

Cleveland Clinic, Cleveland State University,
Great Lakes Science Center, and Parker Hannifin
Present

71st Annual Northeastern Ohio Science & Engineering Fair

March 11-14, 2024



Register at <http://neosef.stemwizard.com>

Handbook and Regulations
Applications are due February 9, 2024!

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The Northeastern Ohio Science and Engineering Fair (NEOSEF)

Established in 1953, the Northeastern Ohio Science and Engineering Fair (NEOSEF) is a non-profit, all volunteer organization, whose goal is to get young adults interested in science and engineering by participating in a science fair competition. At the fair, students compete in nine categories which are subdivided by grade levels. NEOSEF awards one 1st place, and multiple 2nd place, 3rd place and honorable mentions per subdivision. Students also compete for over 300 Special Awards totaling more than \$30,000 that are donated by companies, societies and organizations.



NEOSEF selects students to move on to the next levels of competition: The Regeneron International Science and Engineering Fair (ISEF) and the Thermo Fisher Scientific Junior Innovator Challenge (JIC). NEOSEF nominates approximately 10% of the applicants from grades 7-8 to compete in the Fisher Scientific JIC essay writing contest. Our HS Grand Prize winners move on to the Regeneron ISEF where they will compete with almost 1,800 students from all over the world for over \$4,000,000 in scholarships and prizes.

Welcome

Dear Student, Parent and Teacher,

We are excited to be back at Cleveland State University for the 71st annual Northeastern Ohio Science and Engineering Fair (NEOSEF) March, 2024.

This handbook has all the information you will need to enter the competition as well as directions and schedules for the week of the fair. Please take the time to read it carefully. If you have questions as you go along, contact information is provided later in the handbook. We are here to help you have a good science fair experience and you should feel free to call us if you need help.

As a participant in NEOSEF, you will be eligible for awards. Within each category and grade level, we will give a first prize award and several second and third prize awards and honorable mentions. These awards are accompanied by cash in some cases, and by ribbons and medals in others. We also have a large number of companies and organizations that donate prizes to be given in specific categories or for projects focused on a particular topic. Last year, we gave away approximately \$30,000 in prizes!! You have a chance to be among this year's winners.

There are three very special sets of awards given each year at our fair. A number of selected 7th and 8th graders will be chosen to compete in the Thermo Fisher Scientific Junior Innovator Challenge (Fisher Scientific JIC). You will see a place on the application to indicate whether you are interested in participating.

Secondly, two grand prize winners are chosen from the 7th and 8th grade level. These are the two 7th and 8th graders whom the judges feel have the best projects overall, and they are recognized at the awards ceremony and receive plaques and cash prizes.

Finally, we choose 4-5 grand prize winners who will represent NEOSEF at the Regeneron International Science and Engineering Fair (ISEF). These are usually 11th or 12th graders (but sometimes 9th or 10th graders). These students receive a plaque and all-expense paid trip for themselves and one adult to attend the ISEF, which is a wonderful experience. Please note that this year's ISEF will be held as an in-person event, in Los Angeles, CA.

Something new this year: We will be recognizing a deserving teacher for their contribution and participation in the NEOSEF. Details will be coming out soon. Please look for the information on our website (neosef.org) or on our FB page.

I hope you are as excited as I am for all the good things that will be happening at NEOSEF 2024. See you at the fair!!

Sincerely,



Oanh Loi-Powell, President
NEOSEF

Eligibility

- NEOSEF is open to all students in grades 7-12 in any public, private, parochial or home school in Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit counties.
- A maximum of 12 projects can be entered from any high school, and a maximum of 10 projects can be submitted from any elementary or middle school. A student may enter NEOSEF as an independent if his/her school does not conduct a school-wide science fair, but the limits per school still apply.
- Students may only submit one project to the fair. Students cannot resubmit a previous year's project unless it has been substantially expanded and re-developed. **Group projects are not accepted at NEOSEF!**
- All projects at NEOSEF are subject to the review of the Fair Director and the Scientific Review Committee (SRC). Projects which do not adhere to correct scientific principles or which involve inadequate protection of human or animal subjects may be disqualified. Students can assume approval of their project unless they are contacted by NEOSEF.

Timeline of Events

NOVEMBER 2023 - Handbook available

DECEMBER 2023 - STEM Wizard (neosef.stemwizard.com) opens for registration

FEBRUARY 2024

- | | |
|-------------|---|
| February 9 | Deadline for NEOSEF Application Forms (No late entry forms or walk-ins accepted) <ul style="list-style-type: none"> • Complete online registration at neosef.stemwizard.com |
| February 24 | Acceptance notices emailed to students |

MARCH 2024

- | | | |
|-------------|--|-----------------|
| March 11-14 | 71 st Northeastern Ohio Science and Engineering Fair at Cleveland State University in the Woodling Gymnasium in the Physical Education Building <ul style="list-style-type: none"> • Parking lot entrance located on the south side of Chester Ave near East 24th St. | |
| March 11 | Registration and Project Display Set-Up | 1:00 – 8:00 pm |
| | <ul style="list-style-type: none"> • The registration and set-up process takes approximately 20-30 minutes • Only students are permitted in the exhibit hall • No projects will be registered after 8:00 pm | |
| March 12 | Instructions to Students prior to Judging | 3:00 – 3:15 pm |
| | Judging of Projects | 3:15 – 6:30 pm |
| | <ul style="list-style-type: none"> • Students must be present during judging to be eligible for awards • Students must remain at their projects until dismissed (5:45 – 6:00 pm) | |
| | Public Viewing of Projects (Students need not be present) | 6:30 – 9:00 pm |
| March 14 | Public Viewing of Projects (Students need not be present) | 3:30 – 6:30 pm |
| | Awards Ceremony | 6:30 – 9:00 pm |
| | Removal of Projects | 9:00 – 10:00 pm |
| | <ul style="list-style-type: none"> • Any project remaining after 10:00 pm will be discarded | |

MAY 2024

- | | |
|-----------|--|
| May 12-17 | Regeneron International Science and Engineering Fair in Los Angeles, CA. |
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NEOSEF Board of Directors

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Oanh Loi-Powell

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Shamone Gore-Panter, PhD

Carl Jeffries, Jr.

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Jonathan Litt

Kirsten Mahovlich

Alana Majors, PhD

Christine S. Moravec, PhD

Joellen O'Neill

Jason Ross, PhD

Don Scipione, PhD

Marcia Snavelly

Karyn Torigoe

Crystal Weyman, PhD



Contact Information

- For general questions about NEOSEF, application forms or deadlines contact:

Wendy Sweet
(216) 445-9950
sweetw@ccf.org

Oanh Loi-Powell
(440) 319-5566
oklpowell@gmail.com

- For questions regarding the science or engineering of your project, please contact the person related to your field of study:

BIOLOGICAL SCIENCES

Dr. Nancy DiIulio
Case Western Reserve University
(216) 368-2542
nad3@case.edu

PHYSICAL SCIENCES

Dr. Nick Baumgartner
John Carroll University
(216) 382-6385
baumgart@jcu.edu

ENGINEERING

Dan Galdun (ret.)
Rockwell Automation
(440) 635-8901
losthorizon@nls.net

Scientific Review Committee

It is the responsibility of the Scientific Review Committee (SRC) to assess and approve each project that is submitted to NEOSEF. The SRC evaluates the scientific integrity of the project, especially those projects using human and/or animal subjects. The SRC also verifies that all project-appropriate paperwork is submitted with each student's application. Students that need to consult with the SRC about their project either before or after the application deadline may contact any of the members of the committee listed below for assistance.



James Bader
Case Western Reserve
University
(2316) 368-5289
jxb14@case.edu

Nancy DiIulio, PhD
Case Western Reserve
University
(216) 368-2542
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(216) 445-9949
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Jason Ross, PhD
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(216) 445-9417
rossj12@ccf.org

Crystal Weyman, PhD
Cleveland State
University
(216) 687-6971
c.weyman@csu.edu

Category Descriptions

Biological Science Categories



Biology: The study of living organisms, including the study of animals (zoology), plants (botany) and microorganisms (microbiology). Projects which should be entered into the biology category examine the structure, function, growth, origin, evolution and distribution of living things.



Health/Medicine: The study of health and disease in humans or animals, including disease diagnosis, causes of disease, ways of treating disease, medical procedures, alternative therapies for diseases, or the way in which the human or animal body functions normally.



Environmental Science: The study of the interactions among physical, chemical and biological components of the environment, including pollution (land, air and water), ecology, biodiversity, sustainability of the environment and causes of environmental degradation related to human activities.



Behavioral Science: The study of human and animal behavior through systematic observation and experimental intervention. Behavioral sciences investigate the decision processes and communication strategies within and between organisms in a social system.

Physical Science Categories



Chemistry: The study of the nature and composition of matter and the laws governing it – physical chemistry, organic chemistry, inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, food chemistry, etc.



Physics: The study of the universal laws that govern matter, energy, space and time, including solid state, optics, acoustics, particle, nuclear, atomic, plasma, superconductivity, fluid and gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics and biophysics.



Math/Computer Science: The study of formal logical systems, patterns, and numeric computations, and the application mathematical principles to the world. The study and development of computer software and hardware and associated logical devices.



Earth/Space Science: The study of physical subjects related to the earth or space, including geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology and geography.



Engineering: The study of the application of scientific principles to manufacturing and other practical causes, including civil, mechanical, aeronautical, chemical, electrical, photographic, sound, automotive, marine, heating and refrigeration, and transportation engineering.

Information for Teachers

Dear Teacher,

Organizing a science fair that ensures the safety of our student researchers and others involved in their projects is a complex task. Please read this manual carefully. There are a few important points NEOSEF staff would like to bring to your attention before beginning the science fair process at your school.

1. Each student (no group projects permitted) in the fair is required to complete Forms 1, 1A, and 1B. Depending on the student's project, additional paperwork may be required.
2. Online registration (neosef.stemwizard.com) is the only method for student registration. Late entries interfere with our abilities to run a smooth and successful fair. Please plan accordingly.
3. Bacteria and microorganisms may not be grown at home! Culturing of bacteria, mold and viruses by students must be done at an institution (such as their school) under proper supervision.
4. NEOSEF does not accept toxicity studies or projects that have incidental death rates greater than 25%. Death may not be used as an endpoint in a study, and students should design experiments to avoid harm or death to living organisms.
5. Due to judging limitations, the number of entries permitted per school is 10 entries for elementary and middle schools, and 12 entries for high schools.



Online support for teachers

WE ARE HERE TO HELP!

NEOSEF organizers appreciate the challenges associated with hosting a school science fair and understand the complexities of moving students along to the regional fair level. However, it is critical that all projects entered into NEOSEF conform to the highest standards of scientific integrity and ethics, so your assistance in working with your students on their NEOSEF forms is GREATLY APPRECIATED!!

To assist in this process, NEOSEF has a series of short videos to help walk you and your students through the registration process. Topics include registering on STEM Wizard, completing the information sheet, filling in the abstract, deciding what forms are required for your project, the mechanics of uploading signed forms, and more. We hope these videos will answer most of the questions you might run into while registering for NEOSEF.

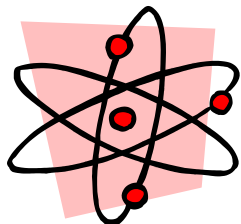
In addition, a limited number of students from Case Western Reserve University will be available to come to your school to assist in the process. They will be familiar with the mechanics of STEM Wizard and the registration process, but questions related to which forms are required should be referred to James Bader (jxb14@case.edu).

Links to videos can be found on the NEOSEF web site at www.neosef.org.

Application Submission

Dear Student,

Congratulations on all your hard work on your science fair project and the excellence you have achieved to get to this point. You are already a winner having been chosen by your school to attend the Northeastern Ohio Science and Engineering Fair (NEOSEF). We wish you continued success as you begin this next stage of competition.



In order to participate in NEOSEF you must submit an application form. Because NEOSEF is affiliated with the Intel International Science and Engineering Fair, we are obligated so use ISEF forms and follow their procedures, but don't be discouraged by the paperwork!



The only method to apply is online at <http://neosef.stemwizard.com>. There you will create a unique user ID and password for your project. Once you have successfully logged in, you may choose to follow a link to the ISEF Rules Wizard if you need help deciding which forms are required for your project. Please note that any form that requires signatures must be downloaded, printed, signed, and then either scanned or uploaded through the STEM Wizard app. Please review the video tutorials at www.neosef.org or contact Jim Bader at jxb14@case.edu if you need help navigating the neosef.stemwizard.com site.

If you need more information or assistance, you can seek help from one of the following resources: 1. your teacher and/or advisor, 2. the NEOSEF handbook, 3. the NEOSEF website at www.neosef.org, and 4. the people at NEOSEF at neosefinfo@gmail.com

NEOSEF Display and Safety Regulations

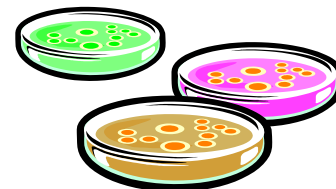
Display guidelines are described in detail in the NEOSEF Project and Materials Guidelines document. All projects will be inspected for adherence to these rules and students of any projects with violations will be contacted and allowed to make corrections prior to competition.

Display Rules/Regulations:

Most of the regulations associated with a traditional tri-fold board display are not relevant for a virtual fair. However, there are still some regulations students should be aware of:

Display items NOT permitted at NEOSEF include:

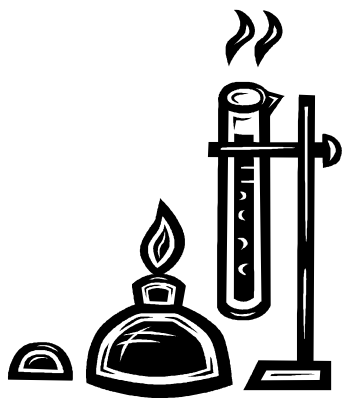
- Photographs that:
 - Depict animals in surgical techniques, dissections, necropsies, etc.
 - Identify human subjects that did not consent to being photographed
- Photographs that are uncredited, even if taken by the student
- Personal information of your human subjects, such as names, addresses, phone numbers, etc.
- Awards, medals, business cards, or other promotional materials not relevant to the project



Official Abstract and Certification

COMPLETING THE ABSTRACT:

Abstracts are limited to a maximum 250 words. If you are having difficulty saving your abstract in STEM Wizard, please remove any mathematical symbols or special characters and try again.



The abstract should include the following:

- a) purpose of the experiment
- b) procedure
- c) data
- d) conclusions

It may also include any possible research applications. Only minimal reference to previous work may be included. **An abstract must not include the following:**

- a) acknowledgments (including naming the research institution and/or mentor with which you were working), or self-promotions and external endorsements
- b) work or procedures done by the mentor

TIPS ON WRITING A PROJECT ABSTRACT

A project abstract is a brief paragraph or two (limited to 250 words or 1,800 characters) highlighting and/or summarizing the major points or most important ideas about your project. An abstract allows judges to quickly determine the nature and scope of a project.

- Emphasize these aspects: purpose (hypothesis), methods (procedures used), data summary or analysis, and conclusions.
- Focus only on the current year's research.
- Omit details and discussions.
- Use the past tense when describing what was done. However, where appropriate use active verbs rather than passive verbs.
- Use short sentences, but vary sentence structure.
- Use complete sentences. Don't abbreviate by omitting articles or other small words in order to save space.
- Avoid jargon and use appropriate scientific language.
- Use concise syntax, correct spelling, grammar, and punctuation.

AVOID A REWRITE

- Focus on what you did, not on the work of your mentor or of the laboratory in which you did your work.
- Do NOT include acknowledgements, self-promotion or external endorsements. Don't name the research institution and/or mentor with which you were working and avoid mentioning awards or honors (including achieving a patent) in the body of the abstract.
- Be sure to emphasize the current year's research. A continuation project should only make a brief mention of previous years' research (no more than a sentence or two).



Elements of a Successful Project



Science is a process by which we learn about the universe around us. Engineering is the application of knowledge toward some useful goal. A good science fair project includes the proper use of scientific and engineering ideas, such as the scientific method. The following steps will help you get started, and hopefully guide you to a well-rounded and winning science fair project. If you need help, don't be afraid to consult with a scientist or engineer that specializes in your field of study.

STEP 1: Pick a Topic to Study

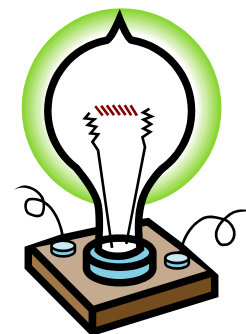
- Spend some time and give serious consideration to this part of your science fair project. Don't settle for a project that has been done before because it's easy. Originality tends to win over judges at NEOSEF. Pick a topic that grabs your interest and you want to learn more about.

STEP 2: Do a Background Search

- While not the most exciting part of doing a science fair project, you will learn more about the topic that will provide you with the necessary information needed to come up with a hypothesis, appropriate methods to test your hypothesis, and allow you to draw conclusions about your results.
- This information will need to be included in your project report and science fair display.

STEP 3: Formulate a Hypothesis or Goal

- A hypothesis is a sentence or two stating that, based on all the information you have to go on, this is what you truly believe will be the outcome of what you are going to test.
- A good hypothesis does not necessarily mean that it is a correct hypothesis. Frequently in science, a hypothesis may be disproved by the results of your experiments. This is not a flaw in your science fair project.
- Be sure your hypothesis can actually be tested within the confines of the timing and resources available to you and your science fair project.

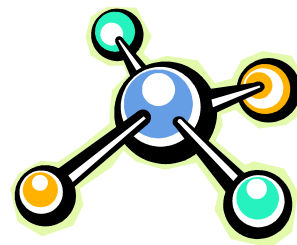


STEP 4: Document Your Work (The Laboratory Notebook)

- One of the most important attributes of a good scientist is good record keeping. Doubt is a human trait so you need to be able to prove that what you found is correct and true. Do not rely on your memory.
- The lab notebook should contain all the procedures used in your experiments and all of the data that came from them. Both good results and bad results should be documented. Not every experiment works perfectly.
- Summaries, conclusions for each experiment should be written in your notebooks and any plans you may have for the next experiment. While it is easy to write too little in your lab notebook, you can never write too much.

STEP 5: Design Experiments to Test Your Hypothesis (Methods)

- Experiments should test your hypothesis. Don't be afraid to design more than one experiment to test your hypothesis. Some of the best scientific designs test a hypothesis using more than one strategy.
- Be sure to include appropriate control groups for comparison.
- While it may seem labor intensive, test for only one thing in each of your experiments. For example: Do not change both the temperature and the nutrients for a bacteria culture in the same experiment. If you find a difference in the amount of bacteria produced in the culture, it won't be clear if it is due to the change in temperature or due to the change in the nutrients the culture was grown.



STEP 6: Results

- This is the data generated from your experiments. It is best to repeat your experiments more than once to ensure reproducibility.
- SI units (grams, liters, meters, etc.) rather than English units (pounds, gallons, yards, etc.) are typically used in science. These units should be used whenever possible, although it will not count against you at NEOSEF if you use English units.
- Statistics provide a quick summary of your data. Some commonly used statistics are the number of samples in each group (n); an indicator for the mid-point of your groups (average); the range (minimum and maximum values); and an indication of the variability of the data (standard deviation or standard error of the mean).
- Statistical tests (such as t-tests and ANOVA) can be used to mathematically determine if the differences between your groups is a result of the treatment you imposed rather than it happened merely due to chance.

STEP 7: Evaluate Your Results and Strengthen Your Project

- Closely examine your data for any inconsistencies to fix, and any interesting findings.
- Take your project a step further. Many times the data you collect generates new questions to be answered. Most judges are impressed by second efforts.
- If your project has any short-comings in the experimental design, you may want to resolve these problems in a second effort, or at least be ready to discuss them.

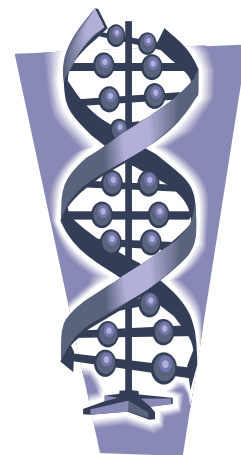


STEP 8: Draw Conclusions

- Try to decipher what the information you have obtained from your data actually means. Sometimes there can be more than one answer. If your finding is very specific try to relate it back into the big picture.
- This section is also a good place to describe what future directions you would take your project.

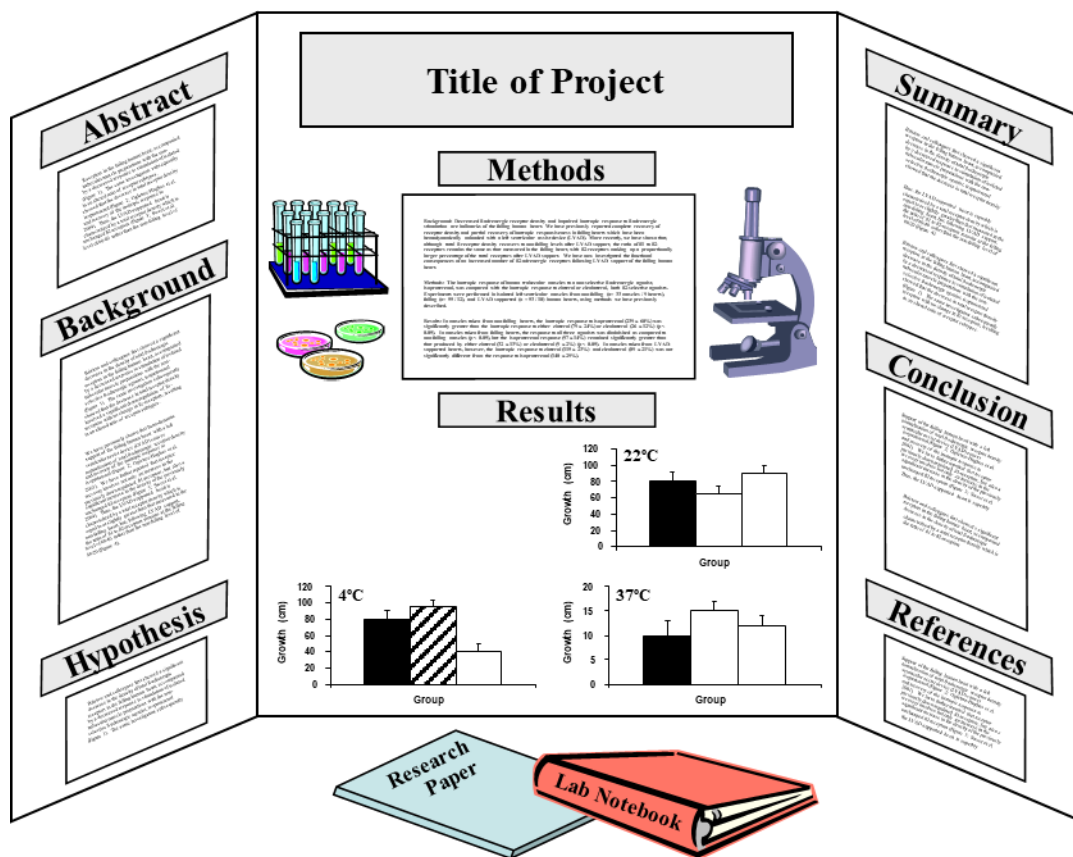
STEP 9: Present Your Findings in a Research Paper

- A research paper is a formal written presentation of your science project. Good research papers are well-written (using proper sentence structure, correct spelling and punctuation, etc.), well-organized and contain all of the following items:
 - a. **Introduction:** A paragraph or two that state your topic, your hypothesis, what you hope to achieve, and how you hope to achieve it.
 - b. **Background:** A general introduction to the topic of study which includes the key findings or factors that lead you to what you decided to study.
 - c. **Hypothesis:** A statement or two about what you believe will be the outcome of what you are testing.
 - d. **Methods:** Describe in detail the protocol(s) used to test your hypothesis. A person reading your research paper should be able to repeat your experiments completely on the basis of what is written in this section.
 - e. **Results:** Describe the data that you obtained from your experiments. In addition to the written text, photos, tables, figures and graphs are good ways to help present your data to the reader. Don't forget to express your data values using appropriate units of measure (examples: 1.29 cm or 5.8 mL, etc.)
 - f. **Discussion:** Explain what your data means. State how your experiments and data support or refute your hypothesis. This section may be the longest and most important section of your paper!
 - g. **Conclusion:** Was your hypothesis supported? Why or why not? What would you do differently? What would you do next?
 - h. **Acknowledgements and References:** List the people and literature sources that assisted you with your project. Don't forget to thank any people or companies who donated time or supplies for your project.



STEP 10: Present Your Findings in a Project Display

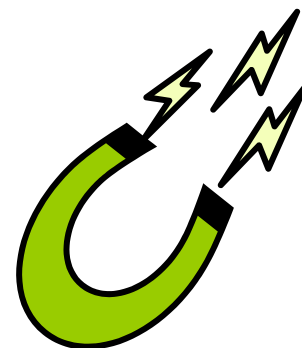
- For science and engineering fairs, you need to construct a display that shows off your project and all the components discussed above. Spend some time on this part of the process. It is your opportunity to showcase your hard work. **Be sure to follow the NEOSEF Project Guidelines when assembling your virtual display.**



Please note:
This display is only an example.

INFORMATION FOR ENGINEERING PROJECTS:

- Engineering projects follow a slightly different process, although it parallels the steps of the scientific method. Read through the steps for science projects, keeping in mind the goals of engineering projects defined below:
 - Identify a need. Be sure your idea is something that has a solution and is within your ability to construct.
 - Determine limits or other criteria that you must impose on your solution. Cost, materials, and time are all possible limiting criteria.
 - Do some preliminary research to see what's already been done to satisfy your need. This process may provide additional ideas.
 - Design something that you think will satisfy your need.
 - Build and test a prototype, refining or redoing if necessary.



Awards



Four types of awards are handed out at NEOSEF.

Regular Fair Awards: These awards are handed out for 1st Place, 2nd Place, 3rd Place and Honorable Mentions based on assigned judging results. 1st Place winners receive \$100, a Gold Medal and a Blue Ribbon. 2nd Place winners receive \$25, a Silver Medal and a Red Ribbon. 3rd Place winners receive a Bronze Medal and a White Ribbon. Honorable Mentions receive a Green Ribbon.

Special Awards: Awards totaling over \$20,000 in the form of cash and prizes are donated by companies, organizations and societies that judge projects based on specific criteria they establish. All students are able to win special awards regardless of placement in regular fair judging.

Thermo Fisher Scientific Junior Innovator Challenge Nominations (JIC): Approximately 30 students from grades 7 and 8 are nominated to compete in the Society for Science and the Public Middle School Program (MSP) which occurs after NEOSEF. Winners of the JIC nominations are based not only on the project, but the scientific report of the project as well.

Grand Prize Winners: Grand Prize Winners are divided into Biological Science Winners and Physical Science Winners and by grade level. 7-8th Grade Grand Prize Winners receive a plaque and a **cash prize**. 9-12th Grade Grand Prize Winners receive a plaque and an all expense paid trip to compete in the International Science and Engineering Fair.

Thermo Fisher Scientific Junior Innovator Challenge (JIC)

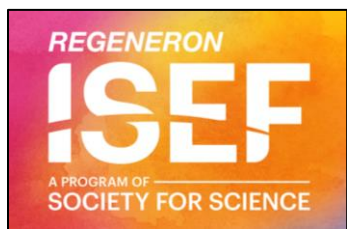
The Society for Science and the Public's Thermo Fisher Scientific Junior Innovator Challenge (JIC) is a national essay writing competition which occurs after the NEOSEF fair. JIC participants are required to write one 250 word and two 500 word essays to compete. Only students in grades 7 and 8 are eligible for the JIC. Finalists of the JIC receive an all-expense paid trip to Washington, DC to compete for \$100,000 in prizes.



To enter this competition students must be nominated by NEOSEF. Each year NEOSEF selects approximately 10% of the applicants, based not only on the quality of their science fair project, but the written report of the project which must be with the display at NEOSEF for review. The student must indicate on his/her application form that he/she would like to be considered for this competition.

Please note that no essays are required prior to attending NEOSEF, and only students sincerely interested in writing the essays to compete in the JIC should indicate "yes" on their application form. Indicating "yes" or "no" will not change the student's ability to win other prizes at NEOSEF.

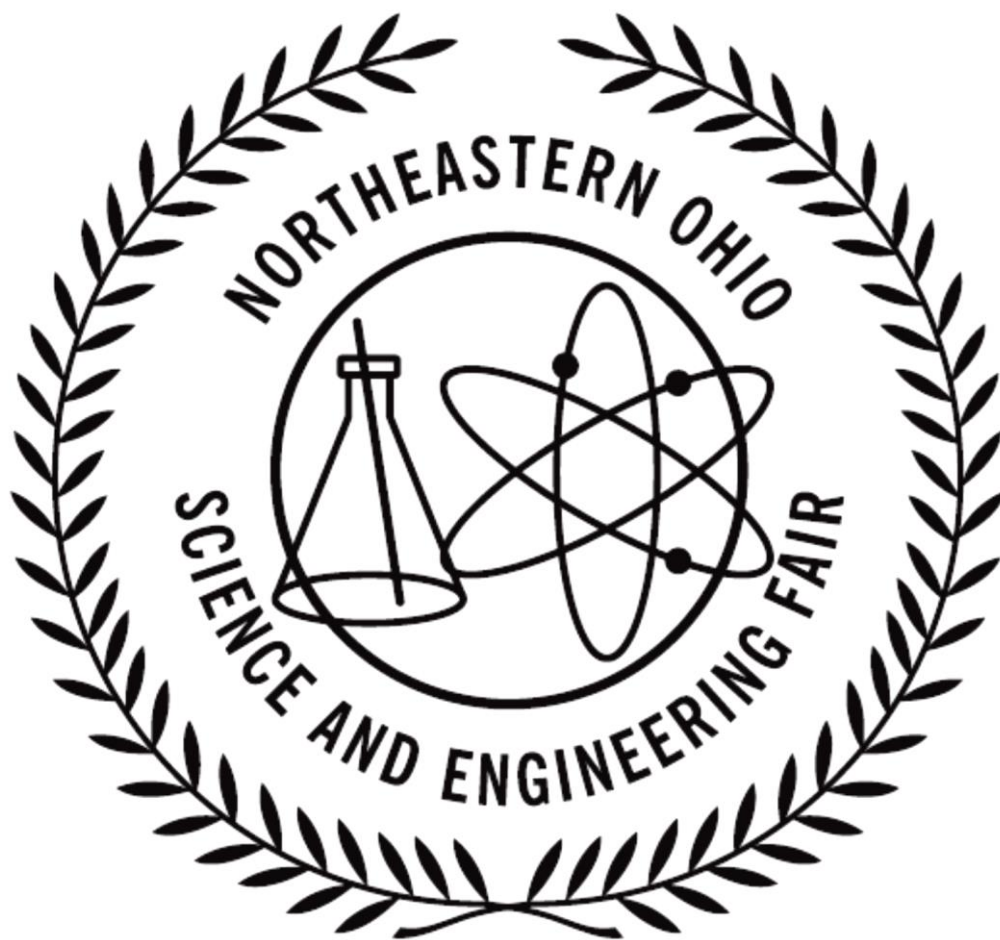
Regeneron International Science and Engineering Fair (ISEF)



Up to five NEOSEF 9-12th Grade Grand Prize Winners are selected to participate at the next level of science fair competition, the Regeneron International Science and Engineering Fair (ISEF). ISEF is known as the "Olympics" of Science Fairs where more than 1,700 students from all 50 states and more than 70 countries from around the world compete for more than \$4,000,000 in scholarships and prizes.

The ISEF is divided into 17 science and engineering categories and each project is reviewed by at least 6 of the over 800 judges at the fair. The 2024 Regeneron ISEF will take place as an in-person only event in Los Angeles, CA in May 2024.

Only about 27% of the students that participate in the ISEF win awards. The ISEF awards \$500 for 4th Place, \$1,000 for 3rd Place, \$1,500 for 2nd Place, \$3,000 for 1st Place and \$5,000 for Best of Category. Like NEOSEF, many Special Awards are also handed out at the ISEF by companies, organizations and societies. Since 2000, NEOSEF Grand Prize Winners have earned three Best of Category Awards, five 1st Place, six 2nd Place, three 3rd Place, and sixteen 4th Place, along with many Special Awards at the ISEF.



www.neosef.org