



# Planning a science project

BLV Prasad and Chetan Gadgil  
National Chemical Laboratory Pune

Based on IRIS handbook and presentation, by Narayan Iyer, IRIS SRC  
nniyer@gmail.com

# What is “research-based”?

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## *Usually*

- We don't know the answer before starting out.....
- So we ask questions, make hypotheses, make observations/ do experiments to prove or disprove our hypotheses...
- No fixed end-point, can modify path of depending on what is done, and upon making interesting observations
- Novelty has to be there!

# Select your topic

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- Choose a topic that interests you - you'll have a lot more fun (and probably learn more)
- Check all the resources around you.
  - For eg. - If you are doing a project on Eucalyptus leaves, ensure that you have the Eucalyptus tree in the surrounding region where you live
- Literature survey helps define questions
  - Books
  - Wikipedia
  - [www.scholar.google.com](http://www.scholar.google.com), [www.scirus.com](http://www.scirus.com) or [www.pubmed.gov](http://www.pubmed.gov)

# Hypothesis and rough plan

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- Hypothesis: a tentative theory that can be proved or disproved through further investigation and analysis.
  - Usually one hypothesis for each question you have.
  - You must do at least one experiment to test each hypothesis.
- Plan should include
  - The purpose of your experiment
  - The variable or the things that you are going to change during the experiment
  - Parameters which remain constant during the experiment
  - Positive and negative controls
  - Number of replicates, kind of analysis
  - Timetable

# Data analysis and interpretation

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- Carry out experiment and record data
  - Raw data in ink
  - There is no 'wrong' answer
  - Record observations that are not 'planned' (i.e. power outage, accidental jolt to table etc)
- Carry out planned data analysis
- Discuss data, analysis and conclusions
- Follow-up experiments if necessary
- Cost feasibility if relevant
- Report writing

# How do I start?

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- Choose a topic that will interests & challenge you
- Don't be afraid to try something new – you will learn a lot in your journey
- Idea need not be complicated – simple idea succeeds
- Do background research – makes you realise the vast amount of research work undertaken
- Data suggests that good Mentoring by Teacher/Parent/Guide lead to higher quality
- If teachers see a potential in any student they can “assign” the students
- Problems are Opportunity

\*Some contents taken from [sciencebuddies.com](http://sciencebuddies.com)

# Common tips

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## *Helpful hints*

- Use available resources fully – *anyone* can be a guide
- Maintain a log book – record of the thought process, and original data is a must!
- Starting off with a hypothesis and proving it is incorrect is also good science
- Control experiments are often forgotten
- Appropriate measurements
- Solid conclusions – repeatability, practicality, knowledge of limitations of data

# Example 1 : Simplicity

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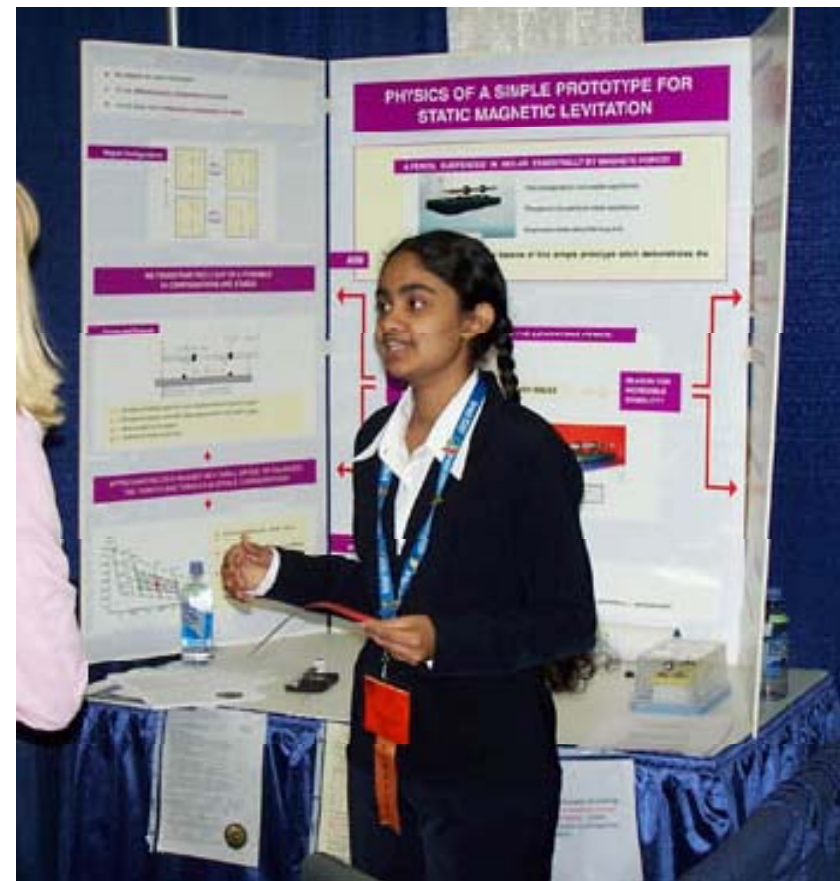
- A winning project does not always require expensive equipment, or a fancy laboratory to work in!

ISEF 2006: Physics Grand Awards 2nd Prize  
winning project of Hamsa Padmanabhan

# Simple projects: levitating pencil

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- What did Hamsa do?
  - Exquisitely detailed analysis of the physics of a simple arrangement of magnets on a pencil, demonstrating the basics of static magnetic levitation
  - All the “experiment” needed was a pencil, some ring magnets, thermocole etc., (but it was followed up with some very rigorous mathematical analysis!)



## Example 2 : Engineering Innovation

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- Innovative Engineering Design – must work out all the nitty-gritty details and have final working product

ISEF 2006: Engineering Grand Award winning project of Apurv Mishra

# Innovative Engineering Design

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- Apurv Mishra, ISEF 2006
- Designed a sensitive device to pick up small movements of the muscles above the eyebrow
- This enables patients who cannot speak, or do not have limbs to communicate
- Made a variation that would enable them to use a computer mouse!
- “Engineering” – not just science – actual prototype fabricated and tested on patients



# Specific issues for engineering-type projects

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- ENGINEERING design – why this length, why this voltage, why this particular chip used...
- Rigorous testing under field conditions – feasible/practical
- Thorough checking of alternative solutions, prior work
- Cost?

# Example 3 : Traditional Knowledge

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- “Ancient wisdom” re-analysed
- Traditional Indian medicine (Ayurveda) or cultural references to a lot of natural remedies, procedures etc. which have not been analyzed using a modern “scientific method”
- ISEF projects:
  - Custard apple seed/leaves
  - Coconut flower extract
  - Spices
  - Kusha grass
  - Papaya leaf

# Termite resistant grass mats

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- Vaishnavi Vishwanathan, ISEF 2007
  - Detailed analysis of termicidal properties of “kusha” grass (desmostachia bipinnata)
  - Analysis of various extraction techniques, attempts at identifying active component, control experiments



# Specific issues for TK projects

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For “traditional knowledge” projects

- thorough checking of prior work – recently lots of work thanks to new patent regimes
  - Many plants etc. studied comprehensively
- Why does it work? – often a synergistic combination of many factors, isolation of single ingredient can be close to impossible
- Comparison with “alternative” (incl. cost)
- Access to labs – beyond a point, need sophisticated standardized equipment
- Statistics

# Example 4 : Local Relevance

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- “Appropriate Technology” – typically low-cost solutions using easily available resources to solve local problems
- Might appear “crude” or elementary but these projects are often the most useful ones
- ISEF projects:
  - Foot operated 2-wheeler
  - Artificial limbs
  - Modified wheelchairs
  - Currency identifier

# Modified wheelchair

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- Mukund Tiwari, ISEF 2006
  - Modified a wheelchair to provide forelimb exercise for cerebral palsy patients
  - A cost effective solution that filled a need in his local environment
  - Used available contacts effectively



# Problems that Intel folks see...

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- Abstract – Lot of pages; sometimes the message is lost  
– Express your idea in 250 words
- Not enough data provided, it is not clear if it is a mere idea or some work has been done
- Not enough novelty – bring out your novelty upfront
- Copied material – judges hate it! & reject immediately
- If you have a prototype done – say a working prototype done!
- State your specific reference – don't hide! Don't say referred google or yahoo – state the exact internet site URL
- If you don't have complete data points – don't make any conclusion – state that it is in progress

# Resources

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- [www.ScienceBuddies.org](http://www.ScienceBuddies.org)\*
- [www.ScienceClub.org](http://www.ScienceClub.org)
- <http://www.societyforscience.org/isef/>
- YouTube – search for science project videos

\*Has Topic selection wizard for project selection

# Judging rules

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- **POTENTIAL MAXIMUM SCORE CHART**

	<b>Individual</b>	<b>Team</b>
1. Creative Ability	30 points	25 points
2a. Scientific Thought /		
2b. Engineering Goals	30 points	25 points
3. Thoroughness	15 points	12 points
4. Skill	15 points	12 points
5. Clarity	10 points	10 points
6. Teamwork	—	16 points
<b>Total Possible Score</b>	100 points	100 points

# What is IRIS?

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- A National Science & Engineering Fair for school students that focuses on “Research Based” projects
- Std 5<sup>th</sup> – 8<sup>th</sup> classified as category I
- Std 9<sup>th</sup> to 12<sup>th</sup> classified as category II
- Jointly conducted by Intel, CII, DST
- Affiliated to ISEF International Fair

# When does it happen?

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- It happens yearly during the month of December
- City is chosen by consensus – This time it is in Kolkata (Dec 4<sup>th</sup> to 6<sup>th</sup>) – Dec 5<sup>th</sup> - Public Viewing
- Abstracts are generally due by September End

# How it works?

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- IRIS Scientific Review Committee meets on a need basis
- Shortlists the abstracts (pre-screening)
- Students get accept letters
- Students participate in the National Fair
  - *Student + One Guide's stay provided and travel re-imbursed*
- Judging of projects (Judged from various scientific community - local and out station) followed by deliberation
- Category wise winners and special awards announced
- Out of the selected National winners 6 projects go to ISEF international fair (4 individuals and two team projects)
- Coaching camp for ISEF projects

# Subject Categories...

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- 10 subject categories for submission of entries
  - Animal Science/Zoology, Plant Science/Botany, Biochemistry
  - Environmental Science
  - Physics, Chemistry, Mathematics, Earth and Space Science
  - Engineering, Computer Science

# India's Performance at ISEF

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Year	Awards (G+S)	Total
2008	4+4	8
2007	2+5	7
2006	4+3	7
2005	1+2	3
2004	7+2	9
2003	4+0	4

Why ALMOST NO ENTRIES from Pune at the National Fairs or ISEF?!!

# Scene from the fair

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# Contact information

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BLV Prasad

Physical Chemistry,

NCL, Pune

020-25902013

pl.bhagavatula@ncl.res.in

Chetan Gadgil

Chemical Engineering,

NCL, Pune

020-25902163

cj.gadgil@ncl.res.in