COLORADO SCIENCE & ENGINEERING FAIR

For Colorado Students in Grades 6 - 12
Hosted by the Natural Sciences
Education & Outreach Center
Held Virtually

APRIL 8, 2021

Angel Castillo
West Grand High School

FINALIST HANDBOOK
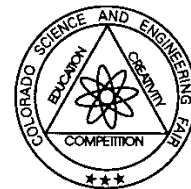
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Revised December 2020

Electronic version can be found at:
http://www.csef.colostate.edu/Handbook

College of Natural Sciences
Education & Outreach Center

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Dear Regional Science & Engineering Fair Winner:

Congratulations! Your outstanding science or engineering research project has earned you the right to represent your region and your school at the 66th Annual Colorado Science & Engineering Fair (CSEF)! This year's state science and engineering fair will be held virtually via zFairs. Grand award judging will take place on Thursday, April 8th as it would normally, but other pieces, such as SRC Interviews, Display & Safety Inspections, Special Awards Interviews, Awards Ceremony, Guest Speaker, etc. will be spread out over a longer time period – some details are yet to be determined, so keep checking the CSEF and zFairs websites for updates!

In this handbook, you will find the necessary information needed to prepare for and participate in the CSEF: instructions for online registration, CSEF and International Science & Engineering Fair (ISEF) form requirements, preliminary CSEF schedule of events, expectations for judging interviews and much more.

At the CSEF, you will be one of approximately 300 talented science students from around the state. You are one of Colorado's top young scientists, and we want your state science and engineering fair experience to be the best we can make it. For this reason, we ask that you **read all of the information in this packet completely and carefully** because it will help make your experience easier and more enjoyable.

Because everything for the 2021 CSEF will be done virtually, the only part that you are required to be available for are the Grand Awards judging interviews on April 8th – please make arrangements with your school/teacher(s) to be available during your assigned interview times. We are hoping to arrange it so you will be able to present your project at least 3 times to teams of grand awards judges on the 8th.

Special awards organizational juding interviews will be scheduled for a later time (most likely during the week of April 12 – 16). Projects for these special award organizational judging interviews will be selected based on the organization's pre-review of your online project materials. If you miss the interview, it will not be rescheduled unless there is a technical issue.

Finalists MUST submit a signed CSEF Finalist Verification/Permmision Form that outlines all of the participation requirements. If for any reason you decide not to participate in this year's CSEF, please notify your Regional Science Fair Director as soon as possible so an alternate Finalist can participate in your place.

Your entire science and engineering fair experience is not only about hard work, dedication, and competition, but also comraderie, creativity, and education. Along with the interviews with working scientists and engineers, we are hoping to be able to bring you opportunites to interact virtually with your fellow participants – we will keep you posted on this optional activity.

Please remember that we are here for you. If you have any questions, please do not hesitate to contact me.

Sincerely,

Courtney Butler
CSEF Director

66th Annual Colorado Science and Engineering Fair

All events, times, and venues are subject to change.

The 2021 Virtual CSEF will use the zFairs (https://co-csef.zfairs.com) platform for project paperwork submission, digital project materials, judging interviews and public viewing. Other platforms such as Zoom, YouTube Live, etc. will be used for SRC meetings, award ceremony announcements and the guest speaker. Updates to the schedule will be made on the main CSEF website (www.csef.colostate.edu) and the zFairs CSEF site as details are decided upon.

Project "Set-Up" – Project materials must be submitted in zFairs by Wednesday, March 24th. Changes to these materials will not be allowed after this date unless requested by the CSEF Display & Safety Inspectors. These changes will need to be submitted by April 1st.

Scientific Review Committee Interviews – Pre-judging interviews requested by the CSEF SRC will be held via Zoom meetings Monday, March 22nd and Tuesday, March 23rd as needed.

Display & Safety Inspections – Review of all project materials submitted in zFairs (including videos) will be conducted between March 24th and April 1st to make sure everything submitted for judging complies with the ISEF D&S rules for this year (see page 11 for details).

Pre-Interview Project Reviews – Grand award and special award judges will be reviewing student project materials in zFairs between March 24th and April 7th. Special award judges will use this pre-interview review to identify which students they wish to interview.

Grand Award Judging Interviews – Category grand award judges will be broken into teams of 2-3 judges and each team will interview all students within that category and division. This means all students will be required to participate in at least 3 interviews on Thursday, April 8th in zFairs.

Special Award Judging Interviews – Once special award organizations have identified the 3-4 projects per division they wish to interview for their awards, the CSEF will schedule those interviews in zFairs. The timing of these interviews is yet to be determined, but will most likely be the week of April 12 – 16.

Guest Speaker – This year's guest speaker is Paul Anderson, Human Lander System Program Director at Lockheed Martin. Paul's talk is tentatively scheduled for the morning of Saturday, April 10th via a platform yet to be determined.

Category Awards Ceremony – The grand awards (place) ceremony is tentatively scheduled for the evening of Saturday, April 10th via YouTube Live.

Special Awards Ceremony – The announcement of special award winners is tentatively scheduled to be pre-recorded and released after the special awards interviews are concluded.

Public Viewing – Project materials will be open to the public via the zFairs' Showcase between April 9th and April 16th.

The Regeneron International Science & Engineering Fair will be held virtually in May 2021 and will include the awarding of prizes this year.

The 2022 Colorado Science & Engineering Fair is tentatively set to be in-person April 7 – 9 (dates subject to change) at Colorado State University in Fort Collins, CO!!

CSEF Registration Deadlines

CSEF Finalist need to complete the registration process as outlined on page 5 by the deadline listed below for their Regional Science Fair. Failure to register by the deadline listed below for your regional science fair may forfeit your spot in this year's Colorado Science & Engineering Fair competition.

Check with your Regional Fair Director to get instructions and deadlines for uploading the ISEF or CSEF Middle School forms and the Finalist Verification/Permission form into zFairs. At this time, we are not sure if you will need to do this or if your Regional Fair Director will do it for you.

ALL CSEF Finalists MUST also submit their abstracts online as directed in the instructions on page 6. Failure to do so will compromise your project's pre-review by the judging captains.

Arkansas Valley Regional Science Fair Held via zFairs February 5 & 8, 2021 Registration Deadline: *February 15, 2021* Dol Nath Khanal– RSF Directors dol.khanal@ojc.edu	**Pikes Peak Regional Science Fair** Held via zFairs February 20 & 23, 2021 Registration Deadline: *March 2, 2021* Nancy Hampson – RSF Director pprsf.colorado@gmail.com
Boulder Valley Regional Science Fair Held via zFairs February 22 & 26, 2021 Registration Deadline: *March 5, 2021* Kristin Donley – RSF Director bvsdsciencefair@bvsd.org	**San Juan Basin Regional Science Fair** Held via zFairs February 14 – 24, 2021 Registration Deadline: *March 3, 2021* Sheila Weahkee – RSF Director sweahkee@sjboces.org
Denver Metro Regional Science Fair Held via zFairs February 20 - 22, 2021 Registration Deadline: *March 1, 2021* Erin Golden – RSF Director erin.golden@ucdenver.edu	**San Luis Valley Regional Science Fair** Held via zFairs February 22 – 26, 2021 Registration Deadline: *March 8, 2021* Lucy Adams – RSF Director laadams@adams.edu
East Central Regional Science Fair Held via zFairs February 23 - 25, 2021 Registration Deadline: *March 4, 2021* Will Mallory – RSF Director wmallory@genoahugo.org	**Southeast Regional Science Fair** Held in Lamar, CO on February 24, 2021 Registration Deadline: *March 3, 2021* Terri Lira – RSF Director terri.lira@lamarschools.org
Longs Peak Regional Science Fair Held via zFairs February 24 - 26, 2021 Registration Deadline: *March 5, 2021* Lori Ball – RSF Director lori.ball@unco.edu	**Southern Colorado Regional Science Fair** Held via zFairs February 18, 2021 Registration Deadline: *February 25, 2021* Christina Rodell – RSF Director Christine.rodell@pueblocityschools.us
Morgan/Washington Regional Science Fair Held in Brush, CO on February 23 – 24, 2021 Registration Deadline: *March 3, 2021* Darline Miner – RSF Director d.miner2@brushschools.org	**Western Colorado Regional Science Fair** Held via zFairs February 26, 2021 Registration Deadline: *March 8, 2021* Kevin Hoskin – RSF Director kevin.hoskin@d51schools.org
Northeast Regional Science Fair Held via zFairs February 25 – 26, 2021 Registration Deadline: *March 5, 2021* Sonya Shaw – RSF Director shaw1@plainstel.com	

2021 CSEF Registration Instructions

All CSEF Finalists are required to register and submit their project materials and project paperwork online at **https://co-csef.zfairs.com**. CSEF Finalists should complete their online registration immediately after being chosen by their Regional Science Fair. Failure to complete the whole registration process by the regional science fair deadline listed on page 4 may forfeit your spot in the CSEF.

1. Create an account with CSEF on zFairs by entering your First Name, Last Name and **Non-School** Email Address and clicking the "I'm Not a Robot" box. Even if you participated in a regional zFairs, you will need to re-register (you can use the same login and password though).

2. ***Once you click "Create Account", you will need to check the email account that you used in order to verify your email address in order to continue.*** If you don't get the email, check your junk folder first. If you used your school email address, then that system may have blocked the email verification message and you are going to have to contact the CSEF (csef@colostate.edu) in order to clear the started account so you can use a different email address (like your parent's).

3. Once you have verified your email address, you will register as a STUDENT.

4. Complete the Registration – Personal Information page. Please note that ALL questions are required on this form and you will not be allowed to move forward until they are completed. Click Save & Continue. **Remember your password!**

5. Complete the Registration – School & Teacher page. All schools in Colorado should be listed, but if your teacher is not, then select the "Not Listed" option. Click Save & Continue.

6. Complete the Additional Questions that are specific for CSEF:

   Pronunciation of name
   Adult Sponsor (person who signed Form 1)
   Adult Sponsor Email Address
   Technical Writing Award Entry (optional if you want to submit a paper for review)
   Statistical Award Entry (optional if you want to submit your project for this special award)

7. Complete the Registration – Project page. You can complete some of this information at a later date, but you MUST input a Project Title and Project Description and select a Category in order to move on.

   TEAMS: Have the Team Leader register first by clicking the "Will this be a Team Project" box, copying the resulting Team Key and sending it to the team members. Then the other members can link to the project using the "Link/Join Existing Team Project" button at the top of the page and adding the Team Key when asked.

8. Review your registration information and if it is correct, click the "My Information Is Correct" button.

9. Permissions & Waivers – you must agree to the 2 statements listed in order to participate in the 2021 Virtual CSEF.

Once you submit, you will find out your Username (you will use this to log back into the system) and Project ID.

You can submit your paperwork from this page or bypass this and add the paperwork later. Please note that at this time, we are still unsure as to whether or not we will have you or your Regional Fair Director upload your project's ISEF or CSEF Middle School forms.

You may also choose to add a profile picture, but this is not required.

Lastly, you will need to ALSO submit your abstract to the CSEF database for use by the grand award and special award judges. You can find the links to the Individual and Team Project Abstract submission pages at: http://www.csef.colostate.edu/CSEF_Finalists.html.

2021 CSEF Project Material Submission Instructions

When you are ready to finalize your project materials, log into the CSEF zFairs site, click on the arrow next to your name in the upper right-hand corner of the page and select Profile. This will take you to "My Profile Manager" where you can check your basic info, change answers to the additional questions or mentor and add your "Images" (up to six documents that explain your project).

Required Project Materials:

Project Presentation – this must be in PDF format and upload as *Project Image 1* on your profile page (instructions can be found on page 19 of this Finalist Handbook)

Signed CSEF Project Abstract – this must be in PDF format and uploaded as *Project Image 2* on your profile page

> In order to get an official CSEF Project Abstract to sign, you must submit it to the CSEF abstract database by March 8th:
>
> Individual Project Abstracts: http://dat.cns-eoc.colostate.edu/csef/abs/indiv_abst.php
>
> Team Project Abstracts: http://dat.cns-eoc.colostate.edu/csef/abs/team_abst.php

Optional Project Materials:

Project Video – this can be a URL link to a publicly viewable video hosted outside of zFairs and put with your Basic Info under "Entry Video URL" (instructions can be found on page 20 of this Finalist Handbook); it can also be put on the title page of your Project Presentation

Project Demonstration/Simulation/Animation Video – this can be a URL link to a publicly viewable video hosted outside of zFairs and put on the title page of your Project Presentation (instructions can be found on page 20 of this Finalist Handbook)

Research Paper – this is a PDF document of your formal research paper being submitted for the Technical Writing Award and can be uploaded as *Project Image 3-6* (details can be found on page 16 of this Finalist Handbook)

Statistical Award Sample – this is a PDF document of your sample graph or table and description being submitted for the David Young Award for the Best Use of Statistics and can be uploaded as *Project Image 3-6* (details can be found on page 17 of this Finalist Handbook)

Log Book/Science Notebook Sample – this is a PDF document of select pages from your research notebook, documenting your progression with the project and can be uploaded as *Project Image 3-6* (please do not include all pages)

Quad Chart – this is a 1-page summary of your project that will be required for ISEF, but is optional for CSEF and can be uploaded as *Project Image 3-6* (instructions can be found on page 21 of this Finalist Handbook)

Submission of CSEF and ISEF Forms

> **REMEMBER!**
> For the 2021 CSEF, all forms must be uploaded separately in zFairs under the correct heading. The option to upload all forms in one file will not be available to make it easier for students to replace individual forms that may need corrections.

Forms Required for ALL Projects					
2021 Finalist Verification/ Permission Form	Signed CSEF Abstract Form	Checklist for Adult Sponsor (1)	Student Checklist (1A)	Research Plan	Approval Form (1B)

NOTE: #1 through #5 are forms that are required for ALL projects:

1. **2021 Finalist Verification/Permission Form** contains permissions and acknowledgements for participating in the 2021 CSEF.

   - *Print a copy of page 23 of this handbook for each student researcher associated with the project, obtain the appropriate signatures and upload it under the correct paperwork slot in zFairs.* Team Leaders should use the main paperwork slot and team members use the appropriate Teammate Finalist Verification/Permission Form slot. **Registration fees of $40/student are due to CSEF by April 1st!**

2. The **CSEF Abstract** (printed from the CSEF website) is one of the most critical forms used by the CSEF Judges. Along with the text of your abstract being submitted in zFairs, CSEF requires that all students submit their abstract to the CSEF database for grand award judges to use during category review and for special award judges to use during pre-interview reviews. A copy of the official abstract must be printed, signed by all student researchers of the project and uploaded to the zFairs site under the appropriate paperwork slot. (See page 13 of this booklet for sample abstracts. The abstract is <u>not</u> a repeat of your research plan!)

3. **Checklist for Adult Sponsor (1)** is required for ALL projects and is used by CSEF SRC to determine if your project is eligible for competition at the state science fair level.

4. **Student Checklist (1A)** is required for ALL projects and is used by the CSEF SRC to determine if your project is eligible for competition at the state science fair level.

   Notes about the Student Checklist (1A):

   - The Project Start Date should be the date that LABORATORY/EXPERIMENTAL work began, not when library/internet research began. Also, all projects must have a Project End date that is prior to CSEF for competition purposes.

   - Include <u>complete</u> names and physical addresses for <u>all</u> work sites. Work done at a residence should be noted as such (i.e.: Jones' residence). P O Boxes are NOT work sites!

   - Attach a **completed and typed** <u>Research Plan</u> that includes your works sited. Be sure to include all information about your experimental design that is relevant.

Submission of CSEF and ISEF Forms

5. **Approval Form (1B)** is required for ALL projects and is used by the SRC to determine if your project is eligible for competition at the state science fair level. Members of Team Projects must have one Approval Form (1B) <u>per student</u>.

   Notes about the Approval Form (1B):

   - The student and parent MUST both approve this project BEFORE experimentation, so signatures must be obtained BEFORE the experiment's start date on Form 1A.

   - Please note that the CSEF SRC Chairperson will sign the last line of this original form and a copy returned to you for your records (if needed for future competitions).

6. **Other Possibly Needed Forms** (see Checklist for Adult Sponsor for details) are used by the SRC to determine if your project is eligible for competition at the state science fair level.

   - Research Institution/Industrial Setting Form (1C) is to be completed AFTER the experimental work is completed.

   - Qualified Scientist Form (2) is required for some types of projects.

   - Risk Assessment Form (3) is required for all projects using the CSEF Middle School forms.

   - Human Participants Form (4) is required for all projects using human subjects and must be reviewed and approved by an IRB prior to experimentation.

   - Human Subject Informed Consent is required at the discretion of the IRB reviewing the project.

   - Vertebrate Animal Form (5A or 5B) is required for all projects using vertebrate animals.

   - Potentially Hazardous Biological Agents Risk Assessment Form (6A) is required for microbiology, rDNA and tissue projects

   - Human & Vertebrate Animal Tissue Form (6B) is required for all projects involving tissue.

   - Continuation/Progression of Projects Form (7) is required for projects that are a continuation or progression of past research.

Forms Required for ALL Projects					
2021 Finalist Verification/ Permission Form	Signed CSEF Abstract Form	Checklist for Adult Sponsor (1)	Student Checklist (1A)	Research Plan	Approval Form (1B)

REMEMBER!
For the 2021 CSEF, all forms must be uploaded separately in zFairs under the correct heading. The option to upload all forms in one file will not be available to make it easier for students to replace individual forms that may need corrections.

What to Expect during the CSEF – <u>PLEASE READ!!</u>

Updates to this information can be found on the CSEF zFairs website: https://co-csef.zfairs.com

<u>Monday, March 8 – Sunday, March 14, 2021</u>
The CSEF Category Judging Captains for each division will review the submitted abstracts to make sure students are entered into the correct category. If it is determined that a change is needed, the student and adult sponsor will be contacted for approval.

<u>Friday, March 19, 2021</u>
The CSEF Scientific Review Committee will be meeting as it normally does in order to finalize the determination of all projects entered into the CSEF. All projects will fall into one of these categories:

- Approved for Competition – no further action is needed and students will be scheduled for judging interviews

- Form Corrections Needed – there are pieces of the paperwork that need to be explained or fixed before the students will be scheduled for judging interviews

- Research Plan Questions – there are questions regarding the students' research plan that must be answered before they will be scheduled for judging interviews

- Safety/Supervision Concerns – there are questions/concerns about the risks involved in the project and who supervised the student that need to be addressed before the students are scheduled for judging interviews

- Interview Needed – the SRC feels that they need to speak with the student and adult sponsor in order to clear up any concerns regarding the research before they can be scheduled for judging interviews

- Fail to Qualify – if a project is found to be in serious violation of the rules for pre-college science research, then it will fail to qualify for competition and the students will not be scheduled to judging interviews

Corrections to paperwork will be due to CSEF by April 2nd.

<u>Monday, March 22 & Tuesday, March 23, 2021</u>
Interviews with the CSEF Scientific Review Committee will be scheduled via Zoom on these 2 days as needed based on the SRC reviews conducted on the 19th. Students will be notified by email of the need for an interview.

<u>Wednesday, March 24 – Wednesday, April 7, 2021</u>
ALL project materials (see page 6 for details) must be uploaded to the CSEF zFairs website by Wednesday, March 24th as the site will be locked in order for Display & Safety Inspections (see page 11) to be completed. And both Grand Award and Special Award judges will be allowed to begin reviewing projects.

Grand Award judges will be required to review both the official abstract and the project presentation in order to formulate questions they want to ask during the interviews. While the other project materials will be available to judges, they may or may not choose to view them.

Special Award judges will view any and all project materials at their discretion in order to narrow their choice of projects to interview. Please note that these interview dates are still to be determined at this time.

Thursday, April 8, 2021

Grand Award Judging Interviews will take place on this day ONLY – students must make sure they are available during the day at the assigned interview time(s). We are hoping to give students at least 3 interviews with teams of judges, but will guarantee at least 1 video interview via zFairs.

What to expect during judging in zFairs:

- All student interviews will be conducted with at least 2 judges – the system will not allow a student to be alone in a video interview with just 1 judge.

- Students will be required to log into zFairs and click on the Virtual Contest tab at the top of the page. This will open a page where it shows your assigned interview times. If you click on the Enter Virtual Judging/Interview button and the required judges are not available yet, you will be put on "hold" until they are ready to let you into the room.

- Interviews will be scheduled for 10-15 minutes (this is still being determined). Students should expect to take 4-5 minutes to review their project with the judges (remember, they have already seen your project materials and video if you did one) and spend the rest of the time answering questions from the judges.

- Students having technical issues or concerns with judges' conduct should email the CSEF right away at csef@colostate.edu – make sure to include name and project number along with details about the problem so we can address it as soon as possible.

Friday, April 9 – Friday, April 16, 2021

The CSEF zFairs Showcase of Projects will be open for public viewing during this time. Registration is not required.

Saturday, April 10, 2021

Guest Speaker, Paul Anderson from Lockheed Martin is tentatively scheduled for the morning of April 10th via a platform yet to be determined.

A Live Virtual CSEF Grand Awards Ceremony is tentatively scheduled for the evening of April 10th via YouTube Live.

Saturday, April 17, 2021

We will be holding post-CSEF Advisory Council (morning) and Board of Directors (afternoon) meetings on this Saturday via Zoom and anyone interested in attending either meeting should email the CSEF Director to get the invite.

To Be Determined

We are still working on when Special Award judging interviews and award announcements will be done for 2021. At this time, we are thinking of scheduling the interviews the week of April 12th and then having the Special Award Organizations recording a video announcing their winners once they have been determined and posting those on the CSEF website.

May 2021

We will work as hard as we can in order to mail out students' t-shirts, CSEF pins, awards and certificates by the end of May.

2021 Project Presentation & Video Regulations

Project Presentation:

- Project Presentation must be a single PDF document of **no more than 12 pages**.

- Page size must not exceed 8½" x 11" and is oriented Landscape.

- The PDF document must not include any animations or active hyperlinks (except for original source material in the references).

- The information on each page must be readable (light background color with dark text).

- Text font size must be 14 pt. or larger.

Presentation Video:

- The project presentation video must be no longer than 2-3 minutes.

- Props/visuals used must not violate any normal D&S safety guidelines for in-person science fairs.

- Student researcher must follow risk assessment protocols outlined on Form 3 (i.e.: proper PPE is being used in the video).

- The project presentation video must not include anyone other than the student researcher(s).

- Video link must have the proper permissions set for public viewing.

Demo Video:

- The project demo video must be no longer than 1-2 minutes.

- Props/visuals used must not violate any normal D&S safety guidelines for in-person science fairs.

- Student researcher must follow risk assessment protocols outlined on Form 3 (i.e.: proper PPE is being used in the video).

- The project demo video may include people other than the student researcher(s) as long as they are not identifiable (no faces).

- Video link must have the proper permissions set for public viewing.

Photographs/Images/Graphs/Charts:

All photographs, visual images (including background images), charts, tables and/or graphs are allowed if:

- They are properly credited.

  If all photos, images, graphs, etc. were taken or created by the student researcher, then a single statement to that fact should be placed on the Title Page of the Project Presentation.

  If the photos, images, graphs, etc. come from different sources, then EACH individual photo, image, graph, etc. must have its own credit line below it.

- They are not deemed offensive or inappropriate (which includes images/photos/videos showing vertebrate animals/humans in surgical, necrotizing or dissection situations) by the SRC, Display & Safety Committee or CSEF.

- They are from the Internet, magazine, newspaper, journal, etc. and a credit line is attached immediately underneath it.

- They are photographs or visual depictions of the finalist.

- They are photographs of a person other than that of the finalist(s) as long as there is a photo release signed by the subject, and if under 18, also by the guardian of the subject. Photo releases must be uploaded with the researcher's project paperwork for verification.

Items NOT Allowed in Project Display Materials:

- Logos, trademarks, flags, patent status, (written or graphic), awards or medals.

- Personal information (addresses, social media accounts, phone number, QR codes, etc.) of finalist.

- Animations or embedded videos or automatic page transitions.

- Prior year's written material or visual depictions (project title may mention which year the project is in).

- Anything labeled as "Abstract".

- Acknowledgements (written or graphic) of people or labs.

CSEF Category Descriptions

Animal Sciences: ● Studies related to all aspects of non-human animals (including insects), animals life, animal life-cycles, animal health and medicine, animal behavior, and animal interactions with one another or their environment.

Behavioral & Social Sciences: ● Studies related to the thought processes and behavior of humans and their interactions with the environment as studied through observational and experimental methods.

Biochemistry & Chemistry: ● Studies related to the chemical basis of processes occurring in living organisms, including the processes by which these substances enter into, or are formed in the organisms and react with each other and the environment. ● Studies related to the composition, structure, properties, and reactions of matter

Earth & Space Sciences: ● Studies related to Earth systems and their evolution. ● Studies related to anything in the universe beyond Earth.

Energy: ● Studies related to biological and chemical processes of renewable energy sources, clean transport, and alternative fuels. ● Studies related to renewable energy structures and processes including energy production and efficiency.

Engineering: ● Studies related to electrical systems in which information is conveyed via signals and wave forms for the purpose of enhancing communications, control, and/or sensing. ● Studies related to science and engineering that involves movement or structure. The movement can be by the apparatus or the movement can affect the apparatus. ● Studies related to the characteristics and uses of various materials with improvements to their design which may add to their advanced engineering performance. ● Studies related to the use of machine intelligence to reduce the reliance on human intervention. ● Studies related to the application of engineering principles and design concepts to medicine and biology for healthcare purposes including diagnosis, monitoring, and therapy.

Environmental Sciences: ● Studies related to the environment and its effect on organisms/systems, including investigations of biological processes such as growth and life span. ● Studies related to the engineering or development of processes and infrastructure to solve environmental problems in the supply of water, the disposal of waste, or the control of pollution.

Mathematics & Computer Sciences: ● Studies related to the measurement, properties, and relationships of quantities and sets, using numbers and symbols. ● Studies related to the discipline and techniques of computer science and mathematics as they relate to biological systems. ● Studies related to the development of software, information processes, or methodologies to demonstrate, analyze, or control a process/solution.

Medicine & Health: ● Studies related to the issues of human health and disease. ● Studies related to the improvement of human health and longevity by translating novel discoveries in the biomedical sciences into effective activities and tools for clinical and public health use.

Microbiology & Molecular Biology: ● Studies related to micro-organisms. ● Studies related to the structure, function, intracellular pathways, and formation of cells. ● Studies involve understanding life and cellular processes at the molecular level.

Physics: ● Studies related to the science of matter and energy and of the interactions between the two.

Plant Sciences: ● Studies related to plants and how they live, including structure, physiology, development, and classification.

Sample Abstracts

The abstract is one of the most important pieces to your project. This is what the Grand Award Judging Captains use to determine whether you are in the right category before you even arrive at the science fair. The Special Awards Judges use the abstracts as a way to filter out the Finalists they want to interview, based on the criteria of the awards they have to present. The following are two excellent examples of abstracts written by your peers. **Remember, your abstract needs to be submitted into the CSEF database as well as in zFairs!**

Real-Time Seizure Forecasting for Epileptics on a Consumer Product
Matthew Anderson, Grade 10 © 2020

Reason or Problem Statement

Epilepsy threatens the lives and freedom of over 65 million individuals worldwide annually. Existing devices to predict seizures for epileptics are invasive, inefficient, or inaccurate. In order to help patients understand and proactively treat their disease, I have developed a consumer product to forecast seizures that avoids issues in existing devices.

Results Findings and/or Product

The product reads brainwaves in real-time from a lightweight, user-friendly scalp electroencephalogram, then sends them via Bluetooth to a smartphone for processing by a patient-customized forecasting model to alert patients of future seizure outcomes. The forecasting model has been tested on ten patients. Over the course of a day, the model learned each patient's brainwave patterns pre-seizure, which it used to forecast seizures over the next day. For all patients, the model significantly outperformed a chance predictor. It runs in the background as patients perform other tasks, alerting them of an upcoming seizure; on average, at 42.5 minutes prior to a seizure. An important aspect of this research is the combination of the model and the first fully-functioning autonomous consumer device in seizure forecasting, including a full data ecosystem to adjust the model given changes in patient's brain patterns.

Conclusion and/or Implications

This product is completely noninvasive, consumes little battery, takes only milliseconds to forecast, and is accurate in testing. It includes a highly-requested novel feature for patients to tune the sensitivity of their forecasts.

Creating More Efficient Neural Networks Used to Find Exoplanets Using SVD and Compression Techniques
Margaret Arthur, Grade 8 © 2020

Reason or Problem Statement

While the amount of exoplanet data has increased in size and complexity, it is largely raw and uninterpreted, meaning that a large amount of time and manpower is needed for exoplanet identification from thousands of Threshold Crossing Events, or TCEs collected by the Kepler Space Telescope. When exoplanets cross between the telescope and a star, a dip in the brightness occurs which is used by astronomers to identify exoplanets.

Results Findings and/or Product

Machine learning techniques, applied to the process, increase the speed and accuracy of exoplanet identification. These techniques take a lot of computer power and time. Therefore, an application of singular value decomposition, pruning, and retraining was applied to a base convolutional neural network to decrease the time and increase the accuracy. Initially, data from the Mikulski Archive for Space Telescopes collected by the Kepler Space Telescope was used to provide training and prediction data for both networks. The time taken by the modified network decreased significantly in training, evaluation, and prediction phases while the accuracy stayed the same. For example, the time taken in the training phase decreased by 62.12% and the accuracy was 93% in both networks.

Conclusion and/or Implications

While the modified network significantly decreased the time taken in all phases, the accuracy remained the same throughout; however, the networks were applied on a relatively small scale with only 6,000 TCEs each for training and prediction. Therefore, using a larger data set and a more powerful computer, the running time of networks could be decreased from days to hours.

Sample Works Cited

The following are acceptable formats for different types of references that might be used in researching a science fair project topic.

Books:

Format:
Author's Last Name, First Initial. (Year Published). *Book Title*. City of Publication: Publishing Company.

Examples:
Sheril, R. D. (1956). *The terrifying future: Contemplating color television*. San Diego: Halstead.

Smith, J., & Peter, Q. (1992). *Hariboall: An intensive peek behind the surface of an enigma*. Hamilton, ON: McMaster University Press.

Article in an Edited Book:

Format:
Author's Last Name, First Initial. (Year Published). Article Title. In Editor's Name (Ed.), *Book Title* (Page Number(s)). City of Publication: Publishing Company.

Example:
Mcdonalds, A. (1993). Practical methods for the apprehension and sustained containment of supernatural entities. In G. L. Yeager (Ed.), *Paranormal and occult studies: Case studies in application* (pp. 42-64). London: Other World Books.

Journal Articles:

Format:
Author's Last Name, First Initial. (Year Published) Article Title. *Journal Name,* Volume Number, Page Number(s).

Examples:
Crackton, P. (1987). The Loonie: God's long-awaited gift to colourful pocket change? *Canadian Change*, 64(7), 34-37.

Rottweiler, F. T., & Beauchemin, J. L. (1987). Detroit and Narnia: Two foes on the brink of destruction. *Canadian/American Studies Journal*, 54, 66-146.

Articles in a Magazine or Newspaper:

Format:
Author's Last Name, First Initial. (Date Published). Article Title. *Publication Name*, Volume Number, Page Number(s).

Examples:
Henry, W. A., III. (1990, April 9). Making the grade in today's schools. *Time*, 135, 28-31.

Wrong, M. (2005, August 17). "Never Gonna Give You Up" says Mayor. *Toronto Sol*, p. 4.

Electronic Sources:

Format:
For Internet articles that are based on a print source, use the appropriate style above and add Retrieved Date, from Web site to the end of the citation. For Internet only sources, use the following:

Web Site Author. *Web Site Title*. (Date Published). Retrieved Date Retrieved, from Web site URL.

Examples:
Marlowe, P., Spade, S., & Chan, C. (2001). Detective work and the benefits of colour versus black and white. *Journal of Pointless Research*, 11, 123-124. Retrieved October 25, 2007, from http://www.pointlessjournal.com/colour_vs_black_and_white.html.

Bicycle Helmet Safety Institute. *Bicycle Helmet Standards*. (September 12, 2004). Retrieved January 12, 2005, from http://www.helmets.org/standard.htm.

Personal Communications:

Format:
Interviewee Name. Interviewee Area of Expertise or Affiliation. Place of Interview: Date(s) of Interview.

Examples:
Echrlich, Jim. Agronomist. Monte Vista, Colorado: 11/4/99.

Swart, Randy. Director, Bicycle Helmet Safety Institute. Via telephone: 2/21/05.

Judging at the Colorado Science & Engineering Fair

Over 150 professional scientists and engineers volunteer to interview the Finalists for the CSEF Grand Awards. They form 24 Grand Award Judging Teams that interview Finalists in each of the categories in both the Junior and Senior divisions. The captains of each judging team form the Best of CSEF Project Judging Team that determines the top five Senior Division and top three Junior Division project winners.

Over 200 professionals volunteer to interview the Finalists for Special Awards presented by the company or professional organization they represent. Each Special Award Organization has its own criteria for presenting awards and will not necessarily visit every project within a given category. To see what Special Awards Judges are looking for in projects, please visit the CSEF website at **www.csef.colostate.edu/CSEF_Special_Awards.html**.

What are the judges looking for?

Judges will examine your project very carefully to confirm the correctness of all research. This is an educational experience for BOTH the Finalist and the interviewer. It is their job to find out how much YOU know about your project. They do this by asking you questions to learn more about your work. You will be evaluated on how well you ACTUALLY DID your project compared to how well you COULD have done it.

Projects are judged on the following:
- ➢ The quality of the work done; how well do you understand the project and subject area?
- ➢ How the project involves laboratory, field or theoretical work – not just library research or gadgeteering.
- ➢ How the project compares with other projects in the same category and division at the state level.

In particular, judges evaluate:
- ➢ how well a student followed the scientific method or reached the engineering, mathematics or computer science goals;
- ➢ the detail and accuracy of the research data book; and
- ➢ whether the experimental procedures were used in the best possible way.

Judges look for well thought-out research. They look for how significant your project is in its field, as well as how thorough you were. Did you leave something out? Did you start with four experiments and finish only three?

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

Grand Award Judging Criteria – *The decision of the judges is final.*

Evaluation of projects is done on work performed by exhibitors, not on the value of accessory equipment either borrowed or purchased.

Creative Ability: Creative research should support an investigation and help answer a question in an original way.

Scientific Thought/Engineering, Mathematics or Computer Science Goals: Is the problem/objective stated clearly and unambiguously? Was the problem sufficiently limited to allow a plausible approach? Was there a procedural plan for obtaining a solution? Are the variables clearly recognized and defined? Is there adequate data to support the conclusions? Is the solution a significant improvement over previous alternatives?

Thoroughness: Was the purpose carried out to completion within the scope of the original intent? Are the conclusions based on a single experiment or replication? How complete are the project notes?

Skill: Does the student have the required laboratory, computation, observational, and design skills to obtain supporting data? Where was the project performed? Was the project completed under adult supervision, or did the student work largely alone?

Clarity: How clearly does the student discuss the project and explain the purpose, procedure, and conclusions? How well does the project display explain the project? Are important phases of the project presented in an orderly manner?

Teamwork: Are the tasks and contributions of each team member clearly outlined? Was each team member fully involved with the project, and is each member familiar with all aspects? Does the final work reflect the coordinated efforts of all team members?

CSEF Special Awards

Technical Writing Awards

The CSEF has two technical writing awards, one for a senior division participant and one for a junior division participant. The Senior Division award is named in memory of Ralph Desch, a former board member, one of the driving forces in the Colorado Science and Engineering Fair, a technical writer, and an employee of the National Bureau of Standards. The Junior Division award is named in memory of Elemer Bernath, one of the founders of the Colorado Science and Engineering Fair, who passed away in December 2019.

To be considered for either award, you must prepare a technical report as if you were planning to be published in a scientific or technical journal. This is separate from your project write-up. The winners receive a $100 cash award.

Technical reports may differ in their organization, but the following format is typical:

I. Introduction – includes a literature review (with appropriate citations) and the research questions/objectives/hypotheses

II. Method – explains how the data were collected, analyzed, and interpreted

III. Results – presents data, usually in tables and/or figures, including a brief narrative reviewing the key findings

IV. Discussion – explain key findings, and interpret data and graphs; other literature relevant to the results, and acknowledgements of limitations of the study are also included here

V. Conclusions

VI. References – includes literature cited in the paper, not the works cited in the project on the topic

2019 Ralph Desch Memorial Technical Writing Award Winner Madeleine Nagle

VII. Appendix

Judges for this award assess the technical quality of the report-- the organization and quality, including correct grammar, spelling, mechanics, format, layout, etc. If you have a sample article from the scientific or technical journal in which you aspire to be published, it is helpful to include that as well.

Students wishing to be considered for this award must indicate this on their registration form and submit an electronic copy of the report via zFairs by March 24th so the judges have time to read them all and make a selection.

Student Choice Awards

The Colorado Science and Engineering Fair provides awards for Finalists to choose your favorite Junior Division project and Senior Division project. A link to an on-line ballot will be sent to all participants and be available in zFairs. Each winner will receive $100 and a trophy. Be sure to vote!

Pioneers of Science Awards

The Board of Directors of the Colorado Science and Engineering Fair understands the hard work and dedication that goes into completing a research project of the caliber it takes to become a CSEF Finalist and congratulates all of you. Each year, board members meet certain students who are impressive in regards to their enthusiasm and hard work as they take their initial steps into the world of scientific research. These students have demonstrated sufficient promise in their research that the members of the Board of Directors have chosen to recognize them for following in the footsteps of the great pioneers of science, mathematics, and engineering.

Other Special Awards

The David Young Award for the Best Use of Statistics

This is a statistical award named in the memory of David Young from the University of Colorado at Denver, Department of Medicine and Biometrics and presented by the Colorado/Wyoming Chapter of the American Statistical Association. David's skills in both science and statistics allowed him to collaborate with medical investigators at the University of Colorado and help communicate results. In this spirit, this award is presented for the best use of statistics in a science project.

To be considered for this award, you must submit a copy of a single graph or table from your project along with a paragraph describing its significance via zFairs by March 24th. Judges will be looking at this document along with viewing the project, so background information is not critical. Winners from each division will be awarded $150, a student membership in the American Statistical Association, and acknowledgement in *AMSAT News*. The winners will also be given the opportunity to give a brief presentation of their results at the ASA chapter's Spring Meeting at the National Center for Atmospheric Research in Boulder.

Each project will be selected based on the following:
- Were statistical issues considered in the design of the experiment? Examples of such issues include: estimating sample sizes, controlling for possible confounding variables or calculating confidence intervals.
- Were appropriate graphics used to present and interpret the results?
- Was a statistical test used to draw conclusions about the data collected during the experiment? Examples of statistical test are the t-test and analysis of variance.
- Can the student explain the results within a statistical context? How likely are the results a matter of chance?

Broadcom MASTERS

The Broadcom MASTERS (Math, Applied Science, Technology and Engineering for Rising Stars) is a competition for 6th, 7th and 8th grade students who complete a science, engineering or math project, enter it into competition at an SSP-affiliated fair and are nominated to compete in the national competition.

Nominees will enter the competition by completing an online application where they will be asked to explain their science project and to evaluate their use of STEM principles – science, technology, engineering and math – in the development and presentation of their project.

From the national entrants, 300 Semifinalists will be selected along with 30 Finalists who win an all-expense paid trip to Washington, DC, where they will compete for awards and prizes, including the top education award of $25,000 presented by the Samueli Foundation, a gift of Susan and Henry Samueli, a founder of Broadcom Corporation.

27th Annual Poster Art Contest
Invitation to Enter

This contest is not a requirement, but if you wish to enter artwork in the poster contest, please follow these guidelines:

➢ Poster designs must represent some aspect of science, engineering, and/or mathematics.

➢ Black and white illustrations only (ink is preferred); no color entries.

➢ Design area is limited to 8" <u>wide</u> by 10.5" <u>tall</u>.

➢ Student collaborations (up to two students) on poster designs is permitted.

➢ Print your name and school name on the back of your entry in pencil.

➢ Entries <u>must</u> include the following information about the fair prominently displayed somewhere in the design (preferably in an area where we can digitally enhance this information):

Colorado Science and Engineering Fair
For Colorado Students in Grades 6 to 12
Hosted by the College of Natural Sciences Education Outreach Center
At Colorado State University
Fort Collins, Colorado
April 7 - 9, 2022

➢ Mail original artwork to CSEF by April 1st.

PO Box 1465; Fort Collins, CO 80522-1465

➢ The Poster Art Contest is open to any Colorado student in grades 6 to 12.

All entries that meet these guidelines will be considered.
The winner will receive a $100 cash award,
and the design will be used on the
2022 Colorado Science and Engineering Fair posters.

The winner will be announced at the
2021 Awards Ceremony on
Saturday, April 10, 2021

Required Project Presentation Instructions

The project presentation replaces the project poster used during in-person fairs – this is NOT a 12-page report. The following are instructions/guidelines for creating the slides. It is recommended that you use one of the following templates to make your project presentation slides:

Science Project Presentations: Powerpoint Template or Google Slides Template

Engineering Project Presentations: Powerpoint Template or Google Slides Template

Math/Computer Science Project Presentations: Powerpoint Template or Google Slides Template

- The Project Presentation must be a single PDF document limited to **no more than 12 pages**.

- Do not change the page settings on the template – they are set up so that the template you fill out will print to pdf with the correct page size (8½" x 11") and orientation (Landscape).

- The PDF document must open with the default magnification set to "Fit Page" so that **the entire page is visible at the same** time.

- The PDF document must be made without animations or active hyperlinks. The document must not have instructions to open in "full screen mode". Eliminating this mode automatically prevents page transitions, embedded videos or animations from playing, so do not attempt to include them. (There are provisions for submitting an optional video if you need to show a demonstration of your project.)

- It is recommended that you use a white background with black text for maximum contrast. If you do change these, make sure to use a light-colored background with dark text to support readability.

- It is recommended that you use a font such as Arial, Calibri, or Century Gothic for readability.

- Page titles should all be the same font size and should be larger than headings within each page. In turn, headings should be larger than body text.

- All text should be easily readable when viewing the entire page at once. The smallest allowable font size for body text is 14 pt (unless you are adding a figure caption or photo credit – these can be 10 pt.).

- Avoid long expository paragraphs. State your points succinctly.

- Use bullets to set out individual points of interest. Use numbered lists when the ordering of points of interest is important.

- You may add more slides as needed to the template, up to the maximum of 12 printed pages.

- All Project Presentation elements must conform to Display & Safety rules as if placed on a physical poster for display to judges and the public (see page 11).

- **Once completed, delete the instruction slide before printing to a PDF file. Your resulting Project Presentation should only be at most 12 pages.**

Optional Project Video Instructions

You may opt to record a video (2-3 minutes max) explaining your project. The target audience for this video is members of the general public who will visit the fair on Public Day. While judges will have access to this video, it will not be the focus of their project review.

What to include in your project video:

1. Introduce Yourself:
   - State your full name.
   - You may include your school and/or town if you wish.
   - Rather than reciting your project title, consider explaining your project in a single sentence.
2. Explain Your Project:
   - Summarize your research in these main points:
     o What did you do?
     o What did you find?
     o What conclusions did you draw?
   - You can use any props or visuals you may have that are within the Display & Safety guidelines. There is another option for doing demonstrations outside of this video.
   - Do not include the faces of anyone in your video other than the student researcher(s) of the project.
   - You will need to post this video in a Google Drive folder (make sure to set the permissions so anyone with the link can access it) or another online video posting site (like YouTube). If you need help hosting your video, please contact the CSEF Director and we will host it on the CSEF site.
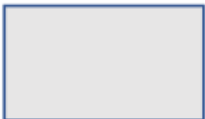
You may also opt to record a video (1 minute max) that shows any demonstrations of your project that you would normally have wanted to show in person (especially for engineering type projects). The target audience for this video will be the judges.

What to include in your demonstration video:
   - Explain what is being shown in the video in as few words as possible. Try to let the images speak for themselves.
   - Make sure anything you are demonstrating is done in a safe manner or it will be flagged as inappropriate by the Display & Safety Committee.
   - Do not include the faces of anyone in your video other than the student researcher(s) of the project.
   - You will need to post this video in a Google Drive folder (make sure to set the permissions so anyone with the link can access it) or another online video posting site (like YouTube). If you need help hosting your video, please contact the CSEF Director and we will host it on the CSEF site.
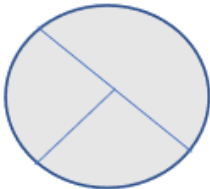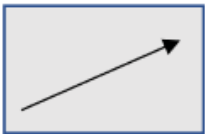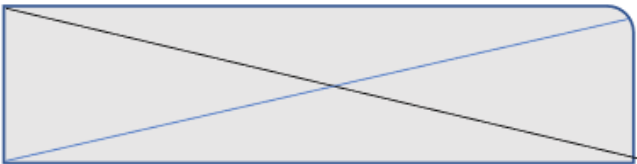
Best practices for filming:
   - Film in a well-lit and non-distracting environment so the viewer's focus stays on you and your work.
   - For best results, film your video horizontally (landscape).
   - Keep the camera still and in place during filming.
   - Speak clearly and loudly enough that the recording is able to pick up every word you say.
   - Avoid long pauses.
   - Listen to your video after recording to ensure your voice is clear and audible, and that the video has not picked up too much background noise.

Other Optional Material Instructions

Quad Chart: A "quad chart" is a single page divided into four quadrants providing a high-level summary of the project. It is intended to be more visual than detailed in order to quickly introduce the judges to what is important about your project. See the ISEF examples for details as engineering and math/computer science projects will have slightly different section titles.

- You must use a wide-screen page format similar to the American Legal standard 8½"X14" and arranged in Landscape orientation.

- The page background color must be a light color and text color must be predominantly dark to support readability.

- The minimum allowable font size is 13 pt. Exception: You may use a smaller font size, down to 9 pt., for figure captions or photo credits.

- All four quadrants of your Quad Chart should each be the same size with a single border line delimiting each, as in the examples below. The Title section should be only as tall as necessary to include your project title and other identifying information (see section on Quad Chart Title).

- The Quad Chart should not include a bibliography, references, or acknowledgments.

- All Display & Safety rules must be followed.

Research Paper: The CSEF does not require any project to include a research paper. However, many finalists have completed such a paper through the research process and would include it at their booth during an in-person fair. If you have prepared such a paper, you may upload it to share with judges, though judges are not required to review it. Students wanting to be considered for either of the Technical Writing Awards should submit their papers as one of the images in zFairs.

Lab Notebook Image/Excerpt: The CSEF does not require any project to submit a laboratory notebook. However, many finalists have this record of their research timeline and process and typically have it available at their booth. A student may upload a PDF of up to 4 pages of a lab notebook to provide evidence of its use, but it is strongly advised NOT to share the notebook in totality to protect your intellectual property.

Colorado Science & Engineering Fair (CSEF)
2021 Finalist Verification/Permission Form

FINALIST'S NAME:_____

PROJECT DOCUMENTATION: All ISEF or CSEF forms must be uploaded into zFairs as soon as the student is registered in order to consider your registration complete and ready for Scientific Review Committee (SRC) review.

- **COMPLETED** and signed Finalist Verification Form (one per student).
- **COMPLETED**, signed, and dated CSEF Abstract Form (one per project).
- **COMPLETED**, signed, and dated Regeneron International Science & Engineering Fair (ISEF) or CSEF forms: Checklist for Adult Sponsors Form (1), Student Checklist (1A), Research Plan, and Approval Form (1B).
- **COMPLETED**, signed and dated copies of other Regeneron ISEF or CSEF forms required for this type of project.

REGISTRATION FEE PAYMENT: Registration fees are $40/STUDENT, checks are the only accepted form of payment and they should be made out to CSEF and sent to P O Box 1465; Fort Collins, CO 80522-1465 by April 1st. If the school/district is paying, either the check or a copy of a purchase order MUST be sent to CSEF by April 1st.

FINALIST'S AGREEMENT WITH THE COLORADO SCIENCE & ENGINEERING FAIR:

I, the above named Finalist, understand that by registering online with the CSEF and submitting this form into zFairs, I am making a commitment to present my project at this year's virtual CSEF and agree to the following:

- My project materials will be submitted by March 24th and will remain available within zFairs to judges and the public through at least April 21st.
- I will be available on April 8th for all scheduled Grand Award Judging interviews.
- I attest that my project is free of plagiarism. The CSEF uses the following definition of plagiarism from Merriam-Webster.com "the act of using another person's words or ideas without giving credit to that person".

I understand that if I do not honor this agreement (without previous arrangement with my RFD and the CSEF Director) I may be disqualified from the competition. If I am unable to participate in the Colorado Science & Engineering Fair, I will notify my RFD immediately so that someone else may participate in my place.

Finalist's Signature:_____ **Date:**_____

PARENTAL PERMISSION:

As the parent or legal guardian of the above named Finalist, I am granting permission for my student to participate in the virtual CSEF and agree to the following:

- My student is allowed to participate in virtual Grand Award and Special Award judging interviews via video conferencing in the zFairs platform (password protected).
- Any student needing special scheduling accommodations for the Grand Award judging interviews on April 8th will need to contact the CSEF by March 31st.
- I understand that the judging interviews will be conducted by groups of 2-3 judges and that at no time will my student be allowed in a judging interview with just one adult.
- In consideration of the Colorado State Science Fair (CSSF), Inc. permitting the undersigned student to take part in the Colorado Science and Engineering Fair, we, the undersigned, waive all claims against CSSF, Inc. and all sponsors for injury to or death of persons or loss or damage of property in any way occurring in connection with the CSEF, and we, the undersigned, agree to indemnify and hold CSSF, Inc. harmless against all such liability.

Parent/Guardian's Signature:_____ **Date:**_____

ADULT SPONSOR VERIFICATION:

The following person is listed as the Adult Sponsor (and signed Form 1) for my project and I understand they will be contacted about any questions the Scientific Review Committee may have about my research.

Adult Sponsor Name:_____ **Email:**_____