Greetings from the Directors of Judging

On behalf of the California State Science Fair Board, we thank you very much for agreeing to serve as a category judge at the California State Science Fair. For the many returning judges who have been with the Fair over the years, we offer our deepest thanks for your continued service. For first time judges, congratulations on being selected to become a part of this group of accomplished scientists and engineers. The success of the California State Science Fair is largely due to the contribution of your scientific expertise in the judging process. We hope that you enjoy the interaction with the students and your fellow judges.

We would appreciate and encourage all comments and suggestions you may have regarding the California State Science Fair. Please communicate your ideas to us at any time either by e-mail or telephone at the address/phone numbers given on pg. 2.

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Directors of Judging
2017 California State Science Fair
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Schedule
Tuesday, April 25, 2017

6:30  **Registration Opens.** Judges will receive name badges, *Program, Change Sheet*, and maps showing project displays and the judge meeting rooms. A continental breakfast is provided.

7:30  **All Panel Members Meet with Directors of Judging, IMAX Theatre.** All judges should be present for important materials and last-minute announcements.

8:00  **Judging Team Meetings at the Project Displays.** Chairs convey last-minute changes. No students are present (they are attending an Orientation meeting) so all projects can be surveyed freely.

8:30-10:30  **First Round of Judging Interviews with Students.**

10:30-11:00  **Scheduled Break in Judging.** Students relax. Judges meet in assigned rooms to decide finalists and identify projects with insufficient interviews.

11:00-12:30  **Final Round of Judging Interviews with Students.**

12:30  **Panel Meeting for Decisions with Lunch.** Lunch provided in the WAB lobby. All judging panels have assigned rooms in WAB.

1:30  **Deliver Results to Judging Results Room.** WAB 381

1:30-3:30  **Project of the Year Committees.** Junior Division convenes in WAB Area M1. Senior Division convenes in WAB Area M6. See the Judges Map distributed at Judge Orientation.

4:00-5:30  **Awards Ceremony.** The Awards Ceremony is closed to the public. Admission is limited to participants. Parents and chaperones will be directed to two locations to watch the ceremony via live video feed.
The California State Science Fair

The 66th California State Science Fair, recognized by the State of California as the official State Science Fair, will be held on Tuesday, April 25, 2017. This year all activities will again take place within the buildings of the California Science Center in Exposition Park, just south of downtown Los Angeles. The Fair is operated under the auspices of the California Science Center, and is administered by the California State Science Fair Board.

Just under 1000 students are expected to compete in this year's Fair. Each has won a top award at their affiliated county or regional science fair. These fairs provide an opportunity for students throughout the State to reach this final science fair of the academic year. The students at CSSF participate in twenty two subject categories in two age divisions. They will be competing for First, Second, Third, and Fourth Place awards. The First Place winners are automatically entered into the Science Fair Project of the Year competition.

The four category award winners in the Senior Division receive $500, $250, $125, and $75, in addition to an inscribed medallion. The corresponding amounts in the Junior Division are $250, $125, $75, and $50. The Science Fair Project of the Year awards in the Senior and Junior Divisions are $5000 and $2500 respectively. Top award winners in the Senior Division will be qualified to Intel ISEF, while top award winners in the Junior Division will be qualified to the Broadcom MASTERS competition. Honorable Mention is not a category award, but is instead a recognition awarded to a small number of additional projects deemed of outstanding merit by the judges. All participants in the Fair will receive a certificate of participation.

Concurrent with the Category judging, many Special and Recognition Awards are judged and presented. These are given by California scientific and engineering associations, corporations, and universities. Special Awards are $1250 or more presented to a single project at the Awards Ceremony which concludes the Fair. Recognition Awards are smaller awards presented to the winners privately at their projects near the end of the judging interview period. Special and Recognition Awards carry monetary gifts determined by the awarding organization.

Finally, there are the prestigious competitions for California State Science Fair Student of the Year, and California State Science Fair Teachers of the Year. The teacher competition is limited to California science teachers who have been nominated by a student entered into the State Science Fair. Teachers nominated by students in the Junior and Senior divisions are judged and selected separately. Finalists in this competition are invited to the Fair for final interviews on the day of the Fair, which occurs separately from the judging of student projects.
The California State Science Fair Student of the Year competition is limited to high school seniors who are competing in the State Science Fair. The decision on this award is based upon the student's project, a separate private interview, and a written statement by the student submitted well in advance of the Fair.

The California State Science Fair will be open for public viewing from 3:00 - 4:30 p.m. on Monday. We have again asked the participants to make a special effort to be at or near their project display during this period. The public viewing time will also provide an opportunity for you to see Science Fair projects you would not ordinarily have time to see the next day during the judging period.

Judges are invited to the Fair on Monday evening, the night before projects are judged, for the Opening Ceremony and Keynote Address at 5:00 p.m. This year’s Keynote Address speaker will be W.E. Moerner, Professor of Chemistry and Professor by courtesy of Applied Physics, Stanford University, and Nobel Laureate in Chemistry, 2014. In previous years the Fair’s Keynote Speakers have included Douglas Osheroff (Nobel Prize, Physics, 1996), Steven Chu (Nobel Prize, Physics 1997), Elizabeth Blackburn (Nobel Prize, Physiology or Medicine, 2009), George Olah (Nobel Prize, Chemistry, 1994), Buzz Aldrin (Second man on the Moon), Louis Ignarro (Nobel Prize, Physiology or Medicine, 1998), Ahmed Zewail (Nobel Prize, Chemistry, 1999), Adam Savage (Mythbusters), and Randy Schekman (Nobel Prize, Physiology or Medicine, 2013).

Communicating with the Fair

**CSSF on the World Wide Web**  [http://cssf.usc.edu/](http://cssf.usc.edu/)

The California State Science Fair maintains the oldest and most complete science fair site on the World Wide Web including application processes for both participants and judges, current rules and regulations, as well as results and photographs from previous State Science Fairs. Judges interested in further interactions with, and providing additional specific assistance to, student participants are encouraged to use this site.

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What’s New for the 2017 Fair

This year all project displays in the Fair will again be in the main building of the California Science Center. There will be no major changes for judges, though we note the following:

- In contrast to the separate Junior Division and Senior Division award ceremonies in recent years, this year there will be a single awards ceremony for all students. While judges are welcome to view the ceremony, parents and chaperones will not be admitted to the ceremony, but will have an opportunity to view it on a video feed in two different locations depending upon the viewing ticket they hold.

- Judges are requested to review the PROS form (or ISEF Form 1C) for projects which have been performed within a professional research environment. Students are required by Display Regulation #8 to have that form available for your inspection. Please distinguish between work done by the student and that done by the research institution for the student.

Changes instituted in earlier years, regarded as successes, and continued are:

- Several judging panels will be sited within the Samuel Oschin Pavilion which now houses the Space Shuttle Endeavour. However, all judges are welcome to visit Endeavour after your afternoon judging meetings.

- During the morning break in interviews, judging panels assigned to the Samuel Oschin Pavilion will be directed by CSC staff to meetings within the administrative offices of the California Science Center instead of needing to walk all the way to the Wallis Annenberg Building where they will meet for final decisions after judging interviews end at 12:30 pm.

- Judges are required to sign the project tent card of every project interviewed.

- In addition to the four Category Awards, judging panels are permitted to name a small number of projects as Honorable Mentions. Recognition of these projects is solely by this title and a certificate. It does not include any financial award. This designation should be reserved only to those projects which judges feel are truly outstanding and truly deserved to receive a Category Award had there not already been four better projects in the panel. While there is no minimum number of Honorable Mentions that must be given, judges are advised not to include more than one-fourth to one-third of all projects in the panel among those projects receiving Category Awards or Honorable Mentions.
The Judging Process

About 400 judges volunteer as category judges to evaluate the student projects. The majority of these judges are scientists and engineers from academia and industry throughout southern California. In addition, about 60 more judges will evaluate projects for Special and Recognition Awards.

Logistics of Judging

Pre-Fair: About two weeks prior to the Fair, on the Fair’s Web site you will be able to view the abstracts for each project you will judge. Study these before the day of the Fair because, on that day, time is a very precious commodity. The Fair does not generate paper copies of these abstracts.

Arrival: The Chair of your panel will have you sign your panel’s Judge/Project grid. This grid will be used to fix the judging schedule for your panel. When all panel members are present, the Chair will assign you to begin your judging at a specific project, and will determine the average length of time you should spend interviewing each project. This determination is given in paragraph 7 on page 22. Please make every effort to keep to the schedule.

First Round of Judging: At the outset of every interview, sign that project’s tent card. When you have spoken with a student for approximately the time determined above, you should proceed to the next project in numerical sequence. If that project is occupied with another judging interview or attention from the media or VIPs, that project should be temporarily skipped and revisited at the earliest possible time. There is no requirement that judges within each panel move precisely synchronously, but gross deviations from the agreed-upon time will cause “traffic jams.”

Scheduled Break in Judging: During this time, first indicate on the Judge/Project grid which projects you have interviewed so far. Then your panel will determine finalists and identify projects which have not yet received a sufficient number of interviews based upon the Judge/Project grid.

Final Round of Judging: You should see at least all of the finalists you did not interview earlier. (See the Guidelines on page 8.) If you are temporarily blocked from all such finalists, you should interview non-finalists, beginning with those with the fewest interviews in the First Round. Remember that one of the primary functions of the California State Science Fair is furthering the education of the participants, and it may be that interviews with non-candidates will, from that perspective, be more important than interviews with finalists. Do not “retire” until time is up or you have interviewed all projects in the entire panel. Do not “retire” early by speeding through interviews. Make use of all of the interview period.
Final Meeting: Over lunch you will update your personal record in the Judge/Project grid, select the winners, and sign the Judging Results form.

Project of the Year Judging: Immediately following panel decisions, two committees (one for each division, composed of one representative from each panel) review all First Place projects and determine this Award. The Senior Division panel will also select Intel ISEF qualifiers.

What to Expect From the Students

In order to have reached the State Science Fair, each student must have a project which was judged as one of the best projects in at least two prior competitions, the last being a county-wide or multi-county-wide competition. Some students will be comparable to good graduate students while others will be obviously outclassed. Whatever the quality, the students have justifiable pride in their accomplishments.

Judges should expect the students to be able to define the scientific or engineering terms and describe any methodology or equipment used during the course of the project. In addition, the student should be able to explain the thought processes and steps taken at each stage. The depth of these descriptions and explanations should be commensurate with the age of the student and the level of sophistication of the project.

For further guidance, see “How To Be A Good Science Fair Judge” beginning on page 17.

Project Evaluation

The projects represent a wide range of student abilities and sophistication. The quality of the student abstracts and project displays should be judged together with the student interview. Each project should be judged against others in the category, not against projects from other years, or in other categories.

Project evaluation issues are covered in the next three sections: “Guidelines for Judging” on page 8, “Judging Criteria” on page 10, and “Comparing Projects That Aren’t Comparable” on page 15.

Determining the Winners

It is important to maintain a balance in evaluating the project and the student's accomplishments. The students should not be given more credit than they deserve because they are young, nor by the same token, should they be judged harshly because they are not graduate students or professionals.

There are no regulations for choosing the winners, and each panel will have its own method. Several different techniques have been used, no one better than
another in the general case, and all are acceptable to the Fair. We rely on the intelligence and experience of the expert judges in each panel to discuss the relative merits of the various projects and determine in their own way, ideally by consensus, the best four projects.

One and only one project must be chosen for each place (first, second, third, and fourth place) in every category. There cannot be a tie, and there cannot be an omission. Should a panel turn in results with these awards improperly specified, a faceless bureaucrat deep within the bowels of the Fair will rectify the error. A small number of projects of outstanding merit may be identified by the judging panel as Honorable Mentions which stand in addition to the four Category Awards.

The only written records required from each judge are (1) a signature on the tent card of every project you have interviewed, (2) a signature on the Judge/Project grid, (3) checks on the Judge/Project grid indicating interviews, and (4) a signature on the final Judging Record Form after the final decisions have been recorded. A short reason is given by the panel for the selection of the First Place award. This form must be submitted by 1:30 p.m. because Project of the Year judges must receive the documentation on the First Place winners at the start of their judging period.

Confidentiality
In fairness to the participants it is absolutely necessary to maintain the confidentiality of the results of the judging process. Judges are not to disclose in any way the results of the judging process to anyone other than the Directors of Judging or other designated Fair Officials. Winners will not be disclosed before the Awards Ceremonies which is held at the conclusion of the Fair.

Conflict of Interest
A potential for conflict of interest arises when a judge is personally acquainted with a student that he/she will be judging. This acquaintance can be the result of a biological relationship (i.e., a family member), mentoring, teaching, etc. It is the responsibility of the individual judge to notify the Directors of Judging of any potential for conflict of interest at the earliest possible time (ideally on the Judge Application Form) so that the judge can be reassigned to a different category that would eliminate the conflict.
The Judge-Student Relationship

Not infrequently, a judge is especially impressed with a student or project and would like to offer help or advice, or even offer the student a job. There are acceptable methods for establishing contact with a student. Judges may not ask students for their phone numbers or initiate or propose any form of future contact. Instead, contact the Directors of Judging and indicate to them your availability to the student for future assistance. If direct contact between a student and judge after the Fair would result in further benefit to the student after the Fair, such contact will be facilitated by the California State Science Fair, but only with the approval of the student's parents or guardians. Student-initiated requests will always be facilitated.

Inappropriate comments of a personal nature by a judge to any participant are unacceptable. Such behavior is sufficient grounds for barring that judge from future Fairs. Judges must adhere to the highest standards of professionalism in all cases.

It is important to remember that students participating in the California State Science Fair are of middle school and high school age. They are not adults. The relationship of student to judge is that of a minor to an adult in a position of authority. It is the responsibility of all judges to ensure that all interactions between themselves and the students are in the best interests of the students.
Guidelines for Judging

Panel Chairs and judges should make every effort to adhere to the following guidelines to ensure that each student is treated equally and fairly. These guidelines are intended to optimize the student's experience at the Fair. Two of the purposes of the California State Science Fair are to stimulate an active interest in science and engineering in students, and to provide an educational experience through exposure to expert judges. These guidelines are intended to promote these goals.

Every student should be interviewed by at least five different judges
Ideally, this ensures that each project is seen by a sufficient number of judges to ascertain its potential for winning. Moreover, as each judge interviews more students, he/she will be able to more accurately determine the quality of projects in the category. This is also the student's opportunity to meet with and learn from professional scientists and engineers. The interview can (and ideally should) be an educational experience for the students. They will benefit from comments from several sources, regardless of the caliber of the project. Multiple interviews multiply and diversify the experiences of both students and judges.

Students should be interviewed by one judge at a time
Even one judge can be intimidating for some students and for this reason one-on-one interviewing is strongly advised. Occasionally, a panel Chair may opt for pairing an inexperienced judge with an experienced one for a short time, numbers of judges and projects permitting. In no case should more than two judges ever interview a student at the same time.

Every interview should last between 5 and 15 minutes
Ideally, each interview should last about 10 minutes. However, logistically this is not always possible in a given category. An interview of less than 5 minutes cannot satisfactorily determine the extent of a student's knowledge of his/her project, while interviews of longer than 15 minutes can slow the judging process and result in some students not seeing judges and vice versa.

Every judge should interview every potentially winning project
This ensures that the winners are chosen by consensus of all panel members. It also ensures that each judge interviews each finalist in order to come to a decision. Each panel Chair will have his or her own strategy for directing the panel to the selection of its winners.
Every student should be treated with respect
This should be self-evident, but is sometimes forgotten. While these students are young, they are aspiring, though inexperienced, scientists. They and their projects should be treated with due consideration, even if the science is flawed. Each judge should introduce him/herself, be polite, and try to put the student at ease.

Every interview should have educational value
The interview should provide some educational benefit to the student, particularly those who are not serious contenders for a prize. This is an opportunity to educate the student as to how a scientist thinks, and how to identify important questions others will ask, and the questions they should be asking themselves about their project. Your interview could set the student on the track to a better project for next year.
Judging Criteria

The Judges Advisory Committee has determined the five areas of originality, comprehension, organization and completeness, effort and motivation, and clarity to be important for creating a quality science project. The following information has been sent to the student participants.

Originality

Original ideas and the creative use of resources are usually impressive. This originality may be in the scientific concept, a new approach to solve an old problem, or a new interpretation of data. However, an original project must be well executed. Original projects are those that go beyond the textbooks and explore new ground and innovative techniques.

Comprehension

Comprehension is the understanding and appropriate use of scientific theory, terms, techniques, and methodologies. Students should have a depth of knowledge about the scientific and engineering principles and practices, which can be shown by the ability to extrapolate what was learned from the project to the subject in general. Depth includes understanding the basic science behind the project topic, comprehension at a finer level of detail, and awareness of the influence that the project has on related material in the subject topic.

Organization and Completeness

The project should have a well-defined goal or objective. The materials, methods, and experimental design should be sufficient to answer all the appropriate questions.

A second component of organization is thoroughness, which includes not only the issue of how well the original questions have been addressed, but also the issue of how fully questions arising during the project have been addressed. It is the duty of all scientists to provide evidence in support of their claims. The burden of proof does not rest with the observer. Without supporting results or data, the science project is not a completed work.

Effort and Motivation

The amount of time a student has spent doing the actual science project and the amount of time the student has spent reading and learning the subject should both be considered. While motivation and effort are not the same, the amount of effort that goes into a project is usually an indication of a student's motivation. It is important to know if a student enjoyed the experience and is interested in learning more.
Clarity

Written and oral communication skills are very important in science and engineering. Ideas should be clearly presented and easy to understand. The experiments should have well-defined goals which indicate clear understanding of the basic science. A well-written abstract, easy to follow visual aids, and clear and concise answers all add to the quality of a project.

Project Display Requirements

Judges should be aware of the following Display Requirements included in the Official Application Packet used by all students in applying to the Fair. These specific requirements are included here because they are enforceable only during the judging period. It is up to each judging panel to decide the importance of any violations they may observe.

“2. Students must be present at their display during the judging period or the project will not be judged. For team projects, at least one of the authors must be present before judging will be allowed.

“3. The student's original laboratory notebook must be present for inspection during judging. However, it is advised that this notebook be on display only during the actual judging period.

“7. A project display at the State Science Fair need not be identical to the display at the County or Regional Fair. The display may be altered to improve the presentation or to incorporate the results of research subsequent to the earlier Fair.

“8. All projects must clearly distinguish between the work of the student participant and the work of others. Students participating in a research opportunity in industry, a university, hospital, or institution other than their school, must display only their research. Such students must have the principal research director complete the Professional Research Opportunity Support form specifying the assistance received and the role and contributions of others in the project. A copy of this form must be submitted as part of the application. The original must be included in the project notebook at the project display for inspection by the judges. Though discouraged, ISEF Form 1C is an acceptable alternative.

“10. Participants are not permitted to distribute any items to the judges.

“11. Parents and advisors are not permitted in the display areas during judging.”
Project of the Year

This prestigious award represents the "Best of the Best" of the California State Science Fair. The winners are selected from the first place winners of each category. Two awards are given, one for Junior Division and one for Senior Division. For each division the judging panel consists of one representative from each of the respective division categories and a chair selected by the Directors of Judging. The chair for each division is selected from judges in the other division, is impartial in the judging process, abstains from voting for the winner, and serves to facilitate the process in a timely manner.

A 90 minute period is allocated for the review of projects in contention for the Project of the Year Award. During this time one representative from each category presents a short synopsis (3 minutes or less) of the winning project from their category. The time limit will be strictly enforced. Review of all candidate projects will take place in two rooms within the Judging Panel Meeting Areas.

Project of the Year Judge Selection

Each Category Chair will select his/her panel’s representative as soon as possible before the Science Fair. By default, if no qualified member of the panel is identified, the Category Chair will serve as the panel representative. The Category Chair should forward the name of the selected judge to the Directors of Judging as soon as possible before the Science Fair so that the Project of the Year judges can be identified in the Program and on the Category Judges sign-in sheet.

It is the responsibility of the Category Chair to contact every panel member to confirm their participation in the Fair. At the time of contact each panel member is to be informed of the Project of the Year judge selection process and their participation solicited. In the evaluation of candidates for Project of the Year judge the Category Chair considers their interest and willingness to serve as panel representative and ability to commit the time necessary to perform in this capacity. Ideally, the Project of the Year judge should have a minimum of two (2) years of prior category judging experience or 10 years of professional experience.
Responsibilities of Project of the Year Judges

1. Agree to participate until 3:30 p.m. on the day of the Science Fair.
2. Agree to serve as an advocate for the First Place Award project in his/her panel, regardless of whether he/she voted for this project as that award winner.
3. Must not be detractors or de-advocates for his/her panel’s winner.
4. Provide a 1 to 3 minute synopsis of his/her panel’s First Place Award project to the other Project of the Year Judges.
5. Judge all of the category winners across all disciplines in a short time to determine the Project of the Year in his/her Division.

Responsibilities of Project of the Year Chairs

1. Ensure that all panel representatives are present and ready to judge at 1:30 p.m. The Directors of Judging are to be notified of any delinquencies.
2. Provide each member with a copy of the Project of the Year judging form.
3. Strictly limit the presentation of the synopsis of each Category Winner to 3 minutes.
4. Expedite the judging process so that the review is concluded by 3:00 p.m.
5. Allow time for each representative to repeat the synopsis of the Category Winner. The Chair should refer representatives to the Project of the Year Judging Guidelines presented in this Judging Handbook.
6. Allow each representative three (3) votes in the first round of voting for the Project of the Year, and one (1) vote in subsequent rounds of voting.
7. Ensure that each member signs the Project of the Year Judging Form.
Project of the Year Judging Guidelines

The following guidelines shall be followed by Project of the Year Judges when viewing category winners and determining the Project of the Year. The objective is to determine which project is clearly superior in original thought, scientific impact, societal impact, and worldly application. Remember that these projects are judged across all disciplines within each division.

1. It is expected that at this level of competition the students have an understanding of problem-solving and of the scientific method, and that this understanding is clearly present in each represented project.

2. It is expected that students have demonstrated that they understand the difference between dependent and independent variables, the importance of replicating experiments, and the importance of modifying their experimental design to account for knowledge gained from replication.

3. Judges are encouraged to keep notes while judging for the Project of the Year.

4. Judges for the Junior Division should keep in mind that projects in this division generally will not have as much breadth, depth, and detail as those projects in the Senior Division.
Comparing Projects That Aren’t Comparable

Projects with Different Levels of Sophistication

One of the most difficult judging tasks is comparing projects carried out in university or industrial laboratories under professional guidance with projects done at home with no professional help. Judges should not be in the position of arguing that a particular student would have done much better (or poorer) if only they had had access (or no access) to state of the art equipment.

Among students with access to professional laboratories, every year there are those for whom the facilities are the enabling mechanism for their efforts, and there are those for whom the facilities are a mask for little effort. Both types of students should be judged on their personal scientific accomplishment and their ability to exploit the resources available.

Students who work entirely on their own may appear to be at a disadvantage when judged solely on the basis of the project's title and display. If their accomplishments are, in fact, superior to others, the interview is where the playing field is leveled. It is important to identify how the student made a difference in the direction of the project.

Regardless of where the science project is conducted, good scientific principles and engineering practices must be evident. The student’s level of scientific understanding should be consistent with the project’s level of technical sophistication and complexity. Judges should apply this standard in evaluating the student’s project.

Team Projects vs. Individual Projects

Judging the Science

It is important that judges keep in mind that all projects, regardless of the number of participants, are to be evaluated primarily on the quality of the personal contribution(s) of the student(s) to the science in evidence. In order for the judge to be able to evaluate the level of science of a team project, it is essential that all students in the team participate in the interview (unless otherwise acknowledged). All students on the team should have general and specific knowledge of the project such as how the question was conceived and subsequently attempted to be answered. The judge has the freedom to ask a question of anyone in the group. However, the judge should be aware that the group has the equivalent freedom to choose a spokesperson and may refer a particular question to a specialist.
Judging the Effort

In your comparison of a team project with one done by an individual, it is fair to have a higher expectation of the team project regarding the overall level of effort involved in the project. In other words, team projects have greater resources (the number of minds working together) and therefore a greater capacity for more research and data collection, more time, effort, and thought spent on the project, and more analysis than someone acting alone.

There should also be evidence of team collaboration and synergy among team members (which should become evident during the interview process). In particular, the judge should try to ascertain how fully the resources of the group have been exploited. Remember that one of the goals of team projects is to encourage students to work as a team (mimicking the way science is done in the real world), and to encourage project management. Each team member should have made a significant contribution to the overall project.

Finally, please do not discount any student for having worked in a team (or in a research lab for that matter) because you feel they have had an unfair advantage.
How To Be A Good Science Fair Judge

Being a judge for the California State Science Fair is challenging, but it’s worth the effort. You are making a memorable impact on the lives of talented young people. For some students, you are the first professional they have ever met who does a science or engineering job for a living. Part of your job at the Science Fair is to be an ambassador for your profession. Students’ perceptions of you could influence their career choices. It is a good idea when you approach a student to introduce yourself and describe your background.

As a judge, it is most important for you to show the students that you are both fair and knowledgeable. Your fairness is indicated by a few simple actions:

- You spend about the same amount of time with each student
- You listen to the student’s explanation of the project
- The questions you ask are intended to find out more about the project and how it was done — *not* to embarrass or intimidate the student

This sounds simple, but can be challenging to implement. Your best tool in judging is your ability to ask questions. Be sensitive to what the student knows. You can always ask questions that the student can answer, and keep a conversation going for ten minutes (see page 8 for judging guidelines regarding length of interviews). There are some questions all students should be able to answer, including variations on:

- How did you come up with the idea for this project?
- What did you learn from your background search?
- How long did it take you to build the apparatus?
- How did you build the apparatus?
- How much time (many days) did it take to run the experiments (grow the plants) (collect each data point)?
- How many times did you run the experiment with each configuration?
- How many experiment runs are represented by each data point on the chart?
- Did you take all data (run the experiment) under the same conditions, *e.g.*, at the same temperature (time of day) (lighting conditions)?
- How does your apparatus (equipment) (instrument) work?
- What do you mean by (terminology or jargon used by the student)?
- Do you think there is an application in industry for this knowledge (technique)?
- Were there any books that helped you do your analysis (build your apparatus)?
- When did you start this project? or, How much of the work did you do this year? (Some students bring last year's winning project back, with only a few enhancements)
- What is the next experiment to do in continuing this study?
- Are there any areas that we not have covered which you feel are important?
- Do you have any questions for me?
(Note: these are only suggestions to keep the dialogue going. You may find other questions to be more useful in specific interviews.)

One type of question to avoid is “Why didn't you do . . . ?” Probing questions are useful to stimulate the thought processes of the student. A solution to or extension of the work presented may be obvious to you with all of your years of experience, but the student may not understand why you’re asking such a question. If you ask a question of this type, be sure to imply the correct intent, as in “Could you have done . . . ?” or “What do you think would have happened if you had done . . . ?” When phrased this way the question is an invitation for the student to think about the experiment in a different way and can turn the question into a positive experience.

Sometimes we come across projects in technical areas with which we are intimately familiar, and the student just didn’t get it — they made some incorrect assumptions, missed a key indicator in the data, came up with a false conclusion, or didn’t look at or understand some common principles. It can be tempting to share your knowledge about the topic, to help the student appreciate what happened (or should have happened) in the experiment. Some judges have been observed to enthusiastically pontificate while a student stood idly listening. Before you do this, please consider that these students are smart, and the next judge may hear the student parroting back the knowledge you imparted. You may try with your questions to lead the student toward the right answers, but please don’t give the answers. If you really feel compelled to make explanations, save them until near the end of the judging time when your knowledge will not be relayed to judges following you. Alternatively, you may give the student your card and invite future discussion about the project. Remember to be sure that your discussion meets the following Science Fair objectives to involve the student in discovery:

- Your conversation should resemble a discussion with an esteemed colleague who is having difficulty with some research — together, you talk through the situation to mutually arrive at improved answers;
- The student should be doing most of the talking;
- Coax and/or coach the student into realizing and describing the correct conclusions; it’s the student’s project, not yours;
- Encourage the student to conduct more experimentation in order to verify the new conclusions.

Finally, during your panel’s meetings, please inform your fellow judges of those students to whom you have provided analysis or information. This is in fairness to other students who are being judged in your category and who may not have received the benefit of your knowledge.

Since you are a judge, most students instinctively think of you as an intimidating figure. The more you can dispel this image, the more likely you are to help the
student be less nervous, and get a better discussion. Again, simple things can make a difference:

- Make eye contact with the student;
- If the student is short and you are tall, stoop, bend, or squat down to lower your eye level (if your knees won't allow this, ask to judge the Senior category);
- Tip your head to the side a little to indicate interest (this is a universal nonverbal form of communication; even your dog does it);
- If you wear glasses, look at the student through them, not over the top of the frames;
- Whenever a student shows a good idea, clear chartsmanship, a clever way to get expensive results with inexpensive equipment, or anything you can compliment, be sure to use a compliment;
- Use a tone of voice that indicates interest or inquisitiveness, not scepticism or contempt.

To assure the perception of fairness, you also need to make sure that one student doesn’t monopolize your time. Some have a well-rehearsed pitch that may prevent you from having a chance to interact with the student. You have to find some way to break the pattern, and again, your tool is questioning. Politely interrupt with a question, usually in the form of “I'm sorry, I didn’t quite catch the relationship between that adjustment and this result,” or even some of the “any student can answer” questions, like “How many times did you run the experiment with each configuration?” and “How many experiment runs are represented by each data point?” The idea is not to stop the student from talking, but to get the student to interrupt the tape recording and think about what is being communicated to you.

Many of these students are exceptionally bright, and it is easy to think — when facing an incredibly impressive display and a supremely confident student — that this student’s research is beyond your knowledge. If a project is really and truly completely outside your experience, you are still knowledgeable in the area of problem-solving and the scientific method. Concentrate on these aspects rather than the details of a particular project.

Young people have largely developed their conversation techniques through their interactions with other young people. They tend to actively converse on topics that they are most knowledgeable about. When teenagers are faced with a discussion they don't grasp, they typically lose interest and look bored. If you keep appearing to be interested, no matter what is said, the student will assume you grasp what's going on. When you ask questions, even the “any student can answer this” type of questions, the student assumes you have kept up with the discussion and are maintaining an interest in their work. You may be struggling with the student’s whole presentation to come up with something — anything — of a topic-specific nature to ask. At the same time it is impossible for the student to understand your level of comprehension of the presentation. As you would with your colleagues,
continue to focus and refine your questions to those aspects that are more familiar to you. Continuing to question will help to familiarize you with the project’s process, procedures, intent, or outcomes. Remember, you are not the only judge who will talk to this student. If something is not completely clear, bring it up in the judging meeting; judges who are familiar with the applicable science will have sorted it all out.

At the other extreme there are a few projects that are “snow jobs” which make it to the State Science Fair. Sometimes you can ferret out a “snow job” by simply asking for explanations of words that the student uses; don’t assume the student knows what the technical terms mean. They may also not know what a piece of equipment does, how it works, or why it was used. Go into one of these discussions with the attitude that, if the student can’t explain it to your satisfaction, then the student really doesn’t understand the science of what’s going on. Chances are, if it doesn’t make sense to you, it doesn’t make sense. Of course, as with all questions or concerns that arise, discuss these projects during the judging session; there will probably be others on your panel with similar reservations.

When you return to your judging panel and deliberate on the projects, you can use a few simple criteria for selecting the winners:

- The quality of the student’s work is what matters, not the amount of work;
- Team projects are judged like other projects — it is the quality of the work that matters (an individual project of equal quality to that of a team project may be ranked higher because of the comparatively greater effort required by the individual);
- A less sophisticated project that the student understands gets higher marks than a more sophisticated project that is not understood;
- Access to sophisticated lab equipment and endorsements from professionals do not guarantee a high quality project (Did the student really understand what was going on?);
- It’s okay if the student ended up disproving the objective or hypothesis of the experiment.

High marks go to:

- Genuine scientific breakthroughs
- Discovering knowledge not readily available to the student
- Correctly interpreting data
- A clever experimental apparatus
- Repetitions to verify experimental results
- Predicting and/or reducing experimental results with analytical techniques
- In engineering categories, experiments applicable to the “real world”
- Ability to clearly portray and explain the project and its results
Low marks go to:

- Ignoring readily available information (*e.g.*, not doing basic library research)
- An apparatus (*e.g.*, model) not useful for experimentation and data collection
- Improperly using jargon, not understanding terminology, and/or not knowing how equipment or instrumentation works
- Presenting results that were not derived from experimentation (*e.g.*, literature search)

Although the most obvious reason for your being a judge at the Science Fair is to assist in the selection of the projects that get prizes, the effective judge knows that this is an important experience in the life of every participant. Please do your best to make sure that all of the participants remember the Science Fair as a positive experience in their lives.
Responsibilities of Panel Chairs

Before the Fair

1. Contact each member of the judging panel by phone and give them your phone number so that they may contact you if necessary. During this first contact, select one judge (which may be you) to represent your panel in the afternoon judging for the Project of the Year. This representative needs advance notice for scheduling because judging for this award continues until 3:30 p.m.

2. Work with the Directors of Judging to ensure that your panel has a sufficient number of judges. You may need to recruit some yourself.

Morning of the Fair

3. Arrive early and check with the Directors of Judging about any last minute changes in student projects or judges. The Directors of Judging will meet with all judges promptly at 7:30 a.m. They will also provide to Panel Chairs a Judge/Project Grid and a Results Form which your panel will use and turn in later. Inform them of who will be judging Project of the Year for your panel. If no one is available, you are responsible for representing your panel.

4. Locate all projects in your category’s display area as identified by the Project Numbers on the Judge/Project grid. This requires that you walk the floor because your final set of projects may differ from that in the printed Program owing to:
   • additions/deletions listed on the Change Sheet inserted into the Program.
   • post-Change Sheet changes given to you by the Directors of Judging. Do not allow any additions or deletions not listed on these two documents.
   • no-shows.

Don’t forget about floor displays which will be located out of numeric order.

5. Have each judge initial the Judge/Project grid to indicate their attendance. Add and delete names on the grid as appropriate.

6. On the Judge/Project grid, distribute your judges (including yourself) evenly over the entire set of projects present. Don’t put a judge on the last project if there is one on the first. (They will be next to each other in just a few minutes!)

7. Determine the length of an average project interview for your panel consistent with the Judging Guidelines on pg. 8 as follows:

   **Small Panels (26 projects or less):** Every judge should see every project during the two Rounds of Judging. Your average project interview length is 210 minutes divided by the number of projects. Every judge will interview every project.

   **Large Panels (more than 26 projects):** Your average project interview length is 8 minutes. Judges will not be able to interview every project.
Responsibilities of Panel Chairs

First Round of Judging  
8. Before the interviews begin, meet with all students and inform them of how the judging will take place. Instruct the students to take note of each judge and be aware that there will be Special and Recognition judges as well.

9. Be aware that no more than two judges are allowed to interview any one student at a time. This applies to Special and Recognition judges as well as Category judges. Notify the Directors of Judging if this rule is not being followed.

10. Periodically check to ensure that all students are being interviewed.

Scheduled Break  
11. Have each judge place check (√) marks on his/her line on the Judge/Project grid to indicate projects interviewed so far. Note especially every project which has not received at least 4 interviews. These projects should receive first attention from judges who are not interviewing finalists during the Final Round of judging. Remember the Fair Guideline of a minimum of 5 interviews per project.

12. In large panels (>26), determine your finalists and mark them on the Judge/Project grid. The count of finalists should be between 6 and 10. Every judge must see every finalist project he/she did not see during the First Round of judging.

Final Round of Judging  
13. The average project interview length is the same as during the First Round, but now projects need not be seen in numerical sequence.

14. Ensure none of your judges is idle unless they have seen every project.

15. If you have finished judging ahead of schedule, make sure that all the students have seen all the judges. This is an excellent time to give students some feedback about their projects.

16. Do not dismiss the students before 12:30 p.m.

Decisions and Report  
17. Have each judge update his/her line on the Judge/Project grid.

18. Your panel must choose exactly one project for each of the four Category Awards and write these on the Results Form. A small number of other projects of exceptional merit may be selected as Honorable Mentions. All judges must sign this form after the results are recorded. Turn this form and the Judge/Project Grid on the reverse side in to the Judging Results Room.
Description of Project Categories

1. **Aerodynamics/ Hydrodynamics (Junior Division Only):** Studies of aerodynamics and propulsion of air, land, water, and space vehicles; aero/hydrodynamics of structures and natural objects. Studies of the basic physics of fluid flow.

2. **Alternative Energy (Junior Division Only):** Studies of power generation using alternative energy technologies such as solar cells.

3. **Applied Mechanics & Structures:** Studies concerning the design, manufacture, and operation of mechanisms, including characteristics of materials, dynamic response, and active/passive control. Testing for strength and stiffness of materials used to provide structural capability; studies and testing of structural configurations designed to provide improved weight and force loading or stiffness capabilities. Senior Division only: includes aerodynamics, hydrodynamics, and fluids projects.

4. **Behavioral & Social Sciences:** Studies of human psychology, behavior, development, linguistics, and the effects of chemical or physical stress on these processes. Experimental or observational studies of attitudes, behaviors, or values of a society or groups within a society, and of the influences of society on group behavior. Includes gender and diversity studies, anthropology, archaeology, and sociology. Studies may focus on either normal or abnormal behavior. Senior Division only: includes studies of cognition.

5. **Biochemistry/ Molecular Biology:** Studies at the molecular, biochemical, or enzymatic levels in animals (including humans), plants, and microorganisms, including yeast. Studies of biological molecules, e.g., DNA, RNA, proteins, fats, vitamins, nutrients.

6. **Chemistry:** Studies in which chemical properties of nonbiological organic and inorganic materials (excluding biochemistry) are observed. Some studies involving physical properties are appropriate, including phase changes, crystal structures and formation, intermolecular and intramolecular forces.

7. **Cognitive Science (Junior Division Only):** Studies of learning, memory, and cognition in humans, using human or animal models for human processes. Studies of the effects of chemical or physical stress on cognition. Includes projects on subliminal perception, optical illusions, recall and observations (e.g. reliability of eyewitnesses), and the interaction of different senses.

8. **Computational Systems & Analysis:** Studies that focus primarily on the development or use of computational systems for applications in the biological,
physical, or engineering sciences, such as analyzing big data, modeling and simulations, autonomous navigation, and bioinformatics.

9. Earth & Atmospheric Sciences (Junior Division Only): Studies in geology, seismology, physical oceanography, marine geology, coastal processes, atmospheric physics and chemistry, meteorology, and climatology including measurements, models, and the effects of climate change.

10. Electronics & Electromagnetics: Experimental or theoretical studies with electrical circuits, computer design, electro-optics, electromagnetic applications, and antennas.

11. Environmental Engineering: Projects which apply technologies such as recycling, reclamation, restoration, composting, and bioremediation which could benefit the environment and/or the effects of pollution on the environment.

12. Environmental Science: Projects surveying, measuring, or studying the impact of natural and man-made changes on the environment. Examples include floods, fires, biohazardous spills, acid rain, earthquakes, air pollution, and water pollution.

13. Mammalian Biology: Studies of growth and developmental biology, anatomy, and physiology in all mammals, including humans. Studies of the behavior of all mammals in their natural habitats (or reproductions of them).

14. Materials Science (Junior Division Only): Studies of materials characteristics and their static (not in motion) physical properties. Includes measurements and comparisons of materials durability, flammability, and insulation properties (thermal, electrical, acoustic, optical, electromagnetic, etc.).

15. Mathematical Sciences: Studies of mathematics (e.g., algebra, geometry, logic), and computer science (e.g., artificial intelligence, and the design, improvement, or optimization of algorithms, computer languages, operating systems, or software architecture.)

16. Microbiology (General): Studies of genetics, growth, and physiology of bacteria, fungi, protists, algae, or viruses. Includes surveys of bacterial contamination. Senior Division Only: includes projects described within the category Microbiology (Medical).

17. Microbiology (Medical) (Junior Division Only): Studies of prevention, diagnosis, and treatment of infectious diseases caused by pathogenic bacteria, fungi, or viruses. Includes all antimicrobial studies except testing of commercial antimicrobials.
18. Physics & Astronomy: Studies of the physical properties of matter, light, acoustics, thermal properties, solar physics, astrophysics, orbital mechanics, observational astronomy, planetary science, and astronomical surveys. Computer simulations of physical systems are appropriate in this category.


20. Product Science (Biological) (Junior Division Only): Comparison and testing of commercial off-the-shelf products for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving biological sciences and processes.

21. Product Science (Physical) (Junior Division Only): Comparison and testing of commercial off-the-shelf products for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving non-biological, physical sciences and processes.

22. Toxicology: Studies of the negative effects of chemicals, toxins, medicinal and nutritional factors, prescription drugs, natural remedies, food components (caffeine), and other potentially harmful factors (such as temperature, carbon dioxide, radiation) at the cellular or higher levels on plants and animals.

23. Zoology: Studies of growth and developmental biology, anatomy, and physiology in animals other than mammals. Studies of the behavior of all animals (excluding mammals) in their natural habitats (or reproductions of them).
What To Do After Judging

**California Science Center.** The California Science Center invites visitors of all ages to touch, interact and participate in the world of science. From exhibits such as the High Wire Bicycle, where guests can pedal along a 1-inch cable to experience the law of center of gravity, to BodyWorks, where Tess, a 50-ft. body simulator and her cartoon sidekick, Walt, teach homeostasis, to the Hypar, a 5,000-pound aluminum, kinetic sculpture that opens from 15 feet to a span of 50 feet to show that even art can benefit from science know-how – visitors will discover the important role science plays in everyday life. Permanent exhibit galleries include World of Life, which covers life processes shared by all living things, and Creative World, which includes technology and its use in communications, structures and transportation. The Air and Space Gallery features hands-on exhibits along with air and space craft dramatically suspended from the ceiling of the multi-leveled exhibit space. The Science Center also offers a selection of fun and educational science kits, books, videos and toys in the ExploraStore, and a choice of dining options – MegaBites, Taco Bell Express, McDonald’s or IMAX concessions.

**IMAX Theater.** Next door to the Science Center is the IMAX Theater with its movie screen 7-stories high and 6-channel surround sound, making film-goers feel as though they’re part of the action. For further information see www.californiasciencecenter.org/Imax/Features/Features.php.

**Natural History Museum of Los Angeles County.** The third largest natural and cultural history museum in the country, the Museum offers permanent exhibits such as a Dinosaur and Fossil Hall, Mammal Halls, History and Native American Halls, a Bird Hall and a hands-on, interactive Discovery Center and Insect zoo with live creatures from around the world. For further information see www.nhm.org.

**California African American Museum.** This museum researches, collects, preserves and interprets the art, history and culture of African Americans with emphasis on California and the Western United States. For further information see www.caam.ca.gov.

**The Rose Garden.** The seven acre sunken Rose Garden is one of the largest of its kind in the nation. Approximately 19,000 rose bushes (about 200 varieties) are found in the garden. The roses will be in process of blooming during the Fair.

**University of Southern California.** Immediately across Exposition Boulevard lies California’s oldest major private university. This provides an ideal opportunity to visit the campus and view its sights, watch the filming of motion pictures and TV series on location, and visit the University Bookstore.
We hope that this Handbook has proved useful to you in your preparations for the California State Science Fair. In an effort to continue to improve the Fair, we would like to get your comments on this Handbook. The content here has been modified from previous editions. We constantly strive to improve the California State Science Fair experience for both the students and the judges and appreciate and encourage your feedback. Categories and judging procedures and criteria are reviewed annually. Please send your comments to any of the Directors of Judging named on page 2.