research institution or at their school
- A teacher signs Form 3 Risk Assessment as a supervisor for a project which the student indicated was completed in a home environment
- The research plan indicates the use of Potentially Hazardous Biological Agents, Human or Vertebrate Animal Tissues, Human Participants or Vertebrate Animals, but Form 1 does not reflect those topics

Lack of pre-approval for projects which require pre-approval - Projects which include the use of Potentially Hazardous Biological Agents, Human or Vertebrate Animal Tissues, Human Participants, Vertebrate Animals or Hazardous chemicals, activities or devices must be reviewed and approved by the Scientific Review Committee (SRC) **BEFORE** the student begins their research. If the student is working in a Regulated Research Institution, approved by that institutions SRC/IRB/IACUC may be substituted for pre-approval from the PRSEF SRC. The project must still be reviewed by the PRSEF SRC before the date of the fair.

Pre-approval projects must be submitted by November 19, 2021. The date listed as the tentative start date must be later than all of the dates next to the signatures on the other forms and later than the SRC review.

All information and forms to be reviewed by the SRC must be submitted through
<https://www.STEMisphere.org/PRSEF>.

Approval Dates

All adults who are involved in the project or are supervising the student at any point during the completion of the project must indicate their approval of the project BEFORE the student begins experimentation. **The dates of the signatures on all forms must be BEFORE the tentative start date or the laboratory experiment/data collection start date on Form 1A.** All signatures and dates must be added through <https://www.STEMisphere.org/PRSEF> .

Experiments which were completed over the summer or for a school science fair will have experimentation start dates which are before the date the forms are completed and signed. In these cases, the adults signing the forms should use the date of approval field on the signature page(s) to enter the date the project was reviewed and approved by the adult(s) signing the form to indicate that they were aware of and approved of the project before it was completed. The date of approval does not need to be the date the form is signed. The date of approval associated with the signature(s) must be before the tentative start date or actual start date listed by the student on Form 1A.

Bacteria Studies

Bacteria is a potentially hazardous biological agents (PHBA). If a student is planning to use a PHBA in their project they must get pre-approval from the PRSEF Scientific Review Committee (SRC) before they begin experimentation. If the student is working in a Regulated Research Institution, approval by that institution's SRC/IRB/IACUC may be substituted for pre-approval from the PRSEF SRC. The project must still be reviewed by the PRSEF SRC before the date of the fair.

The student and a qualified scientist or designated supervisor must conduct a risk assessment using Form 6A. This form defines

- Potential level of harm, injury or disease to plants animals and human
- The biosafety level – only BSL-1 and BSL-2 studies are allowed at PRSEF and ISEF
- Laboratory facilities, equipment, training and supervision required

For more information about PHBA projects, see the Regeneron International Science and Engineering Fair rules at <https://www.societyforscience.org/isef/international-rules/>. The rules include information about:

- Which studies are exempt from pre-approval and do not require Form 6A
- Which types of tissue studies do not need to be treated as PHBA
- How to assess risks in PHBA studies
- What the four levels of biological containment (BSL 1-4) are
- What laboratory facilities, safety equipment, and laboratory practices and techniques are required for each BSL level

Common problems with bacteria studies include

- Approval from the PRSEF SRC was not requested prior to experimentation

- Project involves mold and was not terminated at first evidence of mold
- Project involves growing bacteria at home
 - Experimentation involving the culturing of PHBA (even BSL-1 organisms) is prohibited in a home environment.
 - Specimens may be collected at home only if they are immediately transported to a laboratory with BSL containment approved by the PRSEF SRC.
- Form 2 Qualified Scientist was not submitted
 - Adult Sponsor must provide contact information for the qualified scientist on Form 1 to trigger creation of Form 2
- Proper disposal techniques were not described
- Proper safety equipment was not used or was not described

Note: Hair and teeth do not need to be considered a PHBA study

- Teeth must be sterilized to kill any blood-borne pathogen that may be present.
- Chemical disinfection or autoclaving at 121 degrees Celsius for 20 minutes is recommended.

Human or Vertebrate Animal Tissue Studies

Primary cell lines, human and other primate established cell lines and tissue cultures), blood, blood products and body fluids are considered human or vertebrate animal tissues. These studies require pre-approval from the PRSEF SRC.

The student and a qualified scientist or designated supervisor must conduct a risk assessment using Form 6B. This form defines

- The type(s) of tissue(s) to be used
- The source of the tissue(s)
- Previous approvals gained through a regulated research institution's IACUC

For more information about tissue projects, see the Regeneron International Science and Engineering Fair rules at <https://www.societyforscience.org/isef/international-rules/>.

Common problems with tissue studies include

- Approval from the PRSEF SRC was not requested prior to experimentation
- The study also involves living vertebrate animals or human participants but required forms were not submitted
 - Form 5A/5B Vertebrate Animals must be included for studies which involve vertebrate animals
 - Form 4: Human Participants and a sample informed consent form must be included for human participant studies
- Form 2 Qualified Scientist was not submitted
 - Adult Sponsor must provide contact information for the qualified scientist on Form 1 to trigger creation of Form 2
- Proper disposal techniques were not described in the research plan or on Form 3: Risk Assessment
- Proper safety equipment was not used or was not described in the research plan or on Form 3: Risk Assessment

Note: Human capillary blood, hair and teeth do not need to be considered a tissue study

- Teeth must be sterilized to kill any blood-borne pathogen that may be present.
- Chemical disinfection or autoclaving at 121 degrees Celsius for 20 minutes is recommended.

All information and forms to be reviewed by the SRC must be submitted through <https://www.STEMisphere.org/PRSEF>.

Human Participant Studies

Human participant studies involve intervention or interaction with living individuals or collection of identifiable private information belonging to living individuals. These projects require pre-approval from the PRSEF SRC before experimentation begins.

Informed consent must be given by all human participants who are over 18 years of age. Informed consent and parental permission must be given for all human participants who are under 18 years of age. A sample Human Informed Consent Form must be submitted to the PRSEF SRC as part of the project review.

For more information about human participant projects, see the Regeneron International Science and Engineering Fair rules at <https://www.societyforscience.org/isef/international-rules/>. The rules include information about:

- When pre-approval is not required
- Which studies are exempt from Form 4: Human Participant Forms
- Exemptions related to behavioral observation
- How to assess risk
- When informed consent is required
- Studies which involve the collection of data via the internet (email, web-based surveys etc.)

Common problems with human participant studies include

- Approval from the PRSEF SRC was not requested prior to experimentation
- Form 4, a sample informed consent form or Form 2 is required by was not submitted
- Data in the study was identifiable
- The risks to the participants are too high

All information and forms to be reviewed by the SRC must be submitted through <https://www.STEMisphere.org/PRSEF>.

Hazardous chemicals, activities or devices

Projects involving hazardous chemicals, activities or devices require pre-approval from the PRSEF SRC before experimentation begins.

Examples of hazards include:

- Chemicals
- Equipment
- DEA-Controlled Substances
- Prescription Drugs
- Alcohol and Tobacco
- Firearms and explosives
- Radiation

Special attention must be paid to Form 3: Risk Assessment. This form should contain details about how the risks of working with the hazardous chemical, activity or device will be mitigated.

Projects which involve substances which are DEA-controlled require a qualified scientist and Form 2. All other studies require a designated supervisor.

Common problems with human participant studies include

- Approval from the PRSEF SRC was not requested prior to experimentation
- The adult sponsor and student did not realize the level of risk involved
- Form 3: Risk Assessment is not completed in sufficient detail
- Form 2: Qualified Scientist is required, but was not submitted

For more information about projects involving hazardous chemicals, activities and devices, see the Regeneron International Science and Engineering Fair rules at <https://www.societyforscience.org/isef/international-rules/>.

All information and forms to be reviewed by the SRC must be submitted through <https://www.STEMisphere.org/PRSEF>.

Vertebrate Animal Studies

For research purposes as indicated by the ISEF rules, vertebrate animals are: live, nonhuman vertebrate mammalian embryos or fetuses, tadpoles, bird and reptile eggs starting three days (72 hours) prior to hatching, all other nonhuman vertebrates (including fish) at hatching or birth. Exception: Because of their delayed cognitive neural development, zebrafish embryos may be used up to seven days (168 hours) post-fertilization.

For more information about vertebrate animal projects, see the Regeneron International Science and Engineering Fair rules at <https://www.societyforscience.org/isef/international-rules/>. The rules include information about:

- When pre-approval is required
- When behavioral observations require approval prior to experimentation
- When the supervision of a veterinarian is required
- What considerations must be made for animal safety and well being
- Alternatives to using vertebrate animals
- What types of studies may be performed in a home/school/field environment versus studies which must be conducted in a regulated research institution

Common problems with vertebrate animal studies include

- Approval from the PRSEF SRC was not requested prior to experimentation
- Form 5A/5B: Vertebrate Animal Form was not completed
- Form 2: Qualified Scientist is required, but was not submitted
- Bibliography in research plan is missing an animal care reference
 - At least one of the five references listed in the research plan for vertebrate animal studies must be an animal care manual
- Alternative for the use of vertebrate animals and strategies for minimizing the use of vertebrate animals and the impact of the study on vertebrate animals were not discussed in the research plan
- The study involves intentional death or suffering of vertebrate animals

All information and forms to be reviewed by the SRC must be submitted through <https://www.STEMisphere.org/PRSEF>.

Tips for Individual Forms

Form 1

Detailed instructions for completing Form 1 can be found at [https://www.STEMisphere.org/PRSEF under Form 1](https://www.STEMisphere.org/PRSEF%20under%20Form%201).

This form guides the Adult Sponsor through the rest of the paperwork process and determines which forms are required for each project. It is required for ALL projects. This form must be completed by the Adult Sponsor (Teacher/Homeschool parent/Club leader) in collaboration with the student researcher(s). The form will remain in Pending Completion status until the signature of the Adult Sponsor is provided.

1. Make sure that you know what the student is planning to do in their project as that will inform your responses to the questions on this form and will drive the need for other forms.
2. ANY project that involves Human Subjects, Vertebrate Animals or Potentially Hazardous Biological Agents (Microorganisms, rDNA or Tissues) are pre-approval project which MUST be approved by the PRSEF Scientific Review Committee BEFORE experimentation begins. Therefore, the forms must be submitted for review as soon as possible, but definitely prior to experimentation.
3. If the student is using Human Subjects, Vertebrate Animals or Potentially Hazardous Biological Agents (Microorganisms, rDNA or Tissues) be sure to respond “Yes” to the appropriate questions on this form. These responses will generate additional required forms for the project.
4. Further details about Human Subjects, Vertebrate Animals or Potentially Hazardous Biological Agents (Microorganisms, rDNA or Tissues) can be found in the other parts of the this document or in the ISEF rulebook at <https://www.societyforscience.org/isef/international-rules/>.

Before You Start

- 1) Make sure that you know EXACTLY what the student is planning to do in their project as that will inform the way that Form 1 will be filled out. Form 1 drives all of the other forms.
- 2) Use of the following subjects or materials requires that the project be reviewed by the SRC PRIOR to the student starting the project:
 - a. Human Subjects. Human subject research includes, but is not limited to, the following:
 - i. Surveys and/or questionnaires
 - ii. Experiments involving physical activity by subjects
 - iii. Testing human subjects using premade tests or tests developed by the student
 - b. Vertebrate animals. Vertebrate animals are defined as:
 - i. Live, nonhuman vertebrate mammalian embryos or fetuses
 - ii. Tadpoles
 - iii. Bird and reptile eggs starting three days prior to hatching
 - iv. All other nonhuman vertebrates, including fish, at hatching or birth (zebrafish embryos may be used up to 7 days post-fertilization)
 - c. Potentially Hazardous Biological Agents (PHBA). Culturing of ALL PHBAs is prohibited in a home environment. PHBAs include
 - i. Bacteria
 - ii. Viruses

- iii. Fungi
 - iv. Parasites
 - v. Recombinant DNA
 - vi. Human or animal fresh/frozen tissues, blood or body fluids
- 3) If the student is using Human Subjects, Vertebrate Animals or Potentially Hazardous Biological Agents (Microorganisms, rDNA or Tissues) listed above, make sure to respond “Yes” to the appropriate questions on this form. These responses will generate additional required forms for the project. These forms MUST be approved by the PRSEF Scientific Review Committee BEFORE experimentation begins. Therefore, the forms must be submitted for review as soon as possible, but definitely prior to experimentation.
 - 4) Determine who will be the Designated Supervisor for the project per the definitions above and obtain contact information.
 - 5) Obtain contact information for the Qualified Scientist if one is involved with the student’s project.

FORM 1B

1. This form needs to be signed by the parent AND the student.
2. If there is a problem with having the parent sign this form electronically, please contact the fair director who can upload a manually signed form.
3. If the form is manually signed by either the parent or the student, please have that individual also date the signature by hand.

FORM 2

1. This form is only required if the student is working with a scientist OTHER than the teacher, parent or adult sponsor. See definition of Qualified Scientist above.
2. IF the Qualified Scientist designates a Designated Supervisor, then make sure that BOTH individuals sign this form.
3. DO NOT fill out this form if the teacher is using it to specify that the parent is supervising the experiment. Use Form 3 to specify this.

FORM 3

1. “N/A” or “None” are unacceptable answers to the questions on this Form.
2. If there is minimal risk, then explain why that is the case.
3. Even the simplest projects have some risk associated with them.
4. The reason for requiring this form is to get the students in the habit of assessing the risks of any experimentation.
5. If the experiment is being done at home, then this form MUST be signed by the parent.
6. If the experiment is being done at school, then this form MUST be signed by the teacher or other Designated Supervisor at the school.
7. If the experiment is being done in an Regulated Research Institution, then this form MUST be signed by either the Qualified Scientist or the Designated Supervisor identified on Form 2.

FORM 4

1. This form **MUST** have all three required signatures. **NONE** of the parties signing this form can be the Adult Sponsor, the Designated Supervisor, the Qualified Scientist or related to the student (parent).
2. The first signature should be a medical professional with training/experience which is related to the project, the second an educator and the third a school administrator.
3. For each individual, please submit the person's degree/professional license **AND** the position held (e.g. school nurse, science teacher, asst. principal, etc.)

INFORMED CONSENT

1. The Human Informed Consent Form provided is an example. It is acceptable for the students to prepare their own form, as long as it contains the same information as on the sample form.
2. This form is to be presented to each participant for their information about what they will be asked to do a part of the experiment. It is **NOT** to be used to describe the risks of the experiment to experimenter.
3. The SRC does not need to see the signed forms for review, but they should be available at judging time in case any judge would like to see that they were actually presented to the participants and signed.
4. When submitting this form for signatures, please make sure to remember that forms for minors **MUST** be signed by their parent or guardian. This should be reflected in the Research Plan when discussing getting consent.

FORM 5A/5B

1. Form 5A is to be used for projects involving Vertebrate Animals that is **NOT** conducted in a Regulated Research Institution.
2. You **MUST** get the signature of a Veterinarian for project involving supplemental nutrition, administration of prescription drugs and/or activities that would not be ordinarily encountered in the animals' daily life these animals.
3. If the veterinarian is not directly supervising the experimentation, then a Designated Supervisor must be identified on this form (could be the parent or teacher).
4. Form 5B is used for projects that will be done at a Regulated Research Institution.
5. This form has additional requirements for IACUC Approval from the Regulated Research Institution, which must be provided.
6. No project where the purpose of the experiment is to cause suffering of, injure, or kill animals will be approved.

FORM 6A

1. Form 6A is used for any project that involves Potentially Hazardous Biological Agents.
2. It is **PROHIBITED** to do projects involving bacteria at home. Bacteria can be collected at home, but must be immediately transported for incubation to a laboratory which is at **LEAST** rated as BSL-1.
3. Make sure that the signatory in Section 3 checks off the appropriate boxes in that section, particularly in the **CERTIFICATION** area right above the QS/DS signature.

FORM 6B

1. Form 6B is used if human and/or vertebrate tissue is used in the experimentation.
2. The signatory on this form must provide his/her title and institution.

FORM 7

1. This form is ONLY used if the current project is a continuation from work done in previous years.
2. Do NOT submit this form if you participated in the science fair in previous years, but the work was unrelated to your current project.

Resources

Regeneron International Science and Engineering Fair rules:

<https://www.societyforscience.org/isef/international-rules/>

Pittsburgh Regional Science and Engineering Fair rules:

<https://www.PittsburghScienceFair.org> ; click on Teachers and Students

ISEF Forms:

<https://www.societyforscience.org/isef/forms/>

ISEF Rule and Form Wizard:

<https://ruleswizard.societyforscience.org/>

Instructions for completing forms:

<https://www.STEMisphere.org/PRSEF>; log in and open a form to access instructions

Adult Sponsor User Guide

<https://www.STEMisphere.org/PRSEF>; click on Help/FAQ at the top left corner of the screen or log in and access the Help/FAQ menu on the horizontal menu bar to access the user manual

PRSEF Teachers' and Student's Handbook:

<https://www.PittsburghScienceFair.org> ; click on Teachers and Students

Contact the PRSEF Fair Director:

PRSEF@CarnegieScienceCenter.org or (412) 237-1534