

Designing a Research Project



Define the Problem



- **A creative process**

- ***“What impacts a pillbug (roly-poly) population?”*** is too large a problem to be solved in school.

- ***“Which Bedding Do Pillbugs Prefer?”*** is a narrower focus.

Conduct Research

- Before generating a **hypothesis**:
 - *Conduct background research to understand the scope of the study.*
 - *Use this research to determine both the dependent and independent variables of the study.*



Create a Hypothesis

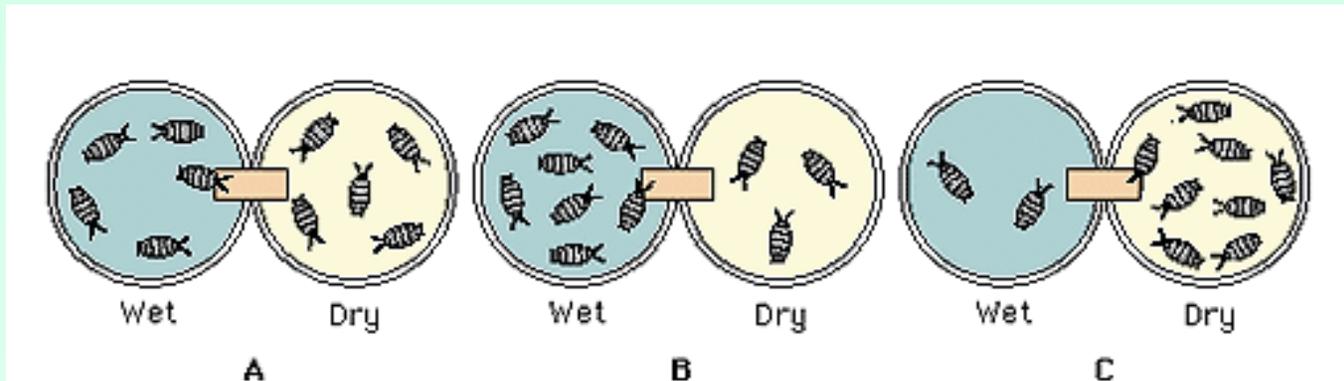
- **Must be testable**
 - Does it show Cause & Effect?
 - ***If _____... then _____...***
 - ***(If Pillbugs prefer natural humus, then they will stay there at least 80% of the time during experimentation)***
 - It is objective?
 - Is it CLEAR?



Define Variables

Think about **Cause & Effect**

- Define the **Independent Variable**
 - Name the variable you will purposefully change during the experiment (*the substrate*)
- Define the **Dependent Variable**
 - Name the variable that will be affected by your test conditions (*# of pillbugs found in each testing chamber at the end of the experiment*)



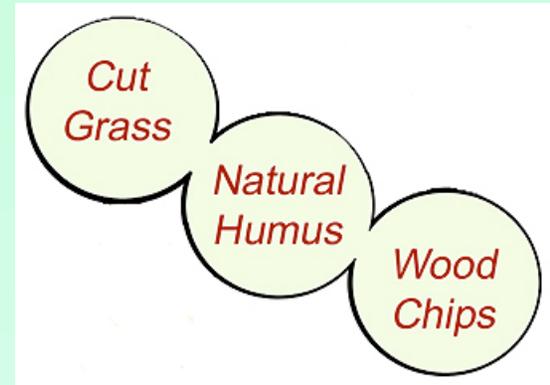
Define Groups

- Define the Experimental Group(s)
 - *plastic, wood chips, sand*
- Define the Control Group
 - *Chamber with natural humus bedding*



Design the Study

- **USE A CONTROL GROUP**
 - or comparative sets of data
 - For behavioral studies, compare with known behavior in the wild



- ***For Engineering projects, explain the benefits of your design***

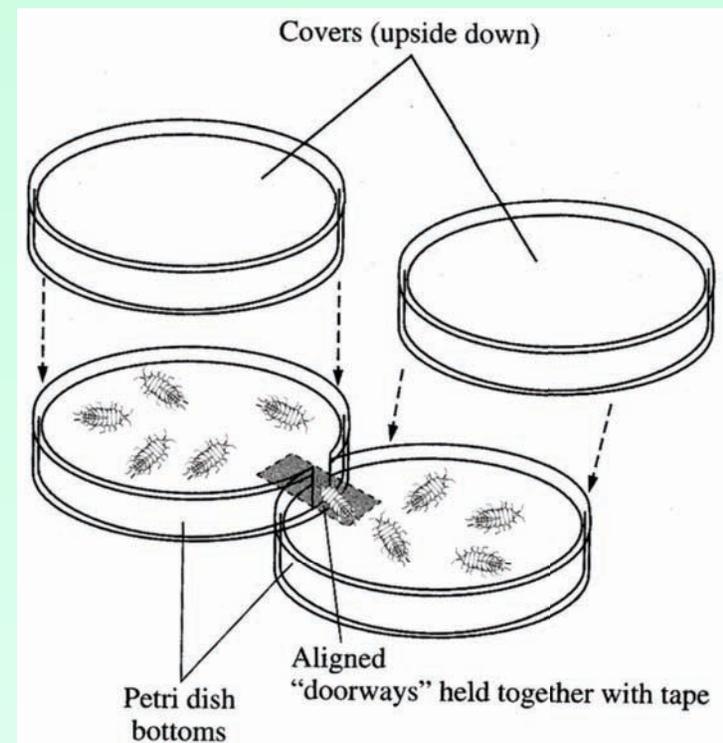


Design the Study

- **Determine the Experimental Constants**
 - Variables NOT altered during the experiment

*– Moisture level,
food,
predation*

***Choose and
Sketch the
set-up***



Design the Study

- Determine the number of trials or groups needed for validity
 - *10 pillbugs/chamber*
 - *15 thirty-second trials*
- Determine how the results will be quantified
 - *# of pillbugs/
chamber/30 sec*



Design the Study

- **Write the Materials and Methods**
 - Don't number steps; use paragraph form
 - *Make them everything clear & repeatable*
- **Use diagrams or a flow chart**

Substrate Type	# of Pillbugs/Chamber										
	10	7	8	7	6	5	6	4	3	3	2
Wood Chips	10	7	8	7	6	5	6	4	3	3	2
Cut Grass	10	13	6	5	5	4	3	3	2	2	0
Natural Humus	10	10	16	18	19	21	21	23	25	25	28
	Time (in secs)										
	0	30	60	90	120	150	180	210	240	270	300

Select a Method of Data Collection

- Take samples **randomly**
- Make sure there is a way to **show patterns/trends** in the data



Write a Proposal

- **State the problem**
- **Include a rationale and justification**
- **List references you have found**
- **If using vertebrates, justify their use and explain the humane manner in which they will be treated.**



Write a Proposal

- State **general materials & methods**
- Include the **length of time** study will run
- Estimate **costs**
- Explain any **safety procedures** you need to follow



Write a Proposal

- Indicate **where** the study will take place
 - Will any **special facilities** will be necessary?
 - Have you received **permission**?
 - State any supervision requirements
 - How are you **getting there**?
- State any expected **results**



Collect Data in a Log Book

- USE a bound notebook ONLY
- A **diary**, detailing all activities
 - Kept **in ink**, with no erasures or other obliterations
 - **Cross out** errors with a single line

SWELL SHRIMP LOG.

ASK ALEX IF HE FEEDS THEM FREQUENTLY; IF NEW SHRIMP PLEASE FEED ONLY TWICE PER WEEK. FEED SOULD ON TUESDAYS AND SHRIMP ON FRIDAYS. FEED ONLY ONE PIECE EACH DAY. 1 PIECE = 2 1/2 to 3 cm³

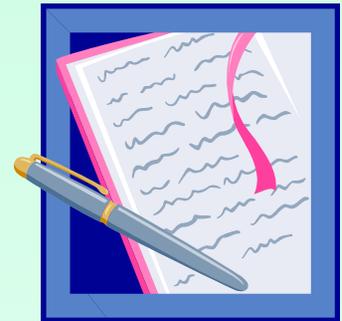
* PLEASE KEEP TRACE OF FEEDINGS IN THIS LOG.

→ SHRIMP 1 = smaller head, younger than rest; front fins darker stripe.
SHRIMP 2 = longer snout, pointy. Light stripe of tan at point.
SHRIMP 3 = wider head, moves slower, wider body, rounded snout.

DATE	WRITER	SHRIMP 1	SHRIMP 2	SHRIMP 3	COMMENT
3/26	CF	0	0	0	
3/27	AS	0	1	0	Shrimp.
3/29	AK	0	0	0	"
4/3	HR	6-1/2 hr	2-1/2 hr	1 hr	squid
4/8	AS	1	1	1	Shrimp
4/12	AS	1	1	1	Squid
4/15	AS	1	1	1	Shrimp

Collect Data in a Log Book

- **First page:** your name, address, phone number, and the name of your advisor
 - Problem statement and a brief summary
- All other entries start with the date, location, time, special conditions of the activity. You should **record all of the following activities:**
 - *Conference with advisor*
 - *Telephone calls*
 - *Research*
 - *Thoughts about your project*
 - *Descriptions of any setup and changes in design*
 - *Data taken while performing the study*
 - *Label all drawings/diagrams*



Collect & Measure Samples

- Collect living specimens safely and with care
- Measure consistently
 - Use ONLY SI or metric measurements!
- Don't contaminate samples
- Record errors



Objectively Analyze Data

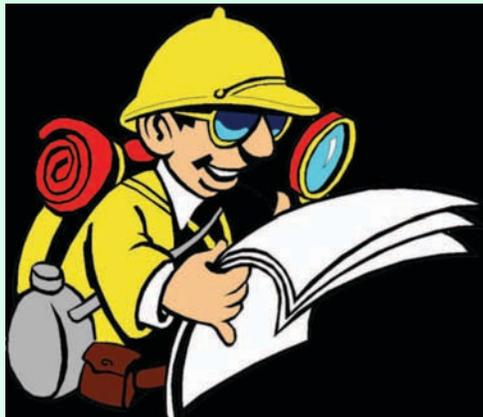
- **Common Statistics**

- Mean (Average)
- % Error
- Standard Dev
- Chi Square
- T-tests
- *Any statistical tests appropriate to your grade level*



Interpret & Draw Conclusions

- Summarize data, show trends
- **DON'T** make broad statements from small samples
- Come to a conclusion: *does the data validate your hypothesis? Do you see trends or lack of patterns?*



Refine and Retest

- If there is time...
 - Improve on the design
 - *Re-test*



Report the Findings

- Team members should work **closely**
- Use **proper format**
- Include **graphics**
- Make **deadlines**



Designed & Photographed by

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for the

Los Angeles County Science Fair

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