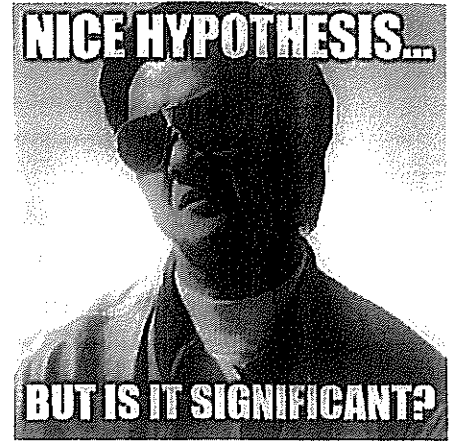


YEAR 11 INVESTIGATING

Make sure you have reviewed chapter 1+2 of the Nelson Textbook. Review the 'Investigating Overview' PowerPoint available to you on Moodle



General skills:

1. Writing a suitable hypothesis for the experiment
2. Writing a suitable aim for the experiment
3. Identifying Independent and dependent variables.
4. Identifying variables that were controlled and listing variables that need or could be controlled.
 - where you can – be descriptive. i.e.
 - i. amount (dosage) of the medication
 - ii. method used to administer medication (e.g. tablet? injection?)
 - iii. same gender? Or genders equally represented in the groups?
 - iv. Age range (it is very hard to do an experiment on a large group of people that are all the exact same age, so a suitable range e.g. 50-60 years could be more realistic)
 - v. Some others to think about (depending on the scenario):
 - previous medical history, severity of the disease, subjects on no other medications that may interfere, strict diet and exercise regimes, time of the day medication taken, time of day measurements taken etc.....
 - remember: if more than one group is involved in the experiment – then controlled variables need to be the same in all groups.
5. Identify the experimental group and control group
6. Define a 'placebo' and describe why placebos are used? What is the placebo effect?
7. Writing a detailed method
 - If required to write a method – once again be descriptive of how exactly the experiment will be carried out from start to finish, how are you controlling the variables.
8. Identifying the type of study: Longitudinal or case study?
9. Tabulating results:
 - Results tables need to have titles, labels, units of measurement.
 - If more than one trial, then make sure to include all trials and calculate averages.
10. Identify the type of data: is the data quantitative or qualitative?
11. Graphing results:
 - Firstly, every graph needs to have a title that is descriptive (it needs to describe exactly what is shown). For example; The effect of 'Drug A' compared to a placebo on body mass, as tested a period of four weeks
 - i. Include the independent variable (if a specific medication is used – include the name)
 - ii. Include the dependent variable (what is was measuring)
 - iii. If more than one group is involved, include these or if compared to a placebo
 - iv. If the experiment is conducted over a specific period of time – state the timeframe
 - Correct axes – these need to be labelled with the units of measurement
 - Use even scales. If you need to make a break in the graph, do so only at the start and clearly show that a break has been made
 - If more than one group or medication is involved and therefore plotted on the graph - use a key/legend to differentiate the groups. If you do not have different colours, use symbols.
 - Accurate plotting. If a line graph, connect the dots (use a ruler!). Also, only plot the data you have, you do not need to continue the line or trend if there is no data shown
12. Be able to interpret results from a graph (or table).
 - You may need to describe trends
 - You may need to use the data in the graph to make predictions
13. Use the results to draw conclusions

- Link it back to your hypothesis
- What results will support your hypothesis?
- What results will refute your hypothesis?
- Depending on the scenario you may need to use specific evidence/data to support your answers

14. Evaluate the experiment

- Comment on the validity
- Comment on the reliability
- In what ways could the validity be improved?
- In what ways could the reliability be improved?
- What are the different types of errors that occurred?

15. Blind studies:

- What is a blind study and what is the advantage?
- What is a double-blind study and what is the advantage?

16. Experimental Bias:

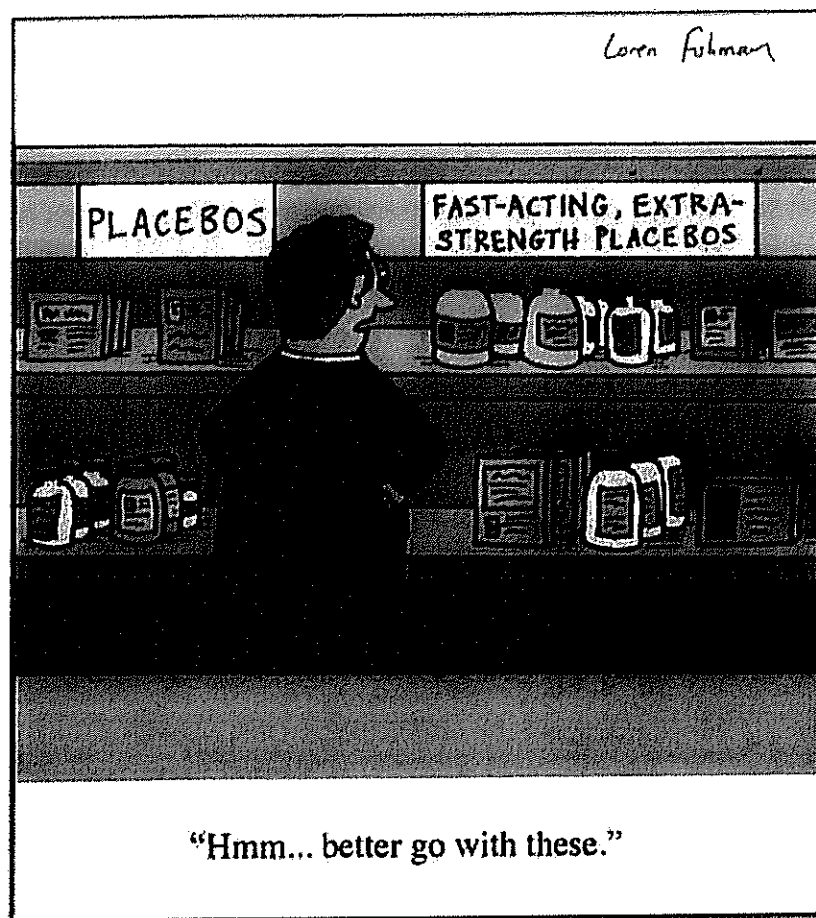
- What is experimental bias?
- How could an experimenter make the experiment bias?
- How could it be avoided?

17. Ethical Principles:

- What are ethical principles (or issues) that need to be considered when conducting experiments?

18. What is a clinical trial? Why are clinical trials undertaken?

Note: These are skills also required for Year 12 ATAR Human Biology



EXPERIMENTAL DESIGN

Marika set up an experiment to try to find out if human saliva would break down starch into sugar. She had two test tubes each containing 20mL of starch solution at pH 7. She kept both test tubes in a water bath at 37°C. To one test tube she added 5mL of saliva and to the other she added 5mL of distilled water. After 20 minutes she tested both tubes for starch and sugar.

1. What hypothesis was Marika testing?

_____ (1 mark)

2. List 4 variables that would need to be controlled

_____ (2 marks)

3. What is the independent variable?

_____ (1 mark)

4. What is the dependent variable?

_____ (1 mark)

5. What results would support her hypothesis?

6. Give one way of improving the design of this experiment.

_____ (1 mark)

7. Would the results have been the same if she used protein instead of starch? Explain.

_____ (1 mark)

8. How could she have tested for sugar?

_____ (1 mark)

Experimental Design and Analysis

The results of a recent study are presented below.

	Average pulse rates after		
	Light exercise	Moderate exercise	Vigorous exercise
Non smokers	93	119	141
Smokers	96	132	169

(All values are in heart-beats per minute)

1. What is a possible hypothesis for the above results?

_____ (1)

2. What was the independent (experimental) variable?

_____ (1)

3. What was the dependent (responding) variable?

_____ (1)

4. List four variables that must be controlled (kept the same) in the above study?

_____ (4)

5. Is the data provided quantitative or qualitative?

_____ (1)

6. The researcher used a total of 9 subjects for his study. comment on the validity of the study and how he may improve it.

_____ (2)

7. The researcher used High School students only as his experimental subjects. What is your opinion on this decision?

_____ (2)

8. Suppose that the results supported the researcher's hypothesis. What could the researcher do to further prove his point?

_____ (1)

9. Suppose that the researcher wanted to convince people that smoking does no harm to one's health. How could he bias the study?

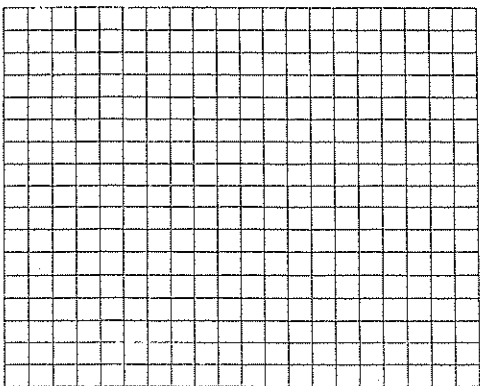
_____ (1)

Line graphs

Blood alcohol concentration (g/100mL)	Reaction time (ms)
0.04	250
0.06	265
0.08	312
0.09	364
0.10	422

The above data shows the average reaction times of a group of people after they had consumed various amounts of alcohol.

Plot the above data as a line graph.



Q2. What is the reaction time of a person who had a blood alcohol concentration of

(a) 0.07 g/100 mL (b) 0.11 g/100 mL breath.

Q3. Which of the two predictions in the previous question could be made most confidently? Explain.

Use this information to answer the following questions. Show all working.

(i) How many cells would fit across the field of vision of this microscope? [1]

(ii) What is the magnification of the drawing compared to the cells on the slide? [2]

15. [10 marks]

(2006/45)

A research report states that a group of 50 individuals who took 2 orange flavoured tablets containing 100 µg of vitamin C each at the first sign of a cold recovered more rapidly than did a different group of 50 individuals who took 2 orange flavoured tablets without vitamin C. The individuals were not told what their tablets contained.

(a) What is the hypothesis of this experiment? [1]

(b) What is the dependent variable and how would it have been measured? [2]

(c) What are three variables that are controlled in this experiment? [3]

- (d) What are two additional variables that should also be controlled in this experiment and explain why each should be controlled? [2]

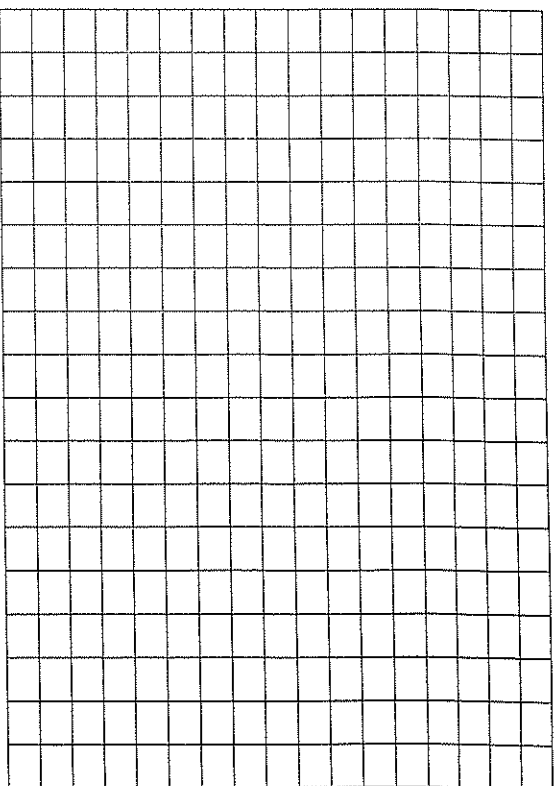
- (e) What is a placebo and what is its importance in the study above? [2]

16. [10 marks] (2008/45)

Researchers wanted to observe and record changes in urine volumes in response to drinking different solutions. One person volunteered to drink one litre (1 L) of distilled water that contained no salts. Another person volunteered to drink a saline solution that had the same salt concentration as the body fluids (0.96% salty). Urine volumes were collected every 30 minutes for both the volunteers, starting 30 minutes before they drank the solutions.

Time (minutes)	Urine Volumes (mL)	
	Person 1 0% salt solution	Person 2 0.96% salt solution
-30	55	50
0	40	35
30	345	55
60	410	90
90	205	45
120	60	95
150	85	105
180	60	95
210	45	55
240	55	45

- (a) Graph these results on the grid provided below. [5]



- (b) Why were recordings made prior to Person 1 and Person 2 drinking the solutions? [2]

- ~~(c) State one factor that is changed in the internal environment as a result of drinking 1 L of 0% salt solution. [1]~~

- ~~(d) At what time would the blood concentration of ADH be the lowest for Person 2? Explain your answer. [2]~~
