Section I

GSEF Rules and Regulations

Student Research Tips & Guidelines
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What is the Science and Engineering Fair?

The Georgia Science and Engineering Fair (GSEF) is one of a number of learning experiences that help young people meet the challenges of the future. It provides a stage from which the junior high and high school students of Georgia can demonstrate their serious contributions to the advancement of society and our way of life.

By participating in the Fair, students learn how to isolate important problems and how to attack and hopefully solve problems all within the framework of organized, logical thought and study. The local science fair provides the initial opportunity for students to exhibit their research projects. If the projects show merit, they may be entered in a district fair. First and some second place winners in district fairs are then eligible to be invited to compete in the GSEF.

At all of these fairs, the student's work is judged by professional scientists who look not only for an attractive functional presentation, but more importantly for the contribution the work has made to new information and for the basic understanding the students have of their research. Please keep in mind that in any competition there is always a small degree of subjectivity and inadvertent inequities may occur in judging. Please remember the decisions of the judges are final.

We hope that you will participate in the 63rd Georgia Science and Engineering Fair and that this experience will encourage you to help meet the challenges of tomorrow. Should you wish to have a copy of this book please visit our website at www.georgiacenter.uga.edu/oasp and print a copy. Additional print copies are not available.

2011 Georgia Science and Engineering Fair Members

To Be Determined
Special Awards Chairperson

Dr. Joseph Hughes
Georgia Institute of Technology
Professor & Associate Chair
Electrical & Computer Engineering

Dr. Robert Matthews
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College of Agriculture & Environmental Science
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Georgia Policy on Regional Fairs:

All GSEF affiliated fairs must admit any eligible student regardless of school organization including: public, home, private, magnet and charter schools in accordance with state and federal laws. This assures equal access for all of Georgia’s students. A student can only participate in one Regional Fair. If project involves a team then they must participate in the assigned Regional Fair of the designated “Team Leader”.

Public Schools - Must attend Regional Fair where school is located.
Private Schools - Student must attend Regional Fair where school is located.
Charter Schools - Must attend Regional Fair where school is located.
Home School - Must attend Regional Fair where place of residence is located.

No exceptions are allowed.

Please visit our website at www.georgiacenter.uga.edu/oasp to see a complete listing of all Regional Fairs to find out which Regional Fair your county/school must attend.
Project Research Tips

**Goals of Science Research**

Research is the process by which people create new knowledge about themselves or the world in which they live in order to answer a question or solve a problem.

Consider this:

Questioning is probably the most important part of scientific creativity and is often followed by an “if...then” statement. Questioning usually leads to experiments or observations.

Good scientists, both young and old, use a process to study what they see in the world. The six stages listed below will help you produce a good scientific experiment:

1) Be curious, choose a limited subject, ask a question; identify or originate/define a problem.
2) Review published materials related to your problem or question.
3) Evaluate the results of your experiment and reach conclusions based on your data.
4) Challenge and test your hypothesis through experimentation (data collection) and analysis.
5) Evaluate the results of your experiment and reach conclusions.
6) Prepare your report and exhibit.

**SCIENCE = RESEARCH**

- Reduce to feasible test
- Refute Hypothesis, if possible
- Replicate to verify repeatability

Students should learn to be skeptical of all research results, especially their own. A good experiment may or may not answer the questions asked, but almost always leads to fresh questions requiring new experiments or observations. The experimental hypothesis is often developed after one has run a number of preliminary experiments, analyzed a body of results, and reached a tentative conclusion for your experiment.

**Goals of Engineering**

Scientists try to understand how nature works, engineers create things that never were. An engineering project should state the engineering goals, the developmental process and the evaluation of improvements. Engineering projects may include the following steps:

1) Define a need
2) Develop design criteria
3) Search literature to see what has already been done
4) Prepare preliminary designs
5) Build and test a prototype
6) Retest and redesign as necessary

**ENGINEERING = DO**

- Determine needs and define problems
- Develop alternatives and select best
- Deploy solutions and evaluate

**Pre-Approval for your project?**

1. SRC (Scientific Review Committee) if your project involves humans, animals, pathogens, controlled substances, recombinant DNA, or tissue.

   The SRC is made up of at least 3 members:
   - a science teacher
   - a doctor or scientist
   - an animal care specialist

2. IRB (Institutional Review Board) if your project involves human subjects.

   The IRB can be the same committee as the SRC but must also have:
   - a school administrator
   - a psychologist, psychiatrist, medical doctor, or nurse

**Eligibility**

Projects will be eligible for exhibition at the Georgia Science and Engineering Fair only if they have won recognition and were selected by a GSEF affiliated fair. However, winners from regional fairs are not automatically accepted due to quota limitations. Grades 9-12 will be in the Senior Division and grades 6-8 will be in the Junior Division with only first or second place winners eligible to be invited. Each ISEF affiliated fair may send up to two finalists and one team project to the International Science and Engineering Fair. Only grades 9-12 are eligible for the International Science and Engineering Fair.
The Science Fair Timeline

This list will help you organize your time for your local fair. Detailed information is on our website.

12 weeks before the fair – or sooner!

Pick Your Topic - Ideas come from hobbies, interests, or problems needing solutions. Limit your topic to concentrate your time and resources. Many ideas are available through books and web sites.

Study Your Topic - Go to the library, talk to professionals in the field, write to companies for information, obtain or construct needed equipment, arrange where you will work (research lab, school, other) and who will supervise your work, if necessary.

Organize and Theorize - Organize everything you have learned about your topic. Narrow down your hypothesis by focusing on a particular idea.

Write out a Research Plan - This plan includes Problem, Hypothesis, Procedures, and Bibliography. It should explain how you will do your experiment before you begin and exactly what it will involve.

Obtain Your Forms - Complete necessary forms before experimentation. Obtain all signatures.

ALL STUDENTS need:
- Checklist for Adult Sponsor (1)
- Research Plan (1A) + written research plan
- Approval Form (1B)
- Abstract Form

Consult with your Adult Sponsor. Get all needed signatures and additional forms you may need.

9 weeks before the fair – or sooner!

Begin Experimentation - Keep detailed notes of every experiment, measurement, and observation in ink in a bound log book. Remember your control and experimental groups must have at least 5 test subjects in each.

4 weeks before the fair

Examine Your Results - Examine and organize your findings. Statistically analyze your data and organize your results into charts and graphs.

Draw Conclusions - Did your experimentation support your hypothesis? Discuss this, any problems you had, and future plans.

3 weeks before the fair

Write Your Abstract - Your abstract is a summary of your research using 250 words or less, on Official Abstract Form.

Prepare Your Report - Your written report is a complete discussion of your research including your problem, hypothesis, materials, procedures, results, graphs, charts, conclusions, acknowledgments, and bibliography.

Prepare Your Display - Attractive, simple, and informative. Follow the Official GSEF/ISEF Rulebook for size and display safety limitations.
School Prescription for Successful Science Research Projects

1. The School or sponsoring institution is REQUIRED to form a Scientific Review Committee (SRC) made up of a Biomedical Scientist (PhD, MD, DDS, or DO), a Science Teacher, and an Animal Care Specialist.
   
   - to PRE-approve experimental procedures of projects involving human subjects, nonhuman vertebrates, pathogens, controlled substances, recombinant DNA, and human/animal tissue.
   - to POST-review procedures and safety rules for above projects.
   - to review all remaining projects to make sure students followed applicable rules.

2. The School or sponsoring institution must provide an Institutional Review Board (IRB) made up of a science teacher, a school administrator, and one of the following: a psychologist, psychiatrist, medical doctor, physician’s assistant, or registered nurse. This committee may be combined with the SRC to form one Review Committee for all projects just by adding one person from the list of human subjects reviewer above.
   
   - to evaluate the potential physical or psychological risk of research involving human subjects.

3. The School should encourage positive commitment by teachers involved.
   
   - Decision should be made if science research projects will be mandatory.
   - Teachers must provide guidance and certify the science research for further competition. Thus, when the teacher signs the form they are giving approval to the quality, safety and appropriateness of the research. Students should be encouraged to exhibit only their very best effort.

4. Sponsors or Teachers should provide clear communication (in writing) to students about:
   
   - What a science research project is
   - What is expected of them
   - What the time lines are
   - Where they may go for help
   - How much help they can get

5. Sponsors or Teachers should provide continuous encouragement and follow-up:
   
   - Schedule 10-15 minutes at least twice a week for discussions of students' progress, ideas, etc.

6. Sponsors or Teachers should use available resources:
   
   - Teacher, librarian, a science contact person, parents, and professionals in the community.

7. Science department or school staff should identify a science fair committee:
   
   - to provide information to students and teachers
   - to plan logistics for setting up the fair exhibits
   - to arrange for judges and awards
   - to plan logistics for judging research projects
   - Involve parents and the community (i.e. open house, PTA, school newspapers, parents' newsletter, etc.)
What Do the Judges Look For?

Judges evaluate and focus on:

1) what the student did in the current year;
2) how well a student followed the scientific methodologies;
3) the detail and accuracy of research as documented in the data book;
4) whether experimental procedures were used in the best possible way.

Overall, judges look for well thought-out research. They look for the significance of your project in its field, as well as how thorough you were. Did you leave something out? Did you start with four experiments and finish only three because of lack of commitment?

The judges applaud those students who can speak freely and confidently about their research. They are not interested in memorized speeches -- they simply want to TALK with you about your research to see if you have a good grasp of your project from start to finish. Besides asking the obvious questions, judges often ask questions outside the normal scope to test your insight into your research such as "What didn't you do?" and "What would be your next step?"

What does the Scientific Review Committee (SRC) look for?

1) Evidence of library search
2) Type and amount of supervision
3) Use of and demonstrated skill in accepted research techniques
4) Completed forms and signatures
5) Humane treatment of animals
6) Compliance with rules and laws governing human and animal research
7) Appropriate use of recombinant DNA, pathogenic organisms, and controlled substances

Additional Resources

1001 Ideas for Science Projects
By Marion A. Brisk, Ph.D., Prentice Hall 1992

The Complete Handbook of Science Fair Projects
By Julianne Blair Bochinski, Wiley Science Editions, 1991

Nuts & Bolts
By Barry A. Van Deman and Ed McDonald

Science Fairs With Style
By Jerry DeBruin

Learning and Assessing Science Process Skills
By Richard J. Rezba, Constance Sprague, Ronald L. Fiel and H. James Funk

Students & Research
By Julia Cothron, Ronald Giese, Richard Rezba

Science Fair Basics - on the GSEF Web Site
www.georgiacenter.uga.edu/oasp
Abstract Tips

Each student who completes a science fair project must write an abstract to be displayed with the project. An abstract gives the essence of the project in a brief but complete form — it should not exceed 250 words. Judges and the public should have a fairly accurate idea of the project after reading the abstract.

The abstract must focus on the current year's research and give only minimal reference to previous work. Details and discussions should not be included in the abstract, but may be put in the longer, written research paper (if required), or given on the project exhibit board.

Finalists at the Intel ISEF are required to use the on-line system for submitting their abstract. Regional and local fairs use the Official Abstract Form (not necessary for most local fairs). It is also required that the abstract not include acknowledgments (such as referencing a mentor or university laboratory).

Sample Abstract:

Effects of Marine Engine Exhaust Water on Algae

Mary E. Jones
Hometown High School, Hometown, PA

This project in its present form is the result of bioassay experimentation on the effects of two-cycle marine engine exhaust water on certain green algae. The initial idea was to determine the toxicity of outboard engine lubricant. Some success with lubricants eventually led to the formulation of "synthetic" exhaust water which, in turn, led to the use of actual two-cycle engine exhaust water as the test substance.

Toxicity was determined by means of the standard bottle or "batch" bioassay technique. Scenedesmus quadricauda and Ankistrodesmus sp. were used as the test organisms. Toxicity was measured in terms of a decrease in the maximum standing crop. The effective concentration - 50% (EC 50) for Scenedesmus quadricauda was found to be 3.75% exhaust water; for Ankistrodesmus sp. 3.1% exhaust water using the bottle technique.

Anomalies in growth curves raised the suspicion that evaporation was affecting the results; therefore, a flow-through system was improvised utilizing the characteristics of a device called a Biomonitor. Use of the Biomonitor lessened the influence of evaporation, and the EC 50 was found to be 1.4% exhaust water using Ankistrodesmus sp. as the test organism. Mixed populations of various algae gave an EC 50 of 1.28% exhaust water.

The contributions of this project are twofold. First, the toxicity of two-cycle marine engine exhaust was found to be considerably greater than reported in the literature (1.4% vs. 4.2%). Secondly, the benefits of a flow-through bioassay technique utilizing the Biomonitor was demonstrated.

Purpose of the Experiment
- An introductory statement of the reason for investigating the topic of the project.
- A statement of the problem or hypothesis being studied.

Procedures Used
- A summarization of the key points and an overview of how the investigation was conducted.
- An abstract does not give details about the materials used unless it greatly influenced the procedure or had to be developed to do the investigation.
- An abstract should only include procedures done by the student. Work done by a mentor (such as surgical procedures) or work done prior to student involvement must not be included.

Observation/Data/Results
- This section should provide key results that lead directly to the conclusions you have drawn.
- It should not give too many details about the results nor include tables or graphs.

Conclusions
- Conclusions from the investigation should be described briefly.
- The summary paragraph should reflect on the process and possibly state some applications and extensions of the investigation.

An abstract does not include a bibliography unless specifically required by your local fair. The Intel ISEF requires the bibliography as part of the research plan to be provided on Form 1A.
Forms Tips and Dates

The Intel ISEF forms constitute written documentation of what will occur in a research project. They are designed to provide the information that is needed to review the project to ensure compliance with the Intel ISEF rules and with laws and regulations that apply to the project. The forms should be filled out and signed before any research takes place. (Only Forms 1C, 7, and the abstract are done after the research.) The dates of the signatures reflect when the approval or consent is given.

Checklist for Adult Sponsor (1)
The checklist is provided so that the adult sponsor can review what information (and therefore which forms) must be provided. The date signed is the date that the sponsor first reviews the project plan.

Student Checklist (1A)
On this page, the student outlines what the project is about. Items that especially need to be clear are the following:

#5 Any project conducted in a similar area of research as previous projects should be considered a continuation. If the project is a continuation, explain on Form 7 as completely as possible how the project will differ from previous experimentation because ONLY a new and different research project is allowed. (If based on previous research, the current year project must demonstrate significant progress.)

#6 Explain when the actual experimental procedure (not the background literature review) will begin and end because ONLY a 12-month project that occurred within the last 18 months before this Intel ISEF is allowed.

#7 Explain where the experimental research will be done: home, university, field. Pathogens may NOT be cultured at home. Research animals must be housed in school or institutional settings only. Universities, research facilities, and industrial settings will require the additional documentation of Form 1C to explain what was done at each facility.

#9 Attach a research plan (next form).

Student Checklist (1A)
Explain clearly and in detail what will be done in the research project.

Approval Form (1B)
These statements attest that each of these people (or committees) approves or consents to this project. The dates should be signed as described below:

a) Student - Date they attest that they understand the possible risks and that they will read and follow the rules.

b) Parent/Guardian - Date they consent to their child doing this project.

c) Adult Sponsor - Date indicates when they approved this project.

d) SRC Approval BEFORE - Date that the committee reviews this project BEFORE the experimentation. Projects that must be pre-approved are research in these areas: human subjects, nonhuman vertebrate animals, pathogenic agents, controlled substances, recombinant DNA, and human or animal tissue.

e) SRC Approval AFTER - This applies only to projects that needed preapproval by the SRC but were done at a research institution and were pre-approved by that institution instead of the SRC. Date signed indicates when the affiliated SRC approved this project after it was completed. Attach all documentation from the research institution showing approval of the project.
f) Final SRC Approval - All projects must be reviewed by the SRC after the experimentation is complete and shortly BEFORE they compete in the affiliated fair. The date signed shows the date that SRC gives final approval to this project.

**Regulated Research Institution (1C)**
This form explains what the student researcher actually did and is signed after the project is completed. This form is only needed if the research was done at a research institution (university lab, for example) or in an industrial setting.

**Qualified Scientist (2)**
On this page, the scientist explains what will be done to oversee this project. The date signed indicates the date that they approve this project (before experimentation takes place).

**Risk Assessment Form (3)**
Required for projects using hazardous chemicals, activities or devices or regulated substances. Must be completed prior to student experimentation.

**Human Subject and Informed Consent (4)**
This page is filled out by the student researcher to explain to the IRB how the safety and well being of the test subjects will be ensured. The IRB reviews the project, checks the risk level and each member signs with the date they approve this project. This review and the date signed must be BEFORE any experimentation takes place.

Copies of this form are used (for informed consent) to explain very completely to the research subject and their parent/guardian exactly what will happen to the subject in the project. Questionnaires, sample tests, and so on MUST be given to the IRB and to the parent/guardian. If they approve, they sign with the date that they approve. (Before the experiment begins). If a photo is to be displayed, the participant signs and dates it when they give permission.

**Vertebrate Animal Form (5)**
This form is filled out by the student researcher and describes the housing and care for the animals. The bottom of the form is filled out by the supervisor or scientist and is signed and dated when they approve this project with these housing conditions. (Before experimentation begins.)

**Potentially Hazardous Biological Agents (6A)**
This form is filled out by the student researcher and is required for all research involving microorganisms, rDNA and fresh tissue, blood and body fluids. SRC/IACUC/IBC/IRAC approval required before experimentation. There is a section to be completed by the designated supervisor and others to be completed by the fair’s SRC.

**Human & Vertebrate Animal Tissue (6B)**
This form is filled out by the student researcher and explains the source of the tissue. The designated supervisor must sign to show approval of the use of this tissue and the date (before experimentation) that they approve.

**Continuation Projects Form (7)**
Any project conducted by the student or team in a similar area of research as previous projects should be considered a continuation. Explain as completely as possible how the project is different from previous experimentation because ONLY a new and different research project is allowed. (It can be based on previous research, but must be new and different research.) Date signed is the date the student researcher is certifying that this information is correct.

**Abstract**
ISEF finalists must use the on-line system. Regional and local fairs use the Adobe Acrobat® file listed above. The abstract is a summary written after experimentation that explains the project. The date signed is the date the student researcher certifies that the statements are correct.
Common Scientific Research Committee (SRC) Problems

Top Five Intel ISEF Paperwork Problems

1. Incomplete Research Plan 1A
   1. Must include proposed and actual start and end dates
   2. Must include detailed research plan
   3. Must have all work site information completed

2. Missing final SRC signature on the Approval Form 1B
   The SRC must sign the bottom of 1B to demonstrate that the paper went through SRC review prior to competition at the regional and state level.

3. Incorrect or incomplete Abstract
   1. Must be in proper format
   2. Must be without acknowledgments
   3. Must have checks properly marked and be signed
   4. Must reflect current year’s work done by student

4. Missing Designated Supervisor Form 3
   1. Must be completed for projects that involve chemicals, equipment, or other potential hazards
   2. Often missing, and often incomplete without description of safety precautions taken

5. Prior year’s paperwork for continuations
   1. Continuing projects, even those with clear demonstration of significant progress, must provide prior year’s research (1A and Research Plan Attachment)
   2. Consider the project a continuation if prior work has been done in same general research area

Top Five Intel ISEF SRC Problems
(Guaranteed to require an interview)

1. Vertebrate animal projects without proper SRC or IACUC approval or lacking appropriate detail in the research plan

2. Human subject projects without evidence of proper prior approval or informed consents

3. Projects involving the culture of potentially-pathogenic and pathogenic agents without appropriate detail about materials cultured, methods, or location of culturing and storage

4. Continuing projects without enough detail in the research plan to demonstrate significant progress, including an abstract that is often too similar to the previous year’s

5. Projects that have eligibility questions regarding either the number of students involved in the project (team to individual or too many team members), the longevity of the research involved, or the age of the participants
Top 10 SRC Problems from Regional SRC Reports

1. Incomplete paperwork - missing forms or signatures

2. Not getting paperwork in on time

3. Missing human subject forms 4a and 4b after conducting a survey or otherwise using humans in the project

4. Not differentiating between a qualified scientist and a designated supervisor

5. Inappropriate handling and safety precautions for the use of bacteria and molds (potentially-pathogenic agents)

6. Incomplete research plans, including insufficient bibliography

7. Failure to obtain prior SRC approval

8. Bad dates - paperwork not signed in the appropriate order prior to the start of experimentation

9. Not having prior paperwork for continuing projects

10. Elementary and junior projects and teachers not following the International Rules
Tips to Encourage Science Fair Participation

If you have talented students who are interested in science, here are some ways to encourage them to participate in a science fair.

In the Classroom

• Introduce science fair at the beginning of each semester and even at the end of the school year to get students interested in working on projects over the summer.

• Determine a plan for working within a school's semester or block scheduling of science classes so that everyone can be encouraged to participate.

• Stress hands-on labs with data collection in your science classes. This reinforces concepts and helps students learn the scientific method in a concrete fashion.

• Urge research experiments, rather than models or collections. To continue on to an Intel® ISEF affiliated fair, only research experiments are allowed.

• Require students to write up their lab experiments using the scientific method. Make sure they have all the parts of an experimental summary: question, hypothesis, materials, procedures, results in chart or graph form, analysis, and conclusion.

Outside of the Classroom

• Encourage students to pursue their individual interests within the scientific topic being learned and to go beyond their classroom learning.

• Start a science club to help students that are not currently enrolled in a science class and to provide extra-curricular opportunities in science exploration and discovery.

• Be familiar with the Intel ISEF & GSEF Rules and Regulations so that you may advise your students. Hold a seminar to explain them.

• Work with the community to connect students to mentors - at the local university, hospital, or veterinary practice.