

Opportunities for Connecticut's Budding
Young Scientists and Engineers

Connecticut Science and
Engineering Fair:
72 Years of Innovation
www.ctsciencefair.org

Frank LaBanca, EdD
Fair Director



Objectives of Today's Workshop

- Discuss the Fair Format
- Discuss the nature of successful projects
- Categorize Types of Projects
- Discuss the role of the teacher



Connecticut Science Fair

March 9 -14, 2020

Quinnipiac University

Hamden, CT



Mission Statement

- Provide a forum for the science, mathematics, and engineering skills of 7th through 12th grade students.
- Encourage young people to develop self-inquiry and critical thinking skills.
- Provide recognition through awards and opportunities to compete in national and international awards programs.





Connecticut Science & Engineering Fair

72nd ANNUAL FAIR, MARCH 9-14, 2020 • QUINNIPIAC UNIVERSITY

Enter search keyword



Fair Week

News

Project/Student Registration

Rules & Regs

Student Guide

Document Library

Workshops

Alumni

Judges



Latest

Popular

Comments



2019 ISEF Thursday
17 MAY 2019



2019 ISEF Wednesday
17 MAY 2019



2019 ISEF- Tuesday
15 MAY 2019



2019 ISEF – Sunday Adventures
14 MAY 2019



2019 ISEF- Monday Events
14 MAY 2019

Welcome

[School Registration is open!](#)

[Project Registration is open!](#)

About the Fair

The Connecticut Science & Engineering Fair is a yearly, statewide science and

project-in-i-sweep-and-genius-olympiad rough 12th grade students residing, or enrolled, in

Recognition and Awards

- Over \$200,000 total
- Scholarships from:
 - Quinnipiac University
 - UConn
 - University of Hartford
- Seven projects to compete at the International Science and Engineering Fair (*Anaheim, CA*)
- Main Fair Categories:
 - Life Science
 - Physical Science
- Special Categories
 - Alternative/Renewable Energy, Applied Technology, Computer Science, Engineering, Environmental Science, Future Sustainability, Math, Technical High Schools, Urban School Challenge, Women in Science and Engineering
- Awards from technical societies, government, businesses, and individuals
- Certificates of recognition to all
- T-shirts for all



Fair is open to:

- 7th to 12th grade students residing in or attending school in Connecticut and Fishers Island, NY
- Individual or team entries
- Projects that comply with the Rules of the CSEF and the International Science and Engineering Fair.



Ways To Enter

- Be selected by school
 - School Science Fair
 - Nomination by School
- Direct entry
 - In absence of School Science Fair or selection process
- First-come, first-served
- School Limits:
 - 10 middle school projects
 - 15 high school projects



Deadlines

- Oct 30 School Registration
- Dec 1 High school student registration/
Middle school students requiring
preapproval
- Feb 15 Middle school student registration
- Mar 1 Project Abstracts Due

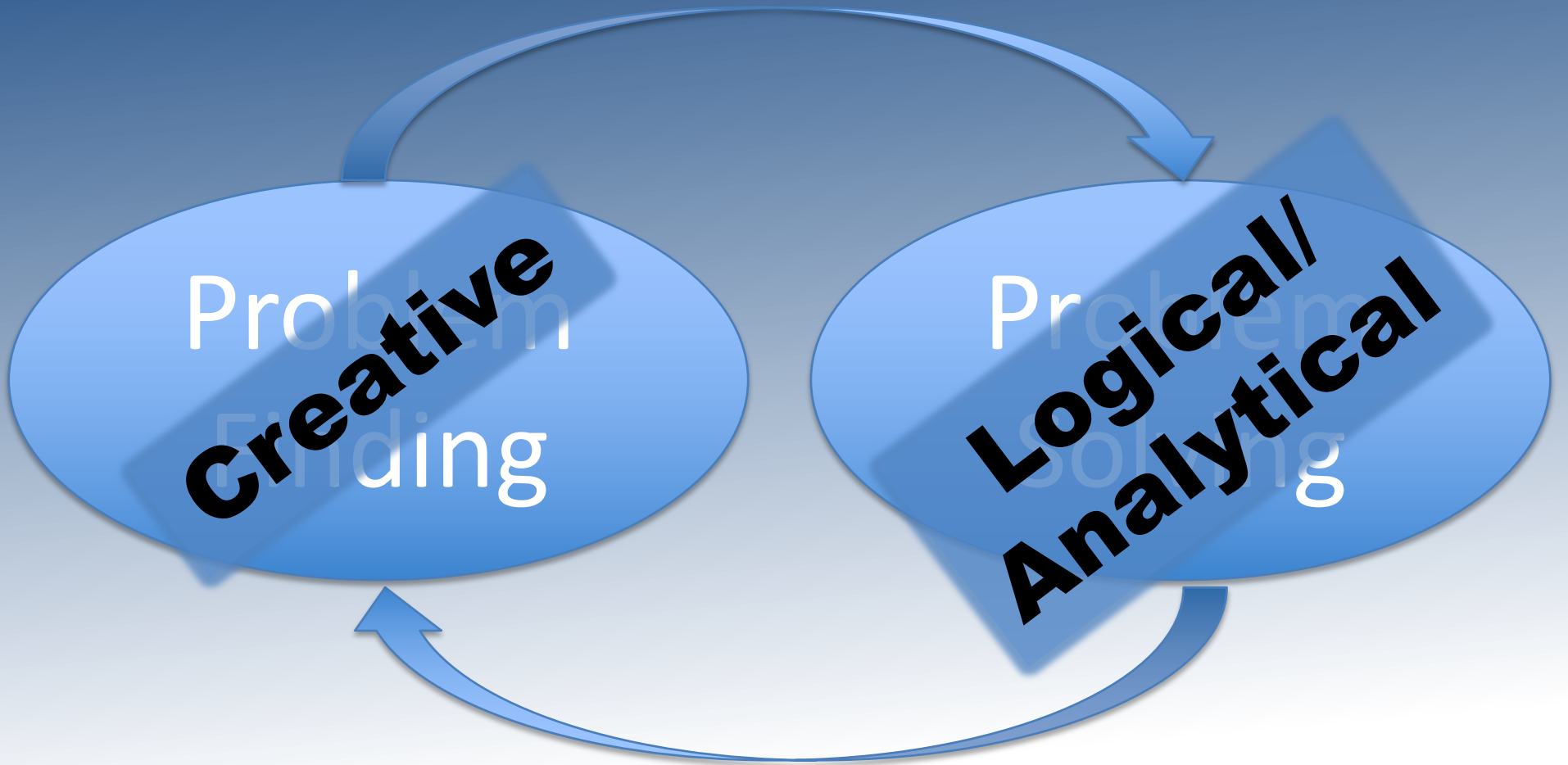
Fair Week

- Monday Project Setup/Urban School Challenge
Preliminary Judging with students
- Tuesday Preliminary Judging without students
- Wednesday Finalist Judging
- Thursday School Visits, Science Demonstrations,
Public Viewing
- Saturday Awards Ceremonies



INQUIRY (/in'kwī(ə)rē/)

Learning by questioning and investigation.



Problem Finding

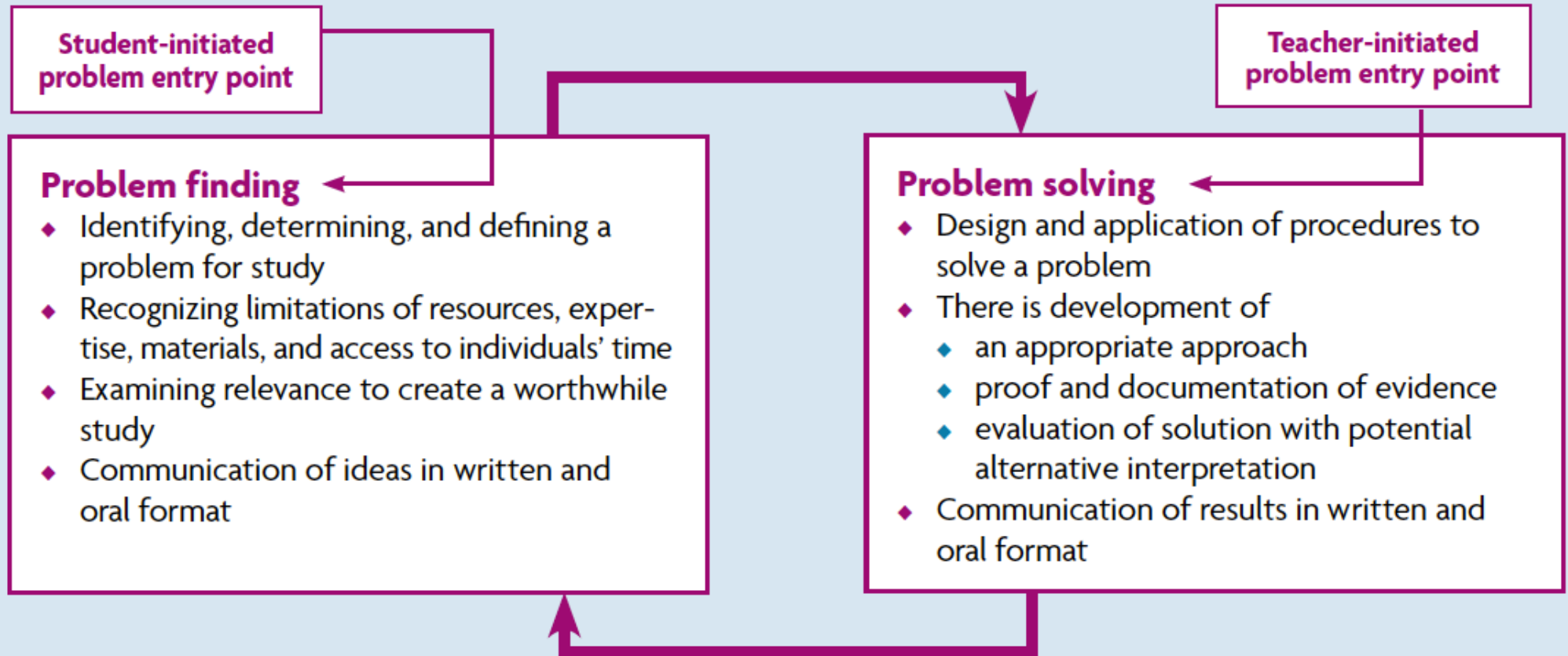
- Identifying, determining, and defining a problem for study
- Recognizing limitations of resources, expertise, materials, access to individuals, time
- Examining relevance to create a worthwhile study
- Communication of ideas

Problem Solving

- Design and application of procedures to solve a problem
- Development of:
 - appropriate approach
 - proof and documentation of evidence
 - evaluation of solution
- Communication of results

FIGURE 1

The relationship of problem finding and problem solving in science research.



Secrets of a Successful Science Project

- A fresh idea with exciting consequences.
- Thorough understanding of the science/ engineering by the student.
- Communicate the idea **written** and **verbally**.



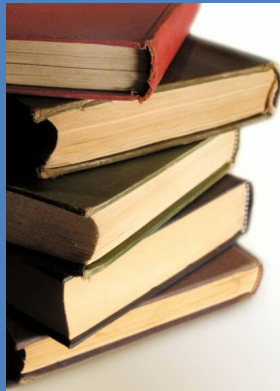
The Consumer-Product Testing Trap



Testing a product for what
it's *supposed* to do

Types of Projects

Literature Review



Technical



Technical with Value

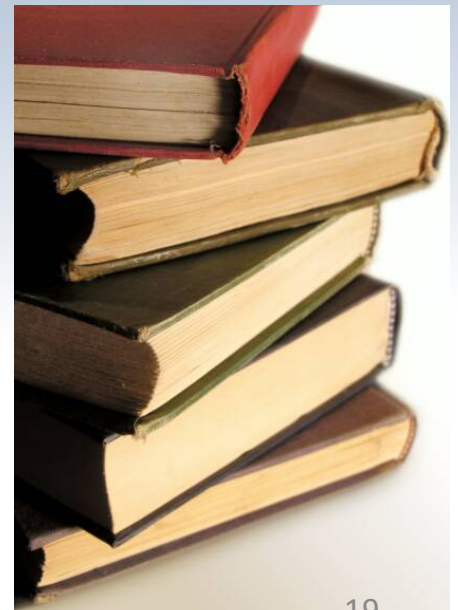


Novel Approach



LITERATURE REVIEW PROJECT

- Use source information for all aspects of project
- Organize primary and secondary sources into a report
- No inquiry



TECHNICAL PROJECT

- Inquiry-based
- Well known question
- Well known outcome

- Predetermined procedures
- Predictable results



TECHNICAL PROJECT WITH VALUE

- Inquiry-based
- Technical data
- Unique data set – unique niche
- Value to an authentic audience



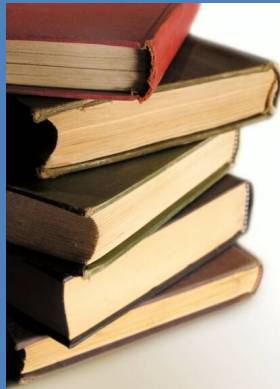
NOVEL APPROACH PROJECT

- Novel question
- Novel method to solve a preexisting question
- Ill-defined question
- Ill-defined outcome



Define Project Based on Abstract

Literature Review



Technical



Technical with Value



Novel Approach



Partitioning Gamma-Ray Sources in Fermi Large Area Telescope Observations for Spatial and Spectral Analysis

The Weakly Interacting Massive Particle (WIMP) theory for dark matter predicts the production of gamma radiation from WIMP annihilation and decay. To examine the possibility of WIMP dark matter, gamma ray sources from M31 are partitioned from the Fermi Gamma-ray Space Telescope from the LAT instrument with 5 years of clean and ultraclean cut-data in the 1 – 300 GeV range. Background, halo, and point source distributions are then used in a spectral and spatial analysis. The spectrum is well described by a power law, but the polar averaged radial density is a good fit with a line of sight integral of the linear and squared Navarro - Frenk - White (NFW) density profile with an $R^2 = 0.9992$. The NFW fit also exhibits a significantly larger contribution coefficient from decay processes than annihilation. The correlation between theory and predictions suggests that either WIMPs are the source of the radiation, astrophysical processes are influenced by dark matter that follows this density fall off, or astrophysical processes follow this profile randomly. These findings raise fundamental questions on the origin of galactic halo gamma rays, and warrants continued research in the field.

Temperature-Independent, Portable, and Rapid Field Detection of Ebola via a Silk-Derived Lateral-Flow System

Up to 90% of Ebola victims will die without early diagnosis and medical intervention, which can reduce fatalities by 50% and are critical to preventing future epidemics. Current detection methods are expensive, time-consuming and utilize complex instrumentation and chemicals that require uninterrupted refrigeration. Successfully maintaining the reagent's "cold-chain" from laboratory to point of use is highly problematic in regions with poor infrastructure, where Ebola is most common. This research sought to devise a rapid, simple and inexpensive Ebola detection platform that can be stored and transported without refrigeration. To begin, current Ebola ELISA reagents were embedded in silk fibroin, which possesses stabilizing properties, allowing storage of otherwise refrigerated reagents at room temperature. To confirm ELISA colorimetric detection of Ebola after prolonged, non-refrigerated storage of the kit's reagents, the Ebola ELISA was conducted in a 96-wellplate format (A450nm) at 0-7days from initial mixing and dilutions. Results indicate Ebola ELISA detection is viable in water dilutions only on the day of mixing. For silk-embedded reagents, successful detection was realized for up to one week of RoomTemp-storage. Silk-film embedded Ebola ELISA reagents were used to construct a four-channel, paper-based, fluidic detection card, with colorimetric reagents positioned to create timed, visible detection of Ebola antigens. In this new device, that is stable and stored at room temperature, 30 μ l drops of water were used to dissolve silk-embedded reagents, initiating a timed-flow towards a center detection zone, where a positive (colored) result confirmed the presence of 500pg/ml Ebola(+)-control antigens in 30min, at a cost of \$25.

The Effects of Barefoot and Shod Running on Risk of Injury in High School, Female, Recreational Runners

While previous studies have investigated the incidence of injuries among high school cross country runners, there has yet to be a study conducted to compare barefoot and shod running in this population. My experiment investigates the influence of these two conditions on biomechanical risk factors that have previously been associated with injuries in female high school runners. Eleven recreational runners participated in this study. Ten trials were conducted per condition for each runner. A trial was defined as one run down the fifty foot long track with the runners striking the force plate with their right foot. Step frequency, step length, contact time, knee flexion angle in the stance phase, sole angle at touchdown, the peak impact force, and the length of time the maximum force was sustained for were compared between both conditions. Stride length and contact time were both shorter in the barefoot condition, which led to less prominent rearfoot striking among the majority of runners. The knee flexion angle and sole angle were also smaller when barefoot, which are both impact reducing mechanisms. Impact forces were higher in the barefoot condition, as was expected for runners who typically run with shoes. However, other biomechanical adaptations were clearly made. This includes a shorter period of time during which the maximum force was sustained during barefoot running in comparison to shod running. This information could be used to support a prospective study that follows barefoot and shod high school runners to determine the incidence of injury in each group.

Novel Glycerol-Free Biodiesel Production using Enzyme Catalysis

Biodiesel production from vegetable oil and ethanol (EtOH) has become a demonstrated alternative energy source. Current processes convert triglycerides to biodiesel, from which 90 million pounds of crude glycerol, a waste product, is extracted per annum in the US. Last year, a new method of production was formulated to avoid glycerol formation using selective partial transesterification; preliminary data required additional research to verify early findings and support the method reliably. This project investigates the effectiveness of the addition of acetic acid (AcOH) to the enzymatic process to prevent the formation of glycerol by inducing faster transesterification of the terminal alcohols. Gas chromatography and mass spectrometry (GC/MS) analyses were applied in order to identify intermediate compounds' structures dependably. Using GC/MS and dodecane, an internal standard (IS), to track formation of the new products, the reaction's stability was demonstrated. Glycerol was continually absent from the invented EtOH+AcOH reaction, supporting the hypothesis that stopping the process at the monoacylglycerol (MG) stage results in a 100% yield of good-quality biodiesel. Furthermore, the reaction of MG acetate, formed under anhydrous conditions, was tracked after the addition of water, experimentally verifying its structure. In the EtOH+AcOH experiment, 8% MG acetate was formed; its complete hydrolysis in the presence of water resulted in a 10% increase in biodiesel and 0.12% increase in MG. These results indicate that the EtOH+AcOH method for biodiesel production is a sound, efficient, and applicable process to prevent waste glycerol formation at minimal cost.

Polyetherketoneketone (PEKK), 3D Printed, Bipartite Surgical Implant: An Alternative and Supportive Cure for Internal Coxa Saltans in Female Adolescents

Coxa Saltans, a condition of the hip, comes in three forms that manipulate a snap, but the contributing factors vary. Internal Coxa Saltans, on which this research focuses, occurs when the iliopsoas muscle-tendon snaps over bony protrusions on the front of the pelvis. The condition is commonly seen in female adolescents due to the hips growing faster than the muscle-tendon can accommodate. The muscle-tendon cannot span such a large area without complications. This results in a tight, inflamed iliopsoas that is prone to snapping. Basic treatment is administered and if the snapping persists and becomes increasingly painful, lengthening of the tendinous fibers of the iliopsoas muscle-tendon is performed. Research has shown that this method removes valuable support from the patient's hip joint. This research seeks to design, 3D print, and mechanically test a bipartite surgical implant that prevents the snapping and provides support for the patient. Using Solidworks, the two parts of the implant were designed, combining the properties of a doorstop and channel like mechanisms. The bipartite implant was 3D printed and then tested mechanically via an Instron machine. The implants were tested for compressive strength in different orientations. When tested mechanically, the femoral implant failed at a load of approximately 1,240 N and the pelvic implant failed at a load of approximately 720 N. Taking the general anatomy of the hip and the strength of the implants into account, it can be concluded that the implant design can provide required support to the hip, while also preventing the snapping.

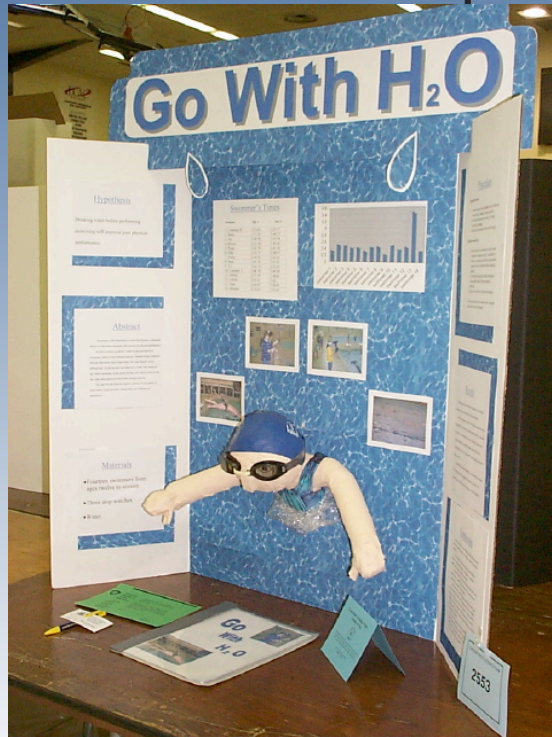
Thank you!
John



Start Selling With The Title!

Title Should Stand Alone!

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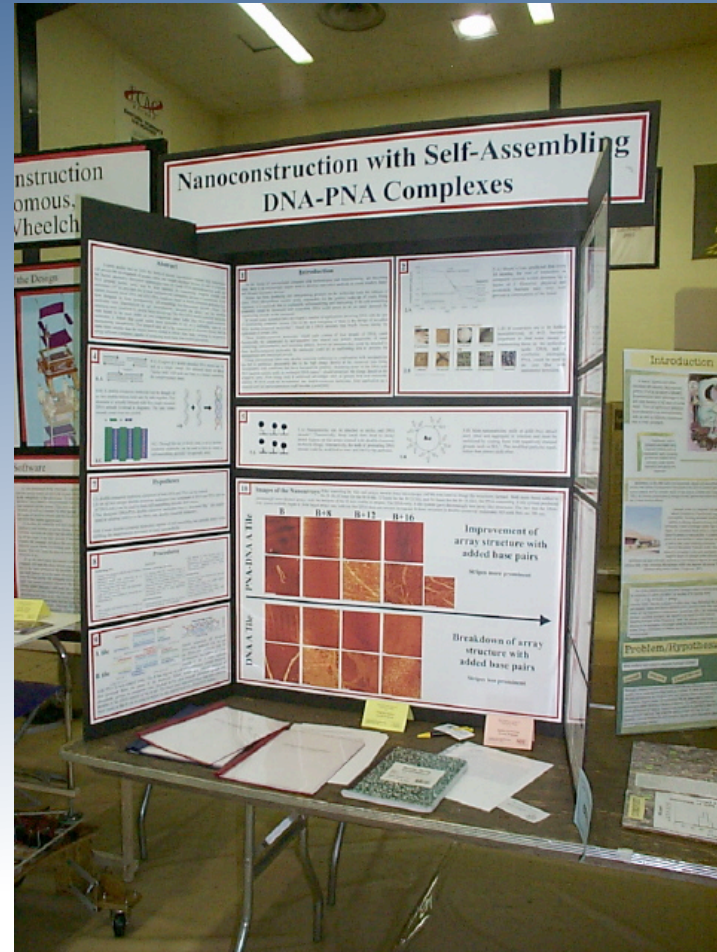


Topic is clear.



You Be the Judge!

- First Impression of a project starts with the title
- Based on ***title alone***, judge the 1st, 2nd, & 3rd Honors for a Fair Category.



Project Titles Speak Volumes (HS)

2002 Connecticut Science Fair

High School Physical Sciences

Honors	Project Number	Title
	6001	The Most Effective Substance For Melting Ice
	6002	Motion Response Deterrents Of Deer
	6004	The Diaper
	6006	The Relationship Between The Number Of Times A Baseball Is Hit And The Distance It Goes
	6007	Geriatric Assist Robotic System (G.A.R.S.)
	6008	Solar Heating Efficiency And Design
	6009	The Design And Construction Of A Semi-Autonomous, Omni-Directional Wheelchair
	6010	Nanoconstruction With Self-Assembling DNA-PNA Complexes
	6011	Comparison Of Packing Media For The Biofiltration Of Hydrogen Sulfide
	6012	Effects Of Thermal Noise And Positional Uncertainty On Nano-Scale Machines
	6013	Which Water Rates the Best
	6014	Sunspots
	6016	Thermal Conduction
	6018	Designing A Laser Jamin Interference Refractometer To Measure Gas Refractive Index
	6019	Wax Your Ride: The Best Snowboard Wax
	6020	Peanut Power



YOUR TASK: Pick 1st, 2nd, and 3rd
Honors Projects.

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2	6008	Solar Heating Efficiency And Design
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