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**Please keep this Handbook for next year.**

## **Pacific Symposium for Science and Sustainability and the Junior Science and Humanities Symposium**

The Pacific Symposium for Science and Sustainability (PS<sup>3</sup>), formerly known as the Pacific High School Science Symposium, provides a unique educational experience by bringing students from Hawaii and other Pacific Islands together to explore their common interest in the sciences.

The Symposium is patterned after professional conferences and includes field trips and social events along with the presentation of papers. Expenses for the weekend will be paid for Hawaii students and teachers selected to participate in the PS<sup>3</sup>. Pacific Island participants will need to fund the cost of their airtickets. Proceedings from the Symposium will be published and all participants will receive a copy.

PS<sup>3</sup> serves as a regional competition for students to advance to the Junior Science and Humanities Symposium (JSHS). The JSHS is a national program funded by the United States Departments of the Army, Navy and Air Force and sponsored by the Academy of Applied Science. Five finalists at the PS<sup>3</sup> will receive expense-paid trips to the national JSHS in April/May. The top three finalists will receive scholarships and the top two the right to represent Hawaii in the national JSHS competition.

At the national JSHS, prizes include scholarships and travel to international science events.

### **Guidelines for Participation**

All students in grades 9 -12 in both public and private schools in Hawaii, American Samoa, and Micronesia are invited to submit papers for participation in the PS<sup>3</sup>. Only one student is allowed on a project. All papers submitted for the Symposium will be reviewed before acceptance.

Students may present a paper on work done as part of a class project (for “extra credit”) or as a science fair or summer research project. Invitations to participate in the Symposium will be issued after the paper review.

Participation in the Symposium offers many benefits to the student including:

- a means to integrate student learning in science, social studies and language arts;
- an opportunity to receive guidance from a scientist or expert on a topic chosen by the student;
- experience in writing a scientific paper and making an oral presentation of that paper to peers and professionals;
- a chance to participate in a scientific conference, take field trips, and have their work published.

### **Types of Papers**

There are two main types of papers at the Symposium, experimental research and library research.

#### **What is an Experimental Research Paper?**

This is a written report describing original research results in science, mathematics or engineering. The paper should rely on previously published literature primarily for background and comparative purposes. A research project begins as a question and involves actual experimentation to gather data that will help answer the question. A research project is an investigation in which a hypothesis is formed, experiments are designed and conducted, data are recorded, and conclusions are drawn.

A research project may also be a field study or an engineering project. A field study involves monitoring some aspect of the environment, such as types of birds in the Kawaiui Marsh. Engineering projects include designing, building and testing a device.

*Only students with experimental research papers are eligible for national JSHS competition.*

#### **What is a Library Research Paper?**

A library research paper involves selecting a topic or a problem and doing extensive reading in books and scientific journals; then writing an organized report of your findings.

*Library research papers are acceptable for presentation at the PS<sup>3</sup>, but are not eligible for the JSHS competition.*

## The Symposium Competition

### Experimental Research

A first round of judging will occur during the reading of papers by scientist reviewers. Six finalists with the best experimental research papers will be chosen to advance to the plenary session at the PS<sup>3</sup>. Other students will present at concurrent sessions. From the plenary session three of the finalists will win a scholarship and three the right to represent Hawaii at the national JSHS. The top five finalists will win expense-paid trips to the national JSHS.

### Judging Criteria for Experimental Research

#### ✓ Quality of the research and experimentation:

##### Problem & Hypothesis:

- Originality in identification of the problem and hypothesis
- Clarity in stating problem
- Objectives and reasons for performing the research

Relevant background information and prior research, acknowledgement of sources

Design of the investigation—the extent of student's involvement in designing the procedures.

##### Investigative Procedures:

- Identification of important variables; control of variables
- Lab skills and techniques
- Selection of proper equipment for research
- Quantity and quality of data generated by investigative procedures: observations, measurements, data gathering, statistical analysis
- Recognizing the limitations of the results obtained, in accuracy and significance.
- Interpretation of data; conclusions supported by data
- Problem solving

##### Overall:

- Creativity/originality
- Evidence of understanding the scientific and technical principles involved in the investigation
- Applications, next steps, or future research

#### ✓ Student's effort and performance:

- Duration of research and the amount of work involved
- Acknowledgment of major assistance
- Evidence of student's understanding

#### ✓ Quality of written report:

- Organization of the paper
- Composition (spelling, grammar, clarity of thought)
- Abstract (content, format, grammar, organization)

#### ✓ Quality of the oral presentation:

- Clarity in stating problem and hypothesis
- Clarity in describing design, procedures, problems, and how they were handled
- Clarity in presenting data, interpretations, and conclusions
- Overall organization
- The definition of terms when necessary
- The appropriate use of audio-visual
- Clarity of enunciation and voice projection
- Response to questions

Note: The presentation is important in the evaluation; however, content—not form—will be given the major weight.

### Library Research

Library research papers are not eligible for the national competition.

A first round of judging will occur during the reading of papers by scientist reviewers. As with the experimental research papers, the students with the better papers will be invited to participate in the Symposium. Students with library research papers will compete at the PS<sup>3</sup> in concurrent sessions. The moderator/judge will select the best paper from each session. The winners of the concurrent sessions will receive an award from the Hawaii Academy of Science.

The judging criteria for library research papers include: thoroughness of the research; evidence of student's understanding of the topic; up-to-date references; organization of the paper; and the oral presentation.

## **Rules for Experimental Research**

### **Non-Human Vertebrate Animals**

- Only animals that are lawfully acquired shall be used in experimentation and their retention and use shall be in every case in strict compliance with state and local laws and regulations.
- Animals used in experimentation must be given every consideration for their bodily comfort; they must be kindly treated, properly fed, and their surroundings kept in a sanitary condition.
- No intrusive techniques may be used, including surgery, injections, or taking of blood. In addition, the PS<sup>3</sup> does not permit giving drugs and other chemical agents to measure their effect on animals.
- No changes may be made in the organism's normal environment with the exception of maze running.
- For maze running and other learning or conditional activities, food or water cannot be used or withheld for more than 24 hours.
- When animals are used by students for their education or the advancement of science, such work shall be under the direct supervision of an experienced teacher or investigator.

### **Human Subjects**

- No project may use drugs, food, or beverages in order to measure their effect on a person.
- Projects that involve exercise and its effect on pulse, respiration rate, blood pressure, and so on are allowed if a valid normal physical examination is on file and the exercise is not carried to the extreme.
- If your research involves questionnaires or surveys, proper consent from subjects must be obtained.
- If your research involves human subjects and your school has no formal policy regarding such research, please call the Hawaii Academy of Science office.
- No human cultures of any type - mouth, throat, skin, or otherwise will be allowed.
- Tissue cultures purchased from reputable biological supply houses or research facilities are suitable.
- The only human blood that may be used is that which is obtained from a blood bank, hospital, or laboratory. No blood may be drawn by any person or from any person specifically for a science project. This rule does not preclude a student making use of data collected from blood tests not made exclusively for a science project. Blood may not be drawn exclusively for a science project.

## **Instructions for Preparation of Library Research Papers**

### **Title:**

Long enough to describe your research without any extra words (see page 8 for more help).

### **Introduction:**

- Introduce your subject and explain your reason for writing about it.
- State the main idea or concept of the paper and / or your goals for writing the paper.
- Preview any important points that will support the main idea.
- Provide important background information, and any definitions, so others will understand your topic.
- Why is your topic important?
- Correctly spell and use scientific terms and names of organisms (see page 8 for more help).

Be sure to acknowledge all references and cite your references properly throughout your paper. (See page 8 for more help).

### **Main body:**

This section will give the bulk of information found during your library research. Organize your material in a logical manner and use headings or subheadings to guide the reader through the paper.

- Have two to four main points that support your thesis (main idea).
- Build a focused discussion with your own ideas (do not just regurgitate information).
- Information in the main body should support your thesis.
- Show evidence of understanding the scientific and technical principles of your topic.
- Use data or illustrations to support your main ideas.

### **Summary:**

This is not a conclusion but rather a summary of the main points of your paper.

- Summarize your central idea and supporting main points.
- Create a final impression of your topic, present your viewpoint, or make a call to action.

### **Citations / References (for more detail, see page 8)**

- Cite references within your paper using author-date (Lee, 2000).
- List a reference in the back for each citation in the text.
- Keep your references adequate and appropriate to the topic.
- List references in alphabetical order by author's last name.
- It is recommended that your references contain at least six (6) sources.
- Your sources should not consist mainly of personal communication or internet sites. When possible find the published reference the internet site was based upon.
- When possible, references should contain recent information (four references within the past six years).
- References should follow the correct format, explained on page 8.

### **Acknowledgments**

- Acknowledge those who provided major assistance in your research.

## **Instructions for Preparation of Experimental Research Papers**

### **Title:**

Long enough to describe your research without any extra words (see page 8 for more help). Do not write the title as a question. Do not use abbreviations.

### **Abstract:**

Provide a brief overview of your paper in one or two paragraphs consisting of no more than 175 words (approx. 10-12 lines of text in Times 11-point font).

- State research problem (**introduction**)
- How the problem was studied (**explaining your methods**)
- What was found (**summarizing your results**)
- Summarize the meaning of your results (**discussion and conclusions**)

Do not include subheadings, bibliographic references, figures, or tables. Do not emphasize minor details or include information or conclusions not stated in your paper. Try not to use first person (e.g., "I").

### **Introduction**

- Clearly state the problem (hypothesis) being investigated.
- Provide background information on the nature and scope of the problem.
- Review the relevant literature. Do not try to include everything you know about the topic. Cite the relevant literature sources in the text.
- Explain your purpose in investigating the problem and why it is significant.
- Correctly spell and use scientific terms and names of organisms (see page 8 for more help).

### **Materials and Methods**

In paragraph format with complete sentences,

- Identify the important experimental variables and controls,
- Describe how you conducted your study,
- What equipment you used,
- What procedures you followed.

A numbered list of steps is not acceptable. Provide enough details so that the research could be replicated by someone else.

### **Results**

- Present the results of your research findings in logical order. You should not interpret the results in this section; just present the facts. Also report your findings even if they are not earth-shaking.
- Use visuals (graphs, tables and/or illustrations) as appropriate:
  - Maps / drawings should be in black, not color.

## **Experimental Research Papers continued**

- Photos in black and white
  - All charts, graphs, maps and photos are labeled “figures” and numbered consecutively
  - Captions should be placed below figures
  - Tables should be labeled as “Table” with a consecutive number, and titled appropriately
  - Give credit for illustrations taken from other sources.
  - 3 dimensional graphs can be misleading; stick with 2 dimensional graphs.
- Even if your results are presented in tabular or graphic form, the important highlights should be explained in the text of your report. Tables and figures supplement or complement the text, eliminating lengthy discussions.
  - The results of any statistical analyses performed should also be reported and discussed in this section. Remember to explain the statistical tests used.

## **Discussion and Conclusions**

This section is an analysis of your results. Therefore, you should interpret your results and draw conclusions. Try to build a focused discussion with reasoning and explanation rather than just regurgitating information.

- Relate your results to your original hypothesis.
- Compare your findings with existing research and show how your results and interpretations agree or disagree.
- Draw conclusions based on your data (as reported in the results).
- State the limitations which affect your results and discuss any other factors over which you had no control. Explain how these might have affected the outcome of the study.
- Finish by summarizing the most important points of your investigation.
- Suggest further experiments to continue this project.

## **Citations / References (see page 8)**

- Cite references within your paper using author-date (Lee, 2000).
- List a reference in the back for each citation in the text.
- Keep your references adequate and appropriate to the topic.
- List references in alphabetical order by author’s last name.
- It is recommended that your references contain at least six (6) sources.
- Your sources should not consist mainly of personal communication or internet sites. When possible find the published reference the internet site was based upon.
- References should follow the format explained on page 8-9.

## **Acknowledgments**

In one short paragraph state:

- Where and when the research was conducted
- The names and titles of those who provided major assistance with the study.

## Hints for Writing Research Papers

### 1. Choosing an appropriate title.

A title is a concise identification of the main topic of the paper. It should not be too short or too long. (A two to three word title may be too short, but a 14 or 15 word title is too wordy).

For example:

“Whales” (What about whales?)

“All About Whales” (Can you really tell all about whales in ten pages?)

“The Tale of the Whale” (Too ‘cutesy.’ You need to be more scientific.)

“Similarities and Differences Among All Kinds of Tails in All Kinds of Whales” (Too long. Too much to write about.)

“A Comparison of the Caudal Appendages in the Marine Mammalian Order Cetacea” (Very scientific, but still too wordy.)

“Comparison of Caudal Appendages of Cetacea (Whales)” (At last we have a good title. Give the common name along with the scientific one.) (Thanks to Sr. Edna Demanche)

### 2. Scientific Names / Terms

- Scientific names are italicized with the Genus capitalized and the species lower case, e.g. *Allium sativum*.
- Once you have given the full scientific name, you then refer to it as *A. sativum*.
- Of course, you could also call it by its common name – garlic.
- Scientific names and terms should be correctly spelled and used.

### 3. Citing References in the Text

Virtually all scientific papers rely to some degree on previously published work. When an idea is borrowed (whether directly or paraphrased) from another source, it must be acknowledged in the text and the origin of the information must be revealed.

The formal acknowledgment in the text is called a citation. The citation serves as a link between the text in which it appears and the formal alphabetical list at the end of the paper called References. All citations in the text must appear in the References; likewise, all references in the list must be cited in the text.

When citing in the text, the reference (author and year) should be placed naturally into the flow of the sentence.

- One author: “Pascal and co-workers (1981) first isolated a mutant...”  
“Examination of codon usage predicts ADH to be a highly expressed protein in *E. coli* (Ikemura, 1985).”
- Two co-authors: (Smith and Jones, 1999)
- Three or more co-authors: (Smith et al., 1997)

### 4. Listing References

References must contain certain minimum information. For journals, include author, year of publication, title of article, abbreviated journal name in italics, volume number, and page numbers. For books include author or editor, year of publication, book title (in italics), location of publication and publisher. For sources other than a book or journal, include enough information so that the source can be identified (see Sample References). Arrange the list alphabetically by the first author’s last name.

The following style points should be observed:

- A single-author entry comes before a multi-author entry beginning with the same name.
- Works by the same person are arranged chronologically by date of publication.
- If the name of the author is unknown, list the work alphabetically by the first important word in the title.
- Titles of books and journals are italicized. Titles of articles are not italicized or enclosed in quotations.

## Hints for Writing Research Papers continued

- Locations that are well known for publishing can be listed without a state abbreviation, e.g. Chicago and New York.
- All references are justified on the left margin. If the reference requires more than one line, the additional lines are indented 1/2”.
- Double space between references.
- Periods separate major components.
- Colons separate titles from subtitles, cities from publishers, and volumes from pages.

## Sample References

### Book

One author: Day, R.A. 1994. How to write and publish a scientific paper. 4th ed. Phoenix: Oryx Press.

More than one author: Woolston, D.C., P.A. Robinson, and G. Kutzbach. 1988. Effective writing strategies for engineers and scientists. Chelsea, MI: Lewis Publ.

**Dictionary , editor:** Urdag, L., ed. 1972. Magnet. In The Random House college dictionary. New York: Random House.

### Encyclopedia

With author: Hart, L. W. 1988. Magnet and magnetism. In World Book. Vol. 13. Chicago: World Book.

Editor, no author: Lorimer, L.T., ed. 1993. Magnet and magnetism. In Encyclopedia Americana. Vol. 15. New York: Americana Corp.

**Internet:** Martin, Linda. 08 Nov 1997. General Information. <<http://www.science.siu.edu/ijsh/info.html>> Accessed 20 Nov 1997.

**Interview:** Barber, J. D. 8 May 1995. Interview by author. Carbondale, IL.

### Journal Article

One author: Clark, D. P. 1989. The fermentation pathways of Escherichia coli. FEMS Microbiol. Rev. 63:223-234.

More than one author, title and subtitle: Kohara, Y., K. Akiyama, and K. Isono. 1987. The physical map of the whole E. coli chromosome: application of a new strategy for rapid analysis and sorting of a large genomic library. Cell 50: 495-508

**Magazine**, paginated by issue:

Cowley, G. 23 Jan 1995. HIV's raw aggression. Newsweek. 75 (4): 58.

### Newspaper

No author: Study finds free care used more. May 1989. APA Monitor. 14.

Discontinuous pages: McDonald, K. A. 15 Dec 1995. Researchers ponder a stormy forecast. The Chronicle of Higher Education. A12, A16.

**Pamphlet**, organization as author:

American Society for Microbiology. 1994. Slide and poster requirements. Pamphlet. Washington, DC: ASM.

**Phone Conversation:** Barber, J.D. 8 May 1995. Personal communication.

## **Communicating Research Results** **Tips for Preparing and Making Oral Presentations**

Sidney B. Westly, Senior Editor  
Program on Population, East-West Center

It's useful to think of an oral presentation as a cross between a written report and a newspaper article. An oral presentation should give the most important information first, leaving the details for last (in case the audience is asleep by then). This format is called an "inverted (or upside down) pyramid." A presentation should tell a story, keeping in mind the journalist's check-list — "Who? What? When? Where? and Why?"

### **Who is your audience?**

The only measure of a good presentation is the reaction of the audience. Will they manage to stay awake during your presentation? Two days later, will they remember anything you said? Will they be convinced?

Find out as much as you can about your audience, think carefully about their needs and preferences, and tailor your presentation to them as precisely as you can. Are they already interested in your topic? This determines what and how much you have to say to introduce your research. What do they already know about your topic and what is their general level of scientific/technical expertise? What are their attitudes/preconceptions about your topic: will they go along with whatever you say, or will you have to convince them to change their minds? What sources do they listen to: do you quote an article from *Nature* or from the *New York Times*? What state are they likely to be in: are you the last speaker on a long day's program? Do they understand English easily?

### **What do you want to say?**

Two rules apply: (1) Your audience determines what you say and how you say it, and (2) You shouldn't say very much. Imagine you're meeting a typical member of your audience who happens to be an old friend. You sit down over lunch to tell her about your research. An outline might look something like this:

1. My research in a nutshell. Why I did it, what I did, and what I found out... all in about six sentences.
2. Why this research? What was the problem? Why was it important? What other work has been done? If another researcher or two has done important work on your problem or your methodology, you should acknowledge them.
3. Here's what I found out.
4. And here's why it's important. Want a quick trick to detect whether you've dropped out of story-telling mode? Look for sentences in the passive voice: "The sequence of amino acids 1-7 was obtained from a partial cDNA clone." Remember: a presentation is talking, not writing. No one talks like this.

### **How do you prepare?**

There are three key ingredients for making a good presentation: preparation, preparation, preparation.

For starters, you must know your material thoroughly, which means knowing a lot more than you actually present. Think of your presentation as the tip of an iceberg: the submerged part of the iceberg, which is the much larger part, as everything you leave out. The better you know your material, the more relaxed and confident you will feel in front of a group.

Many good speakers write their notes on 4x6" index cards. Put one line of your outline at the top of each card, and then jot down everything you want to say in that section of your talk. If you're having trouble thinking of a good beginning, start in the middle or the end, perhaps by telling about your methods or conclusions.

Now try speaking one or two sections out loud. How long did it take? For the Symposium, you will have 10 or 15 minutes to present your research. Here's a hint: a 15-minute presentation is equivalent to about six typed pages doubled spaced; a 10-minute presentation is equivalent to about four pages. Not very much, is it? Just the tip of the iceberg.

This is not to suggest that you should type your presentation out word for word. Rather, you should write it as notes, or cues, on those index cards, just to remind yourself of the points you want to talk about.

After practicing out loud, cross out what you didn't have time for. Leave your cards overnight and then go through them again. You'll probably think of new and better ways to get your points across, a more logical sequence for your ideas, even important points you forgot. Make a new set of cards (buy a big package, you'll probably go through a lot of sets).

Try your speech out on a teacher or friend. You're so close to your subject that you might go on and on (boring!) or leave something important out (confusing!) that another person can easily spot. Be prepared to cut, cut, cut.

### **Preparing your audiovisuals**

You will want a maximum of one overhead per minute of your talk. For a 15-minute presentation of experimental research, your overheads might be as follows: (1) title/author, (2-3) key points (equivalent to an abstract; putting the most important information first); (4-5) background and importance of problem (introduction), (6-9) what you did (methods and materials), (10-13) what you found out (results) and (14-15) importance of your findings (discussion).

To give your presentation a polished, professional look, you should prepare all your overheads in the same style: same type fonts, same spacing, same use of color. Text should be at least 28 points in size (one-half cm high). Titles should be larger. Follow the 6 x 6 rule: a maximum of six lines per overhead and six words per line. Think in terms of a title followed by a bulleted list. Use short, active phrases only, not complete sentences—the complete story is what you say, the overhead is just for emphasis.

Each chart should make one simple point. You may use line charts for continuous data (such as time-series), but bar charts are more dramatic. Even scatter charts can tell a dramatic story: Are all points on a curve except for two outliers? Are the points all over the chart with no pattern at all? Use a maximum of four lines per line chart (three is better), six bars per bar chart (four is better). Keep labels to the minimum necessary, and keep all your charts in two dimensions (no cute, but misleading, perspective effects).

Charts are better than tables; but, if you must use a table, the 6 x 6 rule applies. A maximum of six columns and six rows. This includes the column and row with labels, so you have five columns and five rows for data.

### **Now you're up there**

You will feel a lot more relaxed and confident in front of your audience if you figure out the logistics of your presentation before hand. Arrive early and check the podium where you will be standing (Where should you put your speaker cards?). Check the facilities for showing your overheads (Will someone else help you? Try to practice ahead of time. Where will your overheads be stacked before they are presented...and afterwards?) (Hint: You may need to go back to an overhead during the question period so don't just drop them in a heap when they come off the projector.) Check the microphone. (Hint: Be sure to wear clothes with a lapel or patch pocket in case the auditorium has clip-on microphones.)

When you come up to the podium to begin your speech, take your time. Take a few good, deep breaths, look out at the audience, and find some smiling, friendly faces. Look into their eyes and let their smiles encourage you. Tell them about your project as you would to a friend over lunch.

### **Then they ask questions**

After your presentation, the audience will have 5 or 10 minutes to ask questions. This may be the most important part of your presentation, and you should prepare for the question-and-answer period just as thoroughly as you prepare for your talk.

Have some extra points ready to bring up at this time—some of the material you cut from your speech, such as problems you encountered and how you solved them, or additional items you didn't have time to mention. You may even bring up further implications from your work and ideas as to what you would like to do next. To present additional results, have one or two extra overheads ready to show.

Above all, take your time (remember to breathe!) and don't let the questions fluster you. If someone asks a question straight from outer space, buy yourself some time while you think of a response: "That's a very interesting question. As I understand it, you are asking... [restate their question in your own words]."

Practice making a smooth transition from their question to one of the good answers you have prepared: "I don't know the answer to your question, but a related issue that we encountered was..." or "I'm so glad you asked about the methods we used for handling our cultures because we actually tried a second nutrient system and got some rather interesting results. As you can see from this slide, which I didn't have time to show you during my talk..." or "That's a really good question. Perhaps we can come up with an answer in the next stage of our work."

Remember, you're not expected to know all the answers. Don't be afraid to learn something from your audience. Above all, try to convey a sense of excitement about your work. If you can do this, your audience may just surprise you and stay awake.

## **Project Categories**

### **1) Animal Sciences**

Study of animals and animal life, including the study of the structure, physiology, development, and classification of animals. Animal ecology, physiology, animal husbandry, cytology, histology, entomology, ichthyology, ornithology, herpetology, etc.

### **2) Behavioral & Social Sciences**

The science or study of the thought processes and behavior of humans and other animals in their interactions with the environment studied through observational and experimental methods.

### **3) Biochemistry**

The study of the chemical substances and vital processes occurring in living organisms, the processes by which these substances enter into, or are formed in, the organisms and react with each other and the environment.

### **4) Cellular & Molecular Biology**

The study of the structure and formation of cells.

### **5) Chemistry**

The science of the composition, structure, properties, and reactions of matter, especially of atomic and molecular systems.

### **6) Computer Science**

The study of information processes, the structures and procedures that represent processes, and their implementation in information processing systems. It includes systems analysis and design, application and system software design, programming, and datacenter operations.

### **7) Earth Science**

The study of sciences related to the planet Earth (Geology, mineralogy, physiography, oceanography, meteorology, climatology, speleology, seismology, geography, atmospheric sciences, etc.).

### **8) Engineering: Materials & Bioengineering**

The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical machines and systems.

### **9) Engineering: Electrical & Mechanical**

The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, processes, and systems.

### **10) Energy & Transportation**

The study of renewable energy sources, energy efficiency, clean transport, and alternative fuels.

### **11) Environmental Analysis**

The analysis of existing conditions of the environment.

### **12) Environmental Management**

The study of managing man's interaction with the environment.

### **13) Mathematical Sciences**

The study of the measurement, properties, and relationships of quantities and sets, using numbers and symbols. The deductive study of numbers, geometry, and various abstract constructs, or structures. Mathematics is very broadly divided into foundations, algebra, analysis, geometry, and applied mathematics, which includes theoretical computer science.

### **14) Medicine & Health Sciences**

The science of diagnosing, treating, or preventing disease and other damage to the body or mind.

### **15) Microbiology**

The study of micro-organisms, including bacteria, viruses, prokaryotes, and simple eukaryotes and of antibiotic substances.

### **16) Physics & Astronomy**

Physics is the science of matter and energy and of interactions between the two. Astronomy is the study of anything in the universe beyond the Earth.

### **17) Plant Sciences**

Study of plant life. Ecology, agronomy, horticulture, forestry, plant taxonomy, physiology, pathology, plant genetics, hydroponics, algae, etc.

## Contacting the HAS Office

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Visit our website at <http://www.hawaii.edu/acadsci>

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Some information for this Handbook was taken from the Junior Science and Humanities Symposium (JSHS), Guidelines for Preparation and Presentation of Student Research. The entire JSHS Guidelines can be downloaded from the JSHS website: [www.jshs.org](http://www.jshs.org)