

Research Projects and Science Fairs



Why Do Science Fairs?

- Science Fairs are a **fun and meaningful** hands-on learning activity for students at **ALL** ability levels.
 - Encourages students to **wonder, explore and discover** new ideas and new knowledge
 - Helps to promote a deep, **lifelong passion for science and engineering.**



Courtesy of the White House Science Fair, 2014

Science Research Projects

- Are **student centered**; teacher is *facilitator*
- Demonstrate **experimental design** principles and **science & engineering practices**
- Are really the **“Culminating Task”** for a STEM course, *not something extra to do* but an **integral part of NGSS-aligned curriculum.**



NGSS Science & Engineering Practices

1. Asking questions (*science*) and defining problems (*engineering*)
2. Developing and using **models**
3. Planning and carrying out **investigations**
4. Analyzing and **interpreting data**
5. Using **mathematics** and computational thinking
6. **Constructing explanations** (*science*) and **designing solutions** (*engineering*)
7. Engaging in **argument from evidence**
8. **Obtaining, evaluating,** and **communicating** information



Scientists Use Open Inquiry

- **Inquiry Level 3** = Students decide *what* to investigate, *how* to investigate it, and *how* to interpret the results they generate.

ExD Template for Project Proposal

Problem:

Hypothesis:

Independent Variable (IV):

GROUPS	
Repeated Trials	

Dependent Variable (DV):

Control:

Constants:

1)

2)

3)

Procedure:

How will you present your data?



Science Fair & 21st Century Skills

SF projects integrate **Project Based Learning (PBL)**, **NGSS**, **Common Core** & **21st Century skills** by:

- teaching significant **core content** and key standards;
- requiring **critical thinking, problem solving, collaboration**, and various forms of **communication**;
- requiring **inquiry** as part of the process of learning and creating something new;
- organizing around an **open-ended Driving Question**;



Science Fair & 21st Century Skills

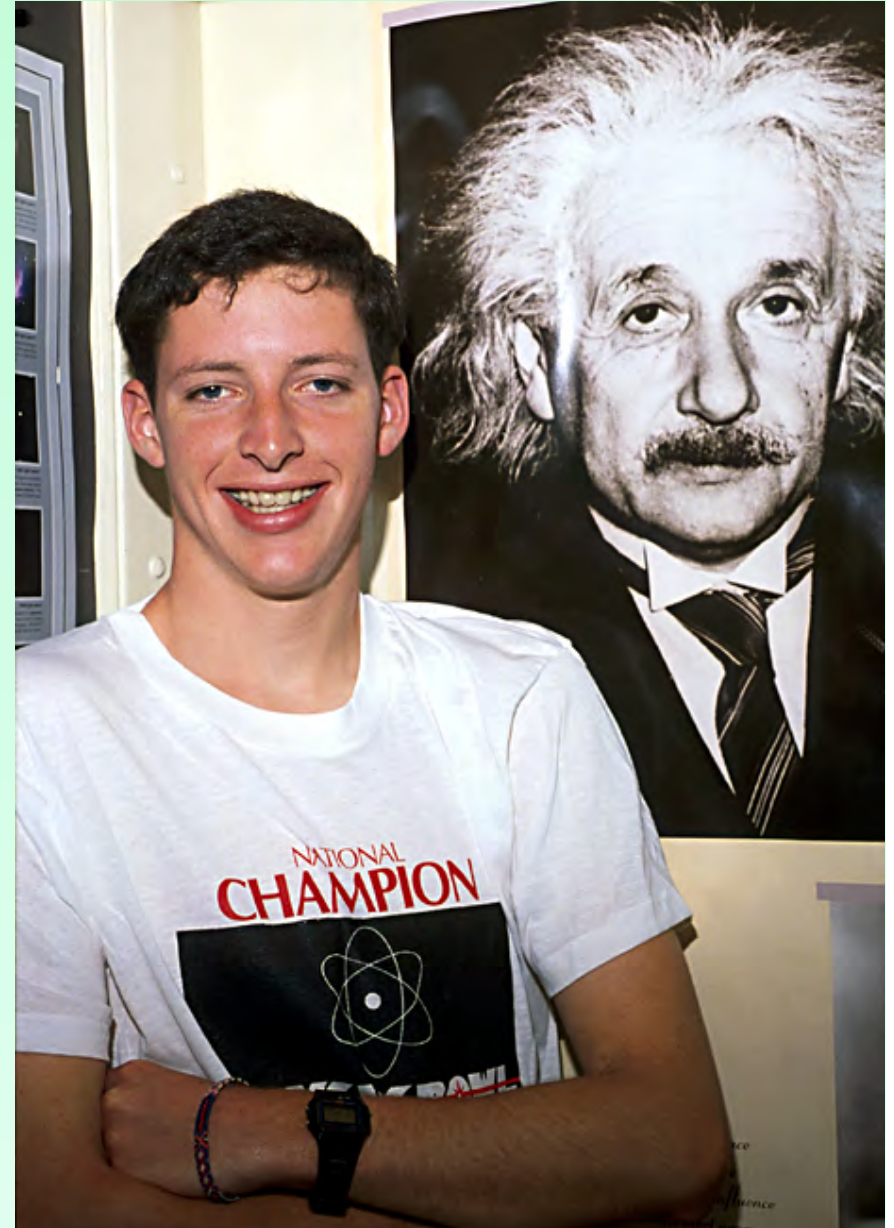
SF projects integrate **Project Based Learning (PBL)**, **NGSS**, **Common Core** & **21st Century skills** by:

- creating a **reason to learn and understand** essential content and skills;
- allowing **student voice and choice**, increasing student **engagement**;
- including processes for **revision, retesting and reflection**; and
- involving a **public audience**, increasing students' motivation to do **high-quality work**.



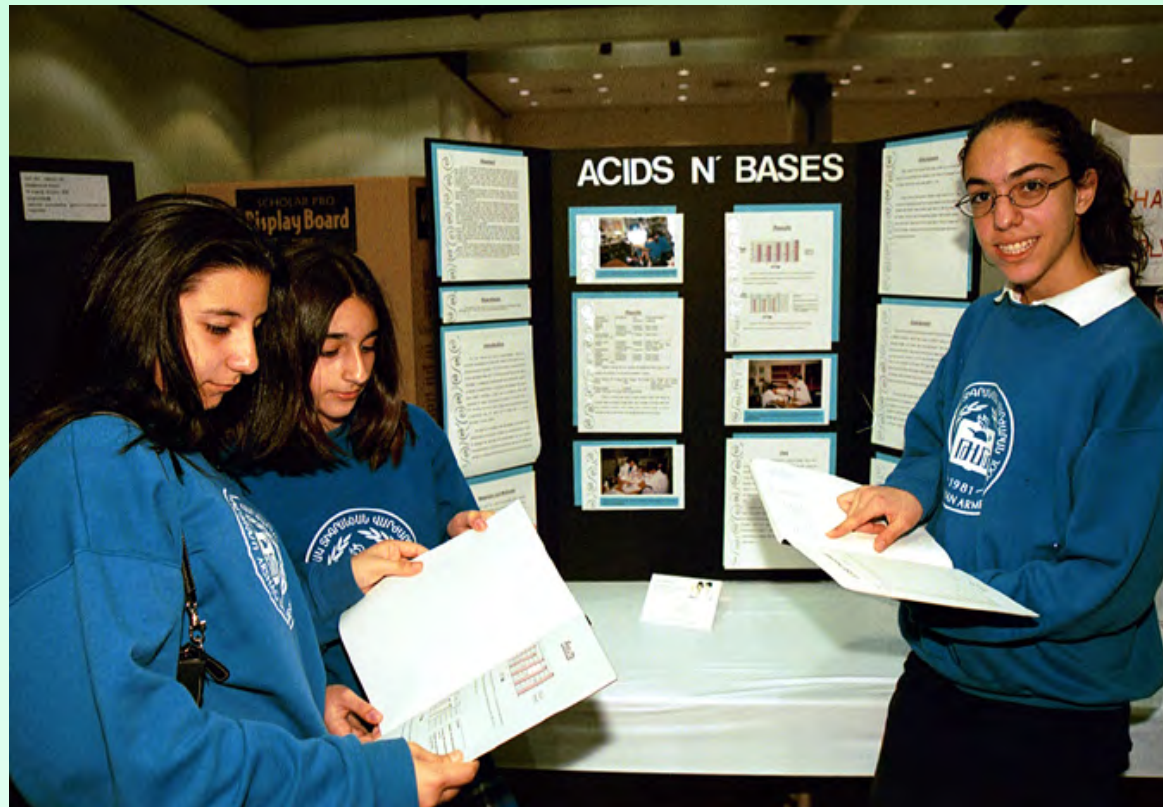
Helps College Acceptance

- *Seniors with projects accepted to regional fairs are more likely to **be accepted** by schools of their choice*



Benefits for Students

- A chance to create **artistic displays**
- Increases confidence through **oral presentations**



Interdisciplinary

- Integrates, into **one activity**
 - *Reading* *Critical Thinking*
 - *Writing* *Computer Science*
 - *Spelling* *Science & Engineering Practices*
 - *Math* *Graphic Arts*
 - *Grammar* *Logic*
 - *Statistics* *Self-learning*
 - *Ethics* *Presentation*
skills



Enhances Inquiry & Collaboration

- Requires teamwork (*one of NGSS “big shifts” for 21st century skills*)
 - Individuals work with teacher advisors, university/industry mentors
 - Teams combine skills to attain group goals



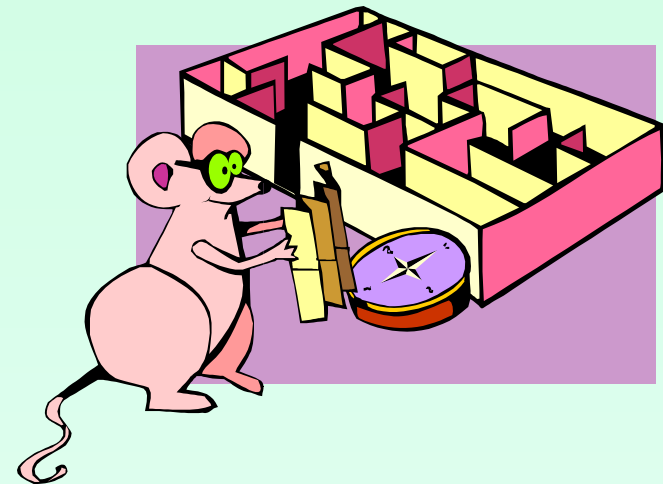
Win Prizes

- **Cash, research trips, equipment and/or college scholarships can open doors of academic opportunity**



SR Science Fair Categories

- **Animal Biology**
- **Animal Physiology**
- **Behavioral/Social Sciences**
- **Biochemistry & Molecular Chemistry**
- **Chemistry**
- **Earth/Space Science**
- **Ecology**
- **Engineering Applications**



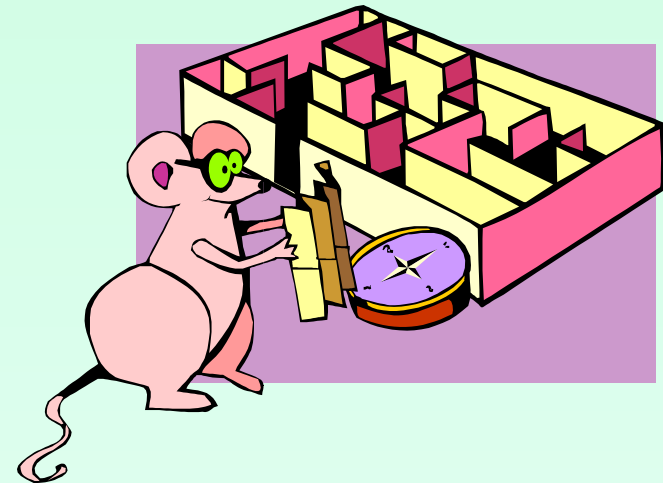
SR Science Fair Categories

- **Engineering Research**
- **Environmental Management**
- **Mathematical/Computer Science**
- **Microbiology**
- **Pharmacology**
- **Physics**
- **Plant Biology**
- **Plant Physiology**



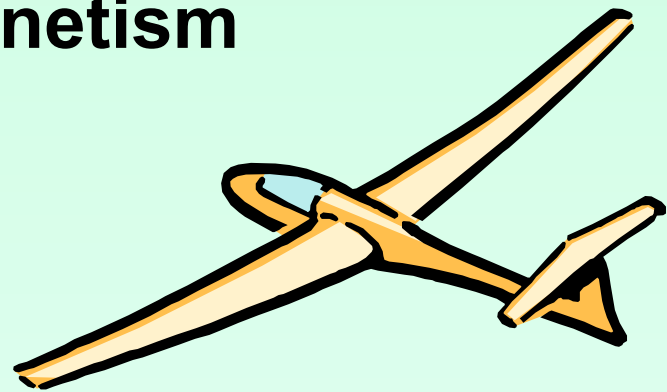
JR Science Fair Categories

- **Animal Biology**
- **Animal Physiology**
- **Behavioral Social Sci-Human**
- **Behavioral Social Sci-Non-Human**
- **Biochemistry & Molecular Chemistry**
- **Chemistry-Applied**
- **Chemistry-General**
- **Earth/Space Science**
- **Ecology**
- **Engineering Applications**
- **Engineering Research**



JR Science Fair Categories

- Environmental Management
- Materials Science
- Mathematical/Computer Science
- Microbiology
- Pharmacology
- Physics-Aerodynamics/Hydrodynamics
- Physics - Electricity & Magnetism
- Physics - General
- Plant Biology
- Plant Physiology
- Product Science



Begins with a School Science Fair



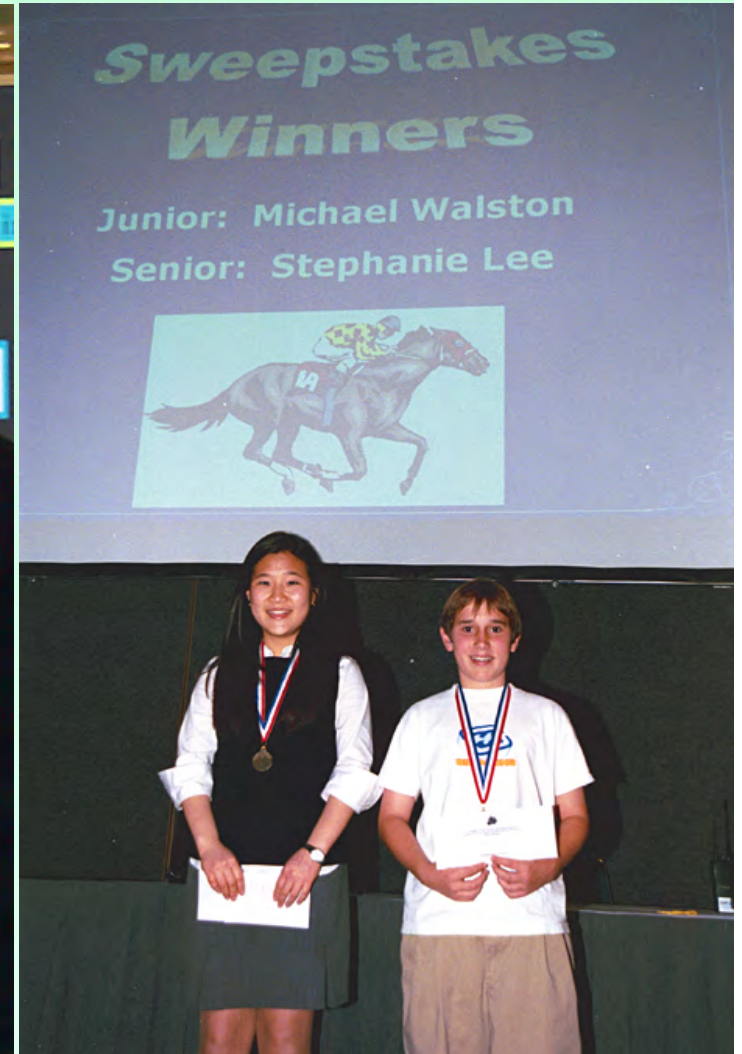


LA County Science Fair

Top 13 projects per school can register
Only 3 may be team projects of **2-3 students**



More Competition, Dress for Success



State Science Fair



**CA Science Center,
Los Angeles, CA**

**Top 1st, 2nd & 3rd
in category per
County Fair**



State Science Fair



**Awards Ceremony
in Big Lab**



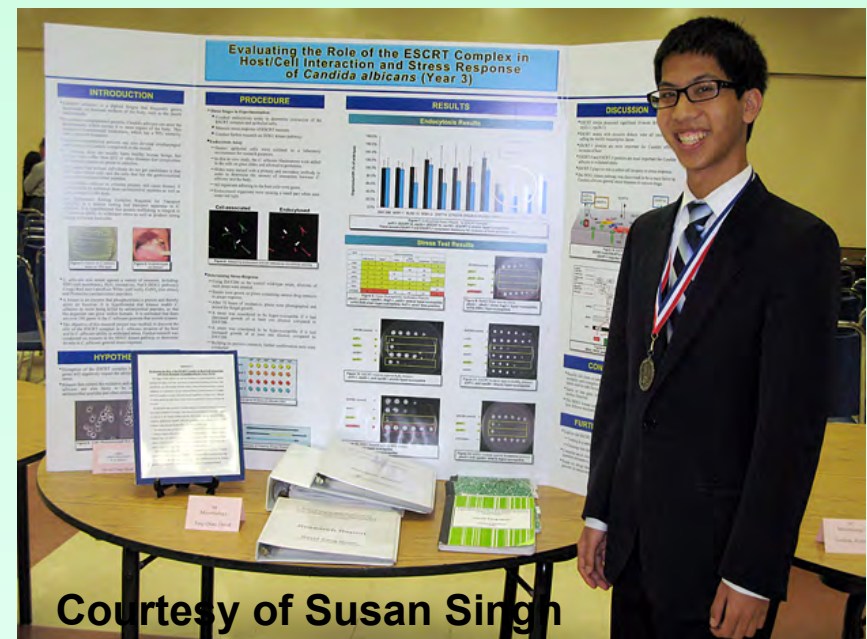
International Science & Engineering Fair



- Top 2-7 student projects in the Senior Division may be selected for international competition!



Courtesy of Susan Singh



Courtesy of Susan Singh

Choosing a Topic

- Projects should be student driven.
- Project ideas *should come from the students*, and the project should be driven by them.
- **Parents** should use their best judgment and provide some guidance, but it is important that **students consider the project their own.**



Choosing a Topic

- Step 1 - *Library/Online Research*
 - Make a list of 5 things that seem interesting to you



Choosing a Topic

- **Step 2 - *Pick a Topic That Matches Your Interests***
 - **NEVER** have someone pick it for you! *It will seem like work*
 - Decide what you are ***PASSIONATE*** about outside of school and design a project that matches
 - *It will seem like **play!***



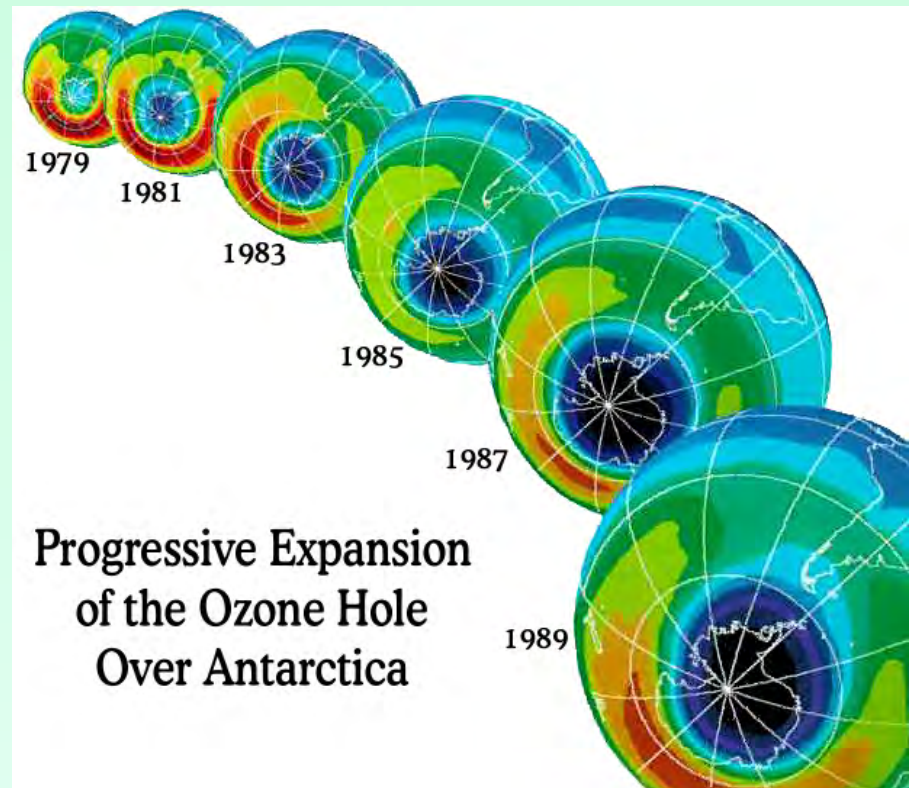
Choosing a Topic

- Step 3 - *Narrow your topic* so that it involves
 - *Experimentation or Engineering Design or Observational Comparisons AND*
 - *Data collection*
- Should be **specific** enough to make into a problem & a research study



CAUTION!

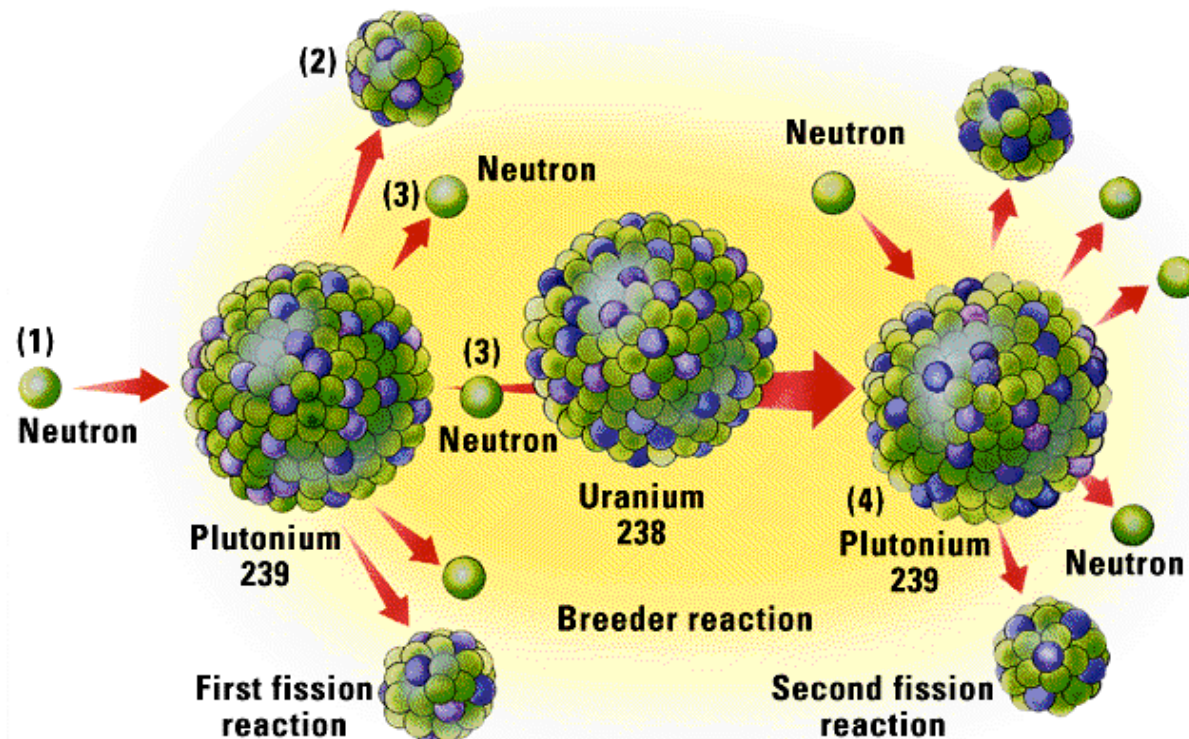
- Avoid topics that are **too general** since these cannot be made into a problem and an experiment
 - *Instead, make general ideas more specific*



CAUTION!

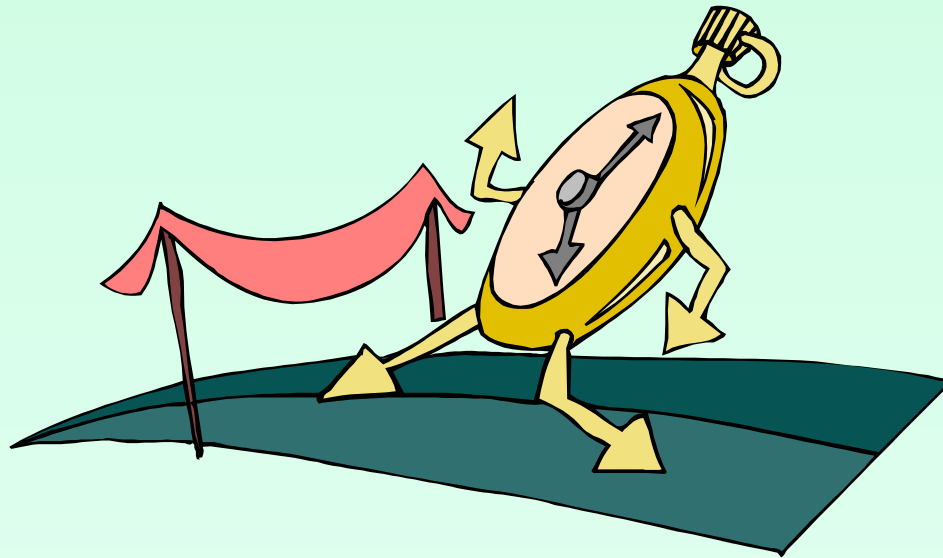
- Avoid topics that require **unavailable resources**

Breeder nuclear fission



CAUTION!

- Avoid projects that require **too much time**
 - Look at your overall schedule, pick a topic that's **reasonable**





Sample Timeline

Get an early start (Sept-Oct)

Most school fairs are in March!

- 1. Decide on a project** **1 weeks**
- 2. Background research** **1 weeks**
- 3. Hypothesis/project design** **1 1/2 weeks**
- 4. Submit project proposal to teacher for approval *before* starting experimentation** **1 week**





Sample Timeline

5. Complete Online Pre-approval Certification before starting experimentation with:

- tissues/cell lines
- human subjects
- live vertebrate animals
- hazardous materials or
- microbes





Sample Timeline

- | | |
|--------------------------------------|-------------------|
| 6. Experimentation | 4- 8 weeks |
| 7. Results, analysis | 1- 2 weeks |
| 8. Writing the project report | 1- 2 weeks |
| 9. Building a display board | 2-3 days |



Teacher's Role - Facilitator

- To help students create a **workable, scientifically sound experimental design**
- To set a **reasonable timeline** for completion
- To encourage **creativity** and independent thinking
- To **periodically check** on and/or grade progress
- To arrange for a **public audience** and **peer review**



Designed & Photographed by

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for the

**Los Angeles County Science &
Engineering Fair**

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