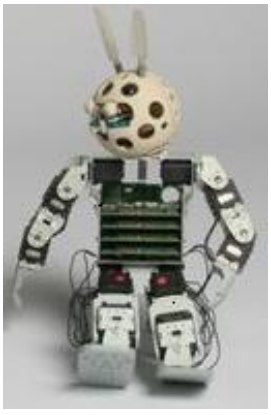
Designing Experiments
Identifying Variables and Controls

When doing an experiment it is vital that you consider the design of the experiment you are doing very carefully as this makes the difference between a successful or unsuccessful outcome!

Definitions:

VARIABLE	A characteristic or factor that may take on different values. E.g. time, weight, colour.
INDEPENDENT VARIABLE	The variable whose effects are to be studied and manipulated or changed in an experiment. It can be used to predict the value of a dependent variable. E.g.
DEPENDENT VARIABLE	The outcome. A variable that is not under the experimenter's control. It is the variable that is observed and measured in response to the independent variable.
CONTROL GROUP	The group that does not get the experimental treatment, they provide an "untreated" basis of comparison for the experimental group. The control group should resemble that of the treatment group as closely as possible.

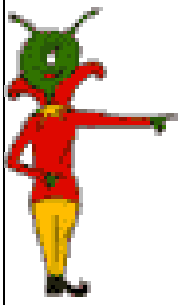
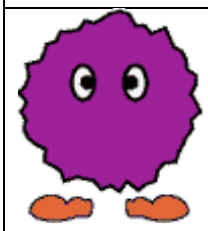
Now have a look at the following five experiments below – Can you help improve these experimental designs?



Robot Bunny thinks that his co-robots are likely to work harder on the production line if he gives them a special oil. To test this theory he decides on two groups of 20 workers each and gives Group A the special oil and Group B their normal oil. After two hours he counts how many items each group has produced. Group A has produced 1246 items and Group B has produced 1953 items.

http://www.plymouth.ac.uk/pages/view.asp?page=26267

1. How does Robot Bunny make this a fair test?
2. Identify the Independent variable. (The one being varied)
3. Identify the dependant variable. (The outcome)
4. What does the result show?
5. What should Robot Bunny's conclusion be?
6. How could this experiment be improved?

 Mrs Alien has noticed that when having a shower she leaves a covering of purple slime. She thinks using lemon juice will get rid of the slime and decides to check this out by spraying half the shower with lemon juice and the other half with water. After 4 days treating the shower in this way there doesn't appear to be any change in the amount of slime anywhere on the shower.	1. What was her initial observation? 2. What is her prediction? 3. Identify the Independent variable 4. Identify the dependant variable 5. What should Mrs Alien's conclusion be?
 Fuzzy was told that a certain itching powder was the newest best thing on the market, it even claims to cause 50% longer lasting itches. Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes.	1. Identify the Control group 2. Identify the Independent variable 3. Identify the dependent variable 4. What do your think about the sample size? 5. Explain whether the data supports the advertisements claims about its product.
 Mr Alien is working on a science project. His task is to answer the question: "Does Rogooti (which is a commercial hair product) affect the speed of hair growth". His family is willing to volunteer for the experiment.	1. Describe how Mr Alien could perform this experiment. Identify the control group, and the independent and dependent variables in your description. 2. Why is the outcome likely to be biased? Can you suggest ways to improve on this?
 A lady in the late 1920's insisted that tea tasted different depending upon whether the tea was poured into the milk or whether the milk was poured into the tea. *Taken from Chapter 1 of 'The Lady Tasting Tea' author David Salsburg*	1. Design an experiment to test this statement. 2. State exactly what you will be testing. 3. What variables will you consider (eg, cup/mug, temperature of the cup/mug, temperature of the water when added to the cup/mug, tea bag/loose tea….)? 4. How will you make the test fair? 5. Who will do the test? 6. What sample size will you use?