

**U.S. ARMY, NAVY & AIR FORCE SPONSORED  
NATIONAL JUNIOR SCIENCE AND HUMANITIES SYMPOSIA PROGRAM--  
PROGRAM FACT SHEET AND GUIDELINES FOR STUDENTS**

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Each year over 12,000 talented high school students and their teachers participate in JSHS at each of forty-eight regional symposia held on university campuses nationwide by presenting the results of their scientific, engineering, or mathematics research. Progressing from the regional symposia, 240 student delegates advance to the National JSHS and may compete for significant military-sponsored scholarships and other awards.

The primary aims of JSHS are to promote original research and experimentation in the sciences, engineering, and mathematics at the high school level, and to publicly recognize students for outstanding achievement. By involving talented students and their teachers in affiliated symposia, and by recognizing students' research endeavors through scholarships and other awards, JSHS aims to encourage continued interest and participation in the sciences and ultimately to widen the pool of trained scientific and engineering talent prepared to conduct research and development vital to our nation.

**SPONSORSHIP**

The Junior Science and Humanities Symposia (JSHS) Program has been sponsored by the United States Department of the Army since its inception in 1958, and additionally joined by the Departments of the Navy and Air Force after 1995. Resulting from this sponsorship and the cooperative efforts of universities throughout the nation, JSHS encompasses forty-eight regional symposia reaching high schools throughout the United States, Puerto Rico, and in cooperation with the Department of Defense Schools of Europe and the Pacific, and the annual National JSHS.

The Academy of Applied Science, a non-profit educational organization in Concord, New Hampshire, administers the National JSHS Program in cooperation with universities or other educational institutions.

**WHY PARTICIPATE?**

Former JSHS participants confirm that the significance and results of JSHS beyond scholarships and recognition. At regional and national symposia students and their teachers may...

- Participate in a forum honoring exceptional work and encouraging personal and academic growth.
- Interact with practicing researchers who offer a look beyond high school to opportunities in post secondary education and to academic and career development in the sciences, engineering, and mathematics.
- Develop higher-order thinking skills and integrated learning across disciplines through the process of scientific inquiry, writing a scientific paper, and delivering a presentation -- all skills that will benefit future post secondary and graduate pursuits.
- Participate in a scientific conference, take field trips, and have their work published.
- Gain self-confidence not only through the experience of the research investigation but also through networking among participants of similar interests.

## **AWARDS**

Significant awards are available to JSHS regional and national student finalists. University contributed scholarships or other awards are sponsored by many regional symposia. The availability of these additional awards, type of award, and value vary by region. The Departments of the Army, Navy, and Air Force jointly sponsor the following awards (subject to the availability and release of government funding)...

### ***For students who participate in regional and national symposia...***

- ***Public recognition and certificates***, honoring achievement and interest in research pursuits
- ***Attain a sense of achievement and self-confidence*** resulting from interaction with students from other schools and regions and with professional researchers and educators. To quote a former JSHS alumnus, [At JSHS] “I learned a tremendous amount of science, got to meet other high school students who shared my interests in science, and learned that I could succeed at any program that I chose to pursue.”

### ***For 48 teachers...***

A **\$500 award** to one teacher at each of the 48 regionals, honoring the individual teacher’s and his or her school’s contributions to advancing student participation in research. The teacher award may be used to partially defray costs for National JSHS attendance.

### ***For the regional finalists...***

- ***An expense-paid trip to the National JSHS***, awarded to five finalists at each regional symposium. The National brings together over 360 participants in a program of educational and scientific exchange.
- ***An invitation to present their original research investigation at the National JSHS***, awarded to two finalists at each regional symposium.
- ***A total \$4,5000 undergraduate, tuition scholarships***, awarded at \$2000, \$1500, and \$1000 to each of three regional symposium finalists. (scholarship payable upon matriculation and upon meeting the JSHS scholarship conditions)

### ***For the national finalists...***

- ***Seven \$12,000 undergraduate, tuition scholarships***, awarded to each of the 1st place finalists in the National research paper competition.
- ***Seven \$8,000 undergraduate, tuition scholarships***, awarded to each of the 2nd place finalists in the National research paper competition.
- ***Seven \$4,000 undergraduate, tuition scholarships***, awarded to each of the 3rd place finalists in the National research paper competition.
- ***An expense-paid trip to the London International Youth Science Forum***, an exchange program bringing together over 400 participants from 60 nations. The London trip is awarded to each of the 1st place finalists; the runner-ups are alternate winners.

## **HOW TO APPLY – THE REGIONAL SYMPOSIA**

JSHS invites the participation of all high school students who have completed an original research investigation in the sciences, engineering, or mathematics. All students in grades 9-12, enrolled in a public, private, or home school within the area served by the JSHS regional symposium are eligible. Experimental research, field research, observational research, and applied research are eligible. While review or library research is a part of the research process, these investigations alone are not appropriate. (See [www.jshs.org](http://www.jshs.org), Guidelines section, for additional descriptive reviews of the types of research.)

Interested students and their teachers are encouraged to contact the JSHS regional symposium director in their area to obtain application guidelines and materials and be prepared to:

- (1) submit a written report (e.g. abstract and/or paper) prepared in accordance with the regional symposium’s guidelines;

- (2) deliver a concise oral presentation to the symposium;
- (3) complete registration and/or application materials; and
- (4) comply with regional and national rules and policies that apply to the preparation of the written reports and the oral presentations.

The written and oral reports should present the results of original research carried out by the student. Students are encouraged to obtain assistance from teachers, mentors, parents, or other students. How can students best demonstrate original work? Through oral and written research presentations made at JSHS, students report on their contributions to the research problem and their approach to undertaking the investigation. The overall test is that students demonstrate valid investigation and experimentation aimed at discovery of knowledge.

### **ELIGIBILITY RULES -- REGIONAL AND NATIONAL SYMPOSIA**

**Team projects.** Students may present a report on work done as part of a class project, or as a science fair project or summer research project. However, students should report on their individual contributions to research. If students are part of a larger group, the presentation should focus on the individual contributions in the larger research project and properly acknowledge the contributions of other students, mentors, and/or teachers. For team research that cannot be divided into individual presentations, a team leader should be selected to present the results of the group work. In this case, all JSHS directives applying to individual research investigations will apply to group research investigations. In the event the group presenter of the winning regional group is unable to present at the National level, this opportunity will be passed on to the next ranking project. This decision is made since the judges' evaluations and scores pertain to the individual presenter.

#### **Research involving non-human vertebrates or human subjects.**

Research involving non-human vertebrates or human subjects must be conducted under the supervision of an experienced teacher or researcher and follow state and federal regulatory guidance applicable to the humane and ethical conduct of such research. This must be acknowledged in the students' written report.

#### **Scholarship eligibility.**

- Students must be a citizen or permanent resident of the United States or U.S. territory to be eligible for the government-sponsored scholarship awards.
- Regional symposia directors are responsible for monitoring citizenship status of student applicants. Foreign nationals may present their research at the regional symposium level for recognition of excellence and may be eligible to attend the National symposium. However, students not meeting the above citizenship requirement may not be eligible for further competition at the National symposium and for the government-sponsored scholarship awards.
- The total scholarship awards available through JSHS are capped at a maximum total of \$30,000 per individual student winner.
- Scholarships are awarded to only one student. Student presenters who are part of a team must notify the JSHS of which student finalist will receive scholarship funding should the team presentation earn regional or national awards.

**Scholarship conditions.** Student scholarship recipients must...

- Demonstrate full-time enrollment as an undergraduate student at an accredited institution;
- Pursue an undergraduate degree in a science, technology, engineering or mathematics discipline, as defined by the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council in their combined directory titled Organization and Members;
- Maintain at least a B (3.0) equivalent grade average;

### ***THE JUDGING PROCESS***

At the regional symposia, the first round of judging will occur where the students' written reports are reviewed by a scientist or expert in the field. Resulting from this review, selected students are invited to orally deliver their research before the regional symposium. Selected presentations will represent the finest efforts of high school students in the state or region toward either original laboratory research, field research, or applied research. Judging of the oral presentations is the final step to select student delegates who will advance to the National JSHS.

At National, student research presentations will be organized in concurrent sessions by discipline. Military-sponsored scholarships and other awards will be made to 1<sup>st</sup> place finalists and runner-up finalists from each of six (6) final sessions. Each of the 1<sup>st</sup> place finalists will be invited to participate in the London International Youth Science Forum.

**Judging criteria.** Regional and national judges evaluate the oral presentations using the below criteria. National judges will use a total score of 30 points for each of the six criteria with each criteria weighted on a scale from 1 to 5. The scores are tallied for each presenter and used as the basis for discussion among judging team members where each criterion is considered.

- Statement and identification of research problem
- Scientific or engineering thought; Creativity and originality
- Research or engineering design, procedures, results
- Discussion/conclusions
- Skill in communicating the research results -- Oral presentation and written reports
- Acknowledgement of sources and major assistance received

**The National JSHS Judging Team and Process.** The National JSHS Judging Team includes individuals 1) who hold either a Ph.D. or equivalent experience, or 2) who are actively engaged in research. Judges will have experience in the general fields of research that are represented by the National student presenters. Specialized experience in each field delivered at the National JSHS may not be represented by each and every one of the judges. Therefore, student presenters are reminded of their responsibility to communicate their results so that they may be understood by both the non-specialized audience and by the judges. Judges are selected also for their interest in encouraging the students' interests and future development in the sciences, engineering, or mathematics. The judges review the National student presentations as follows...

- All of the written reports (e.g. abstract and paper) are read. The paper is used as supporting documentation during the judging process.
- The oral presentations are evaluated by each member of the assigned session judging team.

- The questioning period which follows the oral presentations aids judges in clarifying the student's depth of understanding, the amount of work and level of effort, and the individual contributions to the research problem.
- Following the sessions, the individual session judging teams meet and deliberate to select finalists from each session.
- Judges utilize the "National JSHS Judges Score Sheet" as a tool and consider the weight of each factor during their deliberations.

The National JSHS Office, Academy of Applied Science; and the National JSHS Judging Panel recognize the enormous effort that students undertake in conducting their research. Therefore, our objective is to ensure an equitable competition by selecting qualified judges and by communicating the rules of competition to both students and judges. We realize that in any competition of this nature differences of opinion about the judges interpretations may occur. It is the policy of the sponsors of the JSHS Program (e.g. the Army, Navy, and Air Force) to support the interpretations and final decisions of the judges panel. Recommendations regarding the future conduct of the National JSHS judging process, or requests to clarify the rules of competition can be directed to the attention of the Director, National JSHS Program, Academy of Applied Science, 24 Warren St., Concord, NH 03301.

### ***JSHS CATEGORIES OF COMPETITION***

The organization of the final seven (7) sessions at the National JSHS is based upon a review of all abstracts and the area of research suggested by the student. Student presenters must state on the abstract the major discipline and the sub-discipline of their research. The seven major disciplines in which military-sponsored scholarship awards will be made are:

- Environmental science (pollution and impact upon ecosystems, environmental management, bioremediation, climatology, weather)
- Engineering; technology (including renewable energies, robotics)
- Physical Sciences – physics; computational astronomy; theoretical mathematics
- Chemistry (including chemistry-physical, organic, inorganic; earth science-geochemistry; materials science, alternative fuels)
- Life sciences (general biology—animal sciences, plant sciences, ecology; cellular and molecular biology, genetics, immunology, biochemistry)
- Medicine and Health; Behavioral and Social Sciences
- Mathematics and Computer science/computer engineering; applied mathematics-theoretical computer science

The categories are further defined to assist students in choosing categories of competition and to better align judges in the proper sessions. Regional symposia may or may not choose to use these descriptive categories at the regional competition.

#### **1. Life sciences (i.e. general biology—animal sciences, plant sciences, ecology)**

##### **Subcategories:**

- 1) General biology
- 2) Animal science (developmental biology, ecology, pathology, physiology, population genetics)
- 3) Plant science (agriculture, developmental, ecology, genetics, photosynthesis, plant physiology)

## **1. Life sciences (i.e. cellular and molecular biology, genetics, immunology, biochemistry)**

### **Subcategories:**

- 1) Microbiology – bacteriology, virology, protozoology, fungi, bacterial, genetics, yeast
- 2) Molecular/cellular biology—including genetics, immunology
- 3) Biochemistry -- General biochemistry– metabolism, food chemistry, structural biochemistry

## **2. Medicine & Health/Behavioral sciences**

### **Subcategories:**

- 1) Medicine & health -- disease diagnosis and treatment, epidemiology, genetics, molecular biology of diseases, physiology and pathology
- 2) Behavioral sciences—clinical and developmental psychology, cognitive psychology, sociology, other

## **3. Environmental science**

### **Subcategories:**

- 1) Environmental – Air pollution and air quality; Soil contamination and soil quality; Water pollution and water quality
- 2) General biology – Pollution and impact upon ecosystems
- 3) Bioremediation
- 4) Climatology, weather
- 5) Environmental management – recycling
- 6) Environmental management – land management, forestry
- 7) Environmental management – Ecosystems
- 8) Other

## **4. Physics and astronomy; theoretical mathematics**

### **Subcategories:**

- 1) Physics and astronomy
- 2) Physics: atoms, molecules, solids; Instrumentation and electronics;
- 3) Magnetics and Electromagnetics;
- 4) Physics: Nuclear and particle physics; Optics, lasers;
- 5) Physics, theoretical
- 6) Computational astronomy
- 7) Mathematics: Theoretical; number theory

## **5. Mathematics; Computer science, computer engineering**

### **Subcategories:**

- 1) Computer science/computer engineering: algorithms, databases, artificial intelligence, networking and communications, computational science, computer graphics, software engineering, programming languages)
- 2) Applied Mathematics, including theoretical computer science
- 3) Statistics and probability
- 4) Other

## **6. Engineering, technology (including solar, robotics)**

### **Subcategories:**

- 1) Aerospace and aeronautical engineering
- 2) Engineering – Materials and bioengineering:
- 3) Civil engineering
- 4) Environmental engineering
- 5) Industrial engineering
- 6) Renewable engineering
- 7) Technology: energy, robotics, solar, renewable engineering (consider environmental science, dependent upon research question)
- 8) Other

## **7. Chemistry (including chemistry-physical, organic, inorganic; earth science-geochemistry; materials science)**

### **Subcategories:**

- 1) Chemistry – analytical, general, inorganic, organic, physical
- 2) Energy – alternative fuels, fossil fuels
- 3) Earth science – geochemistry, soil science
- 4) Materials science
- 5) Other

## ***THE NATIONAL SYMPOSIUM – REGISTRATION REQUIREMENTS FOR ALL STUDENT DELEGATES***

All student delegates who advance to the National JSHS are required to complete their registration on-line at [www.jshs.org](http://www.jshs.org) prior to April 3. If the regional symposium is held after April 3, the regional symposium director must contact the National JSHS Office to coordinate an acceptable submission date.

### **Registration requirements for all student delegates include...**

**1. National JSHS Registration** — Upon completing registration, the National JSHS Office will coordinate travel reservations, reserve hotel accommodations, and assign tour preferences. Immediately following the regional symposium, the JSHS regional symposium director will first pre-register all student delegates. Students may access their pre-registration at [www.jshs.org](http://www.jshs.org), National symposium, to complete the registration process.

**2. National JSHS consent form** providing consent for participation from your school and parent/guardian. This is a paper form requiring signatures and receipt by the National JSHS Office prior to April 3.

**3. A registration fee** to support attendance costs not supported through the military's sponsorship. (The amount of the registration fee will be announced after January 1.)

**4. A 200-word abstract** in electronic format . (See [www.jshs.org](http://www.jshs.org), National symposium section for instructions on electronic submission of the abstract. The **format** for the 200-word abstract includes: 1 inch margins, keyed in 10 or 12 point font (Times or Times New Roman). Abstracts must be adequate in length but not exceed these specifications. The header preceding the abstract text includes:

- Title of the research
- Your name
- Name of your high school, high school city, and state
- Name of your teacher/sponsor/mentor and his or her organization. Precede the person's name with a subheading (i.e. teacher, mentor, sponsor:)
- Include one line of space between the heading and the body of the abstract.

Abstracts are **published** as submitted in the National JSHS publication, "Abstracts of the Research Finalists," and distributed to all symposium attendees. A good abstract is written to summarize the research paper. The abstract should accurately convey the essential nature of the research conducted and the most significant conclusions reached. A further purpose of the abstract is to attract the interest and curiosity of the non-specialist reader and thus encourage exchange, discussion, and elaboration between various authors and between authors and readers.

**All National JSHS student presenters are required to prepare and submit a research paper and the following supplementary forms prior to April 3.**

#### **1. Statement on Outside Assistance**

#### **2. An electronic version of the research paper**

- The paper should be a minimum of 5-6 pages and a maximum of 20 pages, including appendices.
- Photography, graphs, tables, diagrams, charts, or other graphic representation presented in the paper must be simply presented and comply with the maximum file size limit of 1.8 mB.

- A maximum size limit for the electronic research paper is 1.8 Mb.
- A recommended outline for the research paper includes:
  - a title page, or cover page stating the student's name, school address, and title of the research;
  - acknowledgement of major assistance received;
  - if applicable, statement that "research involving non-human vertebrates or human subjects was conducted under the supervision of an experienced teacher or researcher and followed state and federal regulatory guidance applicable to the humane and ethical conduct of such research"
  - table of contents;
  - introduction;
  - materials and methods;
  - results (data or findings);
  - discussion and conclusions;
  - references, or literature cited;
  - and appendices (if necessary but please keep in mind that the introduction is far more valuable in the judging process than appendices of raw data)

The research paper is used as a supporting document to the abstract during the judging process. The judges read both the abstract and paper.

### ***THE NATIONAL SYMPOSIUM - REQUIREMENTS FOR THE ORAL PRESENTATIONS***

**Session timing.** The research presentation may not exceed 12 minutes, followed by a maximum 6-minute question period. A session moderator will aid the student speaker in maintaining this schedule and in fielding questions from the audience. The procedure for maintaining the time includes a 10-minute signal for the student, and finally a 12-minute signal. At the 12-minute point, the student speaker must stop the presentation even if he or she has not finished. Following the presentation, the session moderator will ask for audience questions. The speaker may entertain questions while the exchange appears interesting and relevant. Questions intended to harass the student speakers will not be allowed by the session moderator. The speaker should repeat a question before answering so the audience may understand the entire dialogue.

**Use of Audio Visuals - Available equipment.** Available audio-visual equipment in each session at National includes: (1) LCD projector; (2) projection screen; and (3) a laser pointer. Additionally, PC-based computers will be in each session room configured with Microsoft 2010 Powerpoint and Adobe Acrobat. The use of Macintosh computers or use of other software requires students to bring their own equipment.

Equipment operators will not be available in each session. Students should number visuals in sequence so an assisting operator or the presenter can easily reshew one. Many times, visuals are re-shown during the questioning period.

**Aids to the presentation.** No written handouts or models are permitted. Software such as Powerpoint and computer action video may be used to prepare or drive slides or overheads.

**VCR and Computer Usage.**

1. If using LCD projectors and computers, students must...

- Review *Guidelines for Preparing Powerpoint Presentations* (<http://www.jshs.org>, Guidelines section).
- Embed any video, or other presentation developed through other software, into Powerpoint 2007.
- Save the Powerpoint presentation to an IBM-compatible CD or Zip drive, and use that saved file on available PC-based computer and LCD systems.
- Prepare for any equipment problems by bringing back-up overheads.
- Start computer equipment that may be brought to the symposium prior to the designated presentation time. No additional presentation time will be allowed to cue up a presentation.

2. If using video, students must comply with the following groundrules...

- The video component cannot make up more than one (1) minute of the presentation.
- No audio or background music is permitted other than sounds that are an integral part of the research. Recorded or mechanically produced narration is not permitted. Narration must come from the speaker.
- Videos (and audio, if any) may be used only for those aspects of the presentation that cannot adequately be presented by slides or overheads. Video material presented must be an integral part of the research and should not be a substitute for presentation of data. Videos must not be used for presentation of common procedures, illustrating equipment or showing laboratory facilities. Videos should illustrate work that was done and should not be used for stimulation or aesthetic value.

***THE NATIONAL SYMPOSIUM-SUGGESTIONS TO PREPARE FOR THE ORAL PRESENTATIONS***

***Remember, you are the expert.*** No one in the audience knows as much about your research investigation as you. Therefore, remember to explain your research in enough detail so the audience will understand what you did, how you did it, and what you learned.

Whenever possible, ***avoid jargon*** or unnecessary terminology. If it is essential to use specialized terms, remember to explain the specialized term ***briefly***. Give your audience enough time to understand what you are trying to convey.

***Graphs, tables and other representation help explain your results.*** Keep them simple and uncluttered. Focus on important information; for example, remember to name the variables on both axes of a graph, and state the significance of the position and shape of the graph line.

Deliver your presentation at a comfortable pace. It helps to ***practice*** your presentation before a non-specialized audience. Practice will help perfect the presentation and the timing. Do listen to the advice of your non-specialized audience but also get help from a teacher or other advisors as needed.

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**References, National JSHS Guidelines, revised January, 2003**

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*Hundreds of volunteers, including teachers, mentors, university faculty, representatives of the Department of Defense contribute their time and talent to JSHS and the encouragement of science among the nation's best and brightest secondary school students. If we can be of assistance, please contact the National JSHS Office or your regional symposium representative.*

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**The National Junior Science & Humanities Symposia (JSHS) Program**

**Sponsored by the U.S. Army, Navy, and Air Force, and higher education  
Administered by the Academy of Applied Science**

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