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Writing in the Sciences

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Scientific Writing

- Communicate scientific research to peers
- Scientific journals disseminate information
- Generally rigid in format and presentation
- Scrutinised and reviewed by scientific peers

Assessment – Scientific Report

Learn scientific skills:

- Conduct scientific research project
- Analyse data
- Report findings in accepted scientific journal structure
- Review peer articles in a critical manner
- Address peer review of your paper

Scientific Writing Style

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- **Third person**

  The number of individual Kalahari tree skinks were counted

or

- **First person**

  We counted the number of individual Kalahari tree skinks

- **Be consistent!!!**

Scientific Writing Style

- **Past tense**
  - We count**ed** the number of individual Kalahari tree skinks
  - The number of individual Kalahari tree skinks **were** counted

Scientific Writing Style

Use formal, scientifically precise language in technical reports. Avoid imprecise informal language.

Formal words		Informal words	
examine	√	look into	x
increased	√	got bigger	x
decreased	√	got smaller	x
obtained	√	got	x
improved	√	got better	x
many, a number of	√	lots of	x
a large amount (> X tonnes)	√	huge amount	x
conduct, carry out	√	do	x

Scientific Writing Style

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Be objective.

Limit your use of:

- emotionally loaded words (***wonderful, useless, lovely***)
- casual or ambiguous expressions (***the reaction carried on for 10 minutes***).

Do not use contractions (isn't, there's → is not, there is).

Do not use an informal writing style.

Scientific Report - Structure

1. **Title**
2. **Abstract**
3. **Introduction**
4. **Methods**
5. **Results**
6. **Discussion/Conclusion**
7. **References**

Title

- Concise and informative
- Short accurate description of the main point/emphasis of work
- Should reflect exactly what you did and not be vague
- Include any names of species studied – give common name followed by scientific name
- Only the first letter of the first word and proper nouns capitalised

Title

- The reader should be able to decide if the information in your report is relevant from your title

"Greenhouse experiment." – not sufficiently informative

"A simulation of the effects of carbon dioxide on atmospheric temperature and ocean acidity." ✓

Title

Short but **descriptive** title of what was investigated

common name

Differential osmoregulatory capabilities of common spiny mice (*Acomys cahirinus*) from adjacent microhabitats

species name in italics – sometimes in brackets (depends on the journal)

Abstract

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- Summary of whole paper – One concise paragraph

  (about 150-200 words or approximately 10% of the whole text)

- Highlighting
  - The main reason for the study
  - Methods employed
  - Principal results
  - Major conclusions

*Does not contain references

Abstract

- Gives the reader a quick overview of the whole report
- **Write the abstract last** – you will have a clearer picture of findings and conclusions

What they did

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Abstract

The osmoregulatory function of common spiny mice *Acomys cahirinus* living on opposite slopes of the lower Nahal Oren ('Evolution Canyon') on mount Carmel, Israel, was investigated by increasing the salinity of the water source whilst maintaining a high-protein diet. The southern-facing slope (SFS) of this canyon differs from the northern-facing slope (NFS) as it receives considerably more solar radiation and consequently forms a more xeric, sparsely vegetated habitat. During the summer, mice living on the two opposite slopes significantly differed in their urine osmolality, which also increased significantly as dietary salinity increased. Offspring of wild-captured mice, born in captivity, and examined during the winter, continued to show a difference in osmoregulatory function depending on the slope of origin. However, they differed from wild-captured mice, as they did not respond to the increase in dietary salinity by increasing the concentration of their urine, but rather by increasing the volume of urine produced. This study shows that *A. cahirinus* occupying different microhabitats may exhibit differences in their ability to concentrate urine and thus in their ability to withstand xeric conditions. We suggest that they may also differ genetically, as offspring from the NFS and SFS retain physiological differences, but further studies will be needed to confirm this hypothesis.

Key words: ecophysiology, evolution, kidney, rodents, seasonality, *Acomys cahirinus*

Why we should pay attention

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Abstract

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Results – even if unexpected or not significant

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Abstract

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Key conclusions and recommendations – future considerations can be included

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Key words: ecophysiology, evolution, kidney, rodents, seasonality, *Acomys cahirinus*

An estimation of the number of cells in the human body

Eva Bianconi[1], Allison Piovesan[1], Federica Facchin[1], Alina Beraudi[2], Raffaella Casadei[3], Flavia Frabetti[1], Lorenza Vitale[1], Maria Chiara Pelleri[1], Simone Tassani[4], Francesco Piva[5], Soledad Perez-Amodio[6], Pierluigi Strippoli[1], and Silvia Canaider[1]

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Abstract

Background: All living organisms are made of individual and identifiable cells, whose number, together with their size and type, ultimately defines the structure and functions of an organism. While the total cell number of lower organisms is often known, it has not yet been defined in higher organisms. In particular, the reported total cell number of a human being ranges between 10^{12} and 10^{16} and it is widely mentioned without a proper reference.

Aim: To study and discuss the theoretical issue of the total number of cells that compose the standard human adult organism.

Subjects and methods: A systematic calculation of the total cell number of the whole human body and of the single organs was carried out using bibliographical and/or mathematical approaches.

Results: A current estimation of human total cell number calculated for a variety of organs and cell types is presented. These partial data correspond to a total number of 3.72×10^{13}.

Conclusions: Knowing the total cell number of the human body as well as of individual organs is important from a cultural, biological, medical and comparative modelling point of view. The presented cell count could be a starting point for a common effort to complete the total calculation.

Emerging infectious disease and the loss of biodiversity in a Neotropical amphibian community

Karen R. Lips[*,†], Forrest Brem[*], Roberto Brenes[*], John D. Reeve[*], Ross A. Alford[‡], Jamie Voyles[§], Cynthia Carey[§], Lauren Livo[§], Allan P. Pessier[¶], and James P. Collins[||]

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Pathogens rarely cause extinctions of host species, and there are few examples of a pathogen changing species richness and diversity of an ecological community by causing local extinctions across a wide range of species. We report the link between the rapid appearance of a pathogenic chytrid fungus *Batrachochytrium dendrobatidis* in an amphibian community at El Copé, Panama, and subsequent mass mortality and loss of amphibian biodiversity across eight families of frogs and salamanders. We describe an outbreak of chytridiomycosis in Panama and argue that this infectious disease has played an important role in amphibian population declines. The high virulence and large number of potential hosts of this emerging infectious disease threaten global amphibian diversity.

Background & why

Results

Discussion

Conclusion

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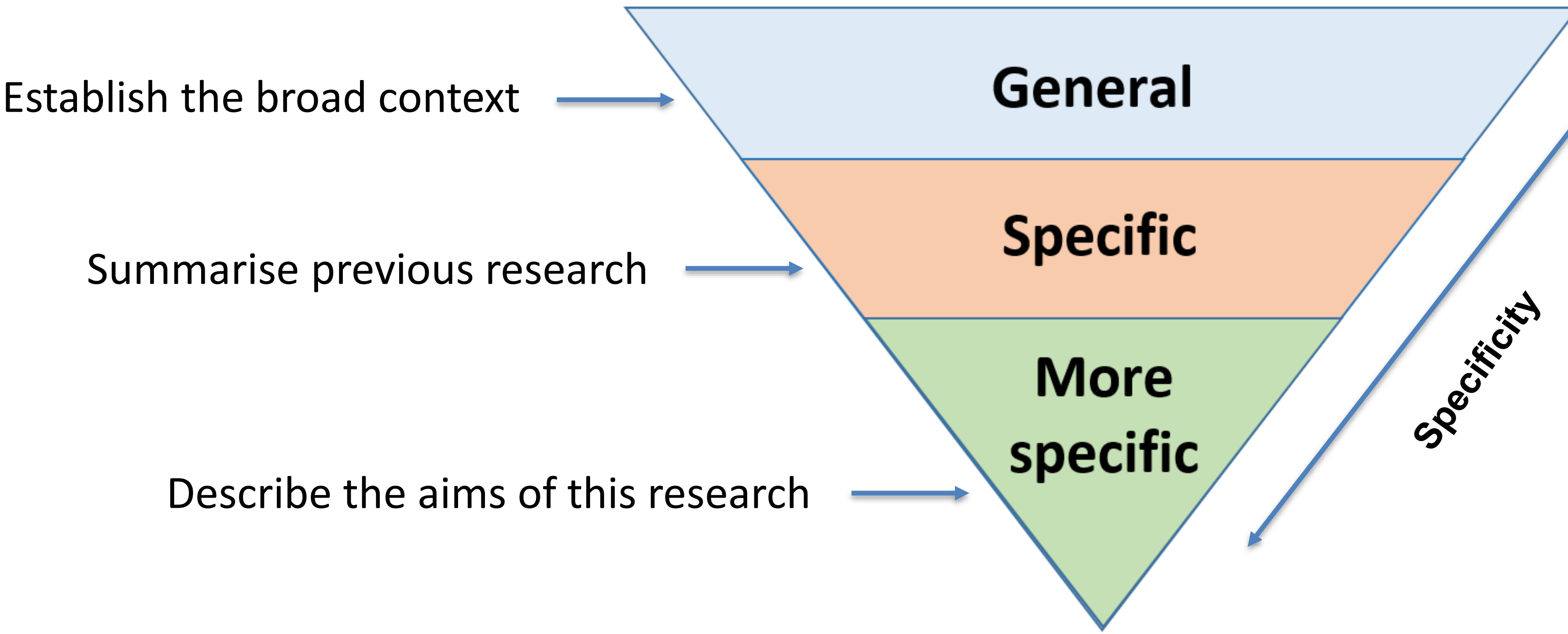
Introduction

- Provides scientific background information
- Establishes rationale for study
- Summarises relevant scientific literature – references (in text citations)
- States objectives, aims, hypotheses and predictions

Introduction



Methods

- Describe what you did so that a colleague/scientist can exactly replicate your experiments
- Not a lab manual
- Past tense
- Don’t list – describe in sentences and paragraphs

- Statistical methods used/programs
- Specialised equipment
- Modifications to any procedures

Methods

Bad examples

- Take 2 clear plastic bottles and fill with water

Don't tell the reader what to do, rather tell them what you did

- Collect 2 clear 2L bottles
- Fill 1 with tap water
- Fill 2nd with carbonated water

Don't list, describe in sentence and paragraph

Better examples

- "Two plastic bottles were filled using a beaker and funnel, to the same level. One bottle was filled with carbonated water and the other with non-carbonated tap water."

- "Two plastic bottles were filled with either carbonated (CO_2) or plain water using a beaker and funnel, to the same level."

Results

- Present the facts – what you discovered during your experiments (in order of importance/relevance)
- Clear and concise written description of your findings first – refer to figures and tables in text
- Detailed data – tables, graphs, figures etc.
- Raw data??

Results

- **Don’t discuss the results**

  – present the facts you discovered only

  - You will interpret them in the next section → Discussion

Tables

- Numbered in the order in which they appear
- Caption directly above table – full description of the data that appears in the table
- Each column and row labelled appropriately

Tables

Table 2. Coefficients (± standard deviation) of each factor (Model 16) influencing a focal individual's proportion of time spent in vigilance

Distance to cover was categorised into five classes (0–50; 51–100; 101–150; 151–200; ≥201 m) and distance to nearest conspecific into two classes (0–70; ≥71 m). In the model, reference points of 0–50 m (distance to cover) and 0–70 m (distance to the nearest conspecific) were used

Factors	Coefficient	s.d.
Intercept	0.115	0.029
Distance to conspecific		
≥71 m	−0.069	0.030
Distance to cover		
51–100	0.033	0.043
101–150	−0.079	0.036
151–200	−0.080	0.039
>200 m	−0.082	0.043

Figures

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- Numbered in the order in which they appear
- Caption directly below figure – full description of the data that appears in the graph/diagram
- Captions **must** contain enough information that they can be **read and understood** without referring to the text.

Keep It Simple

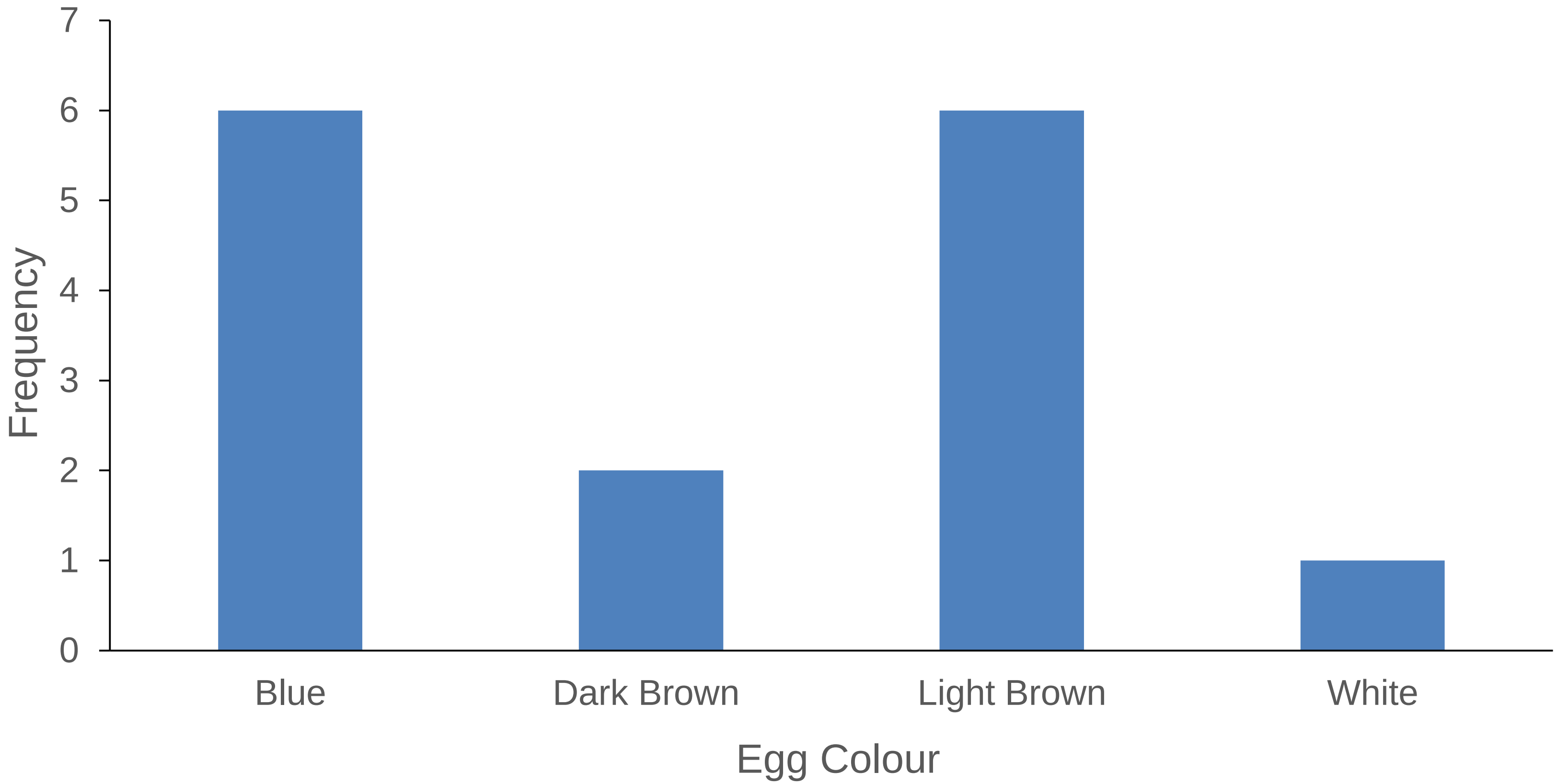
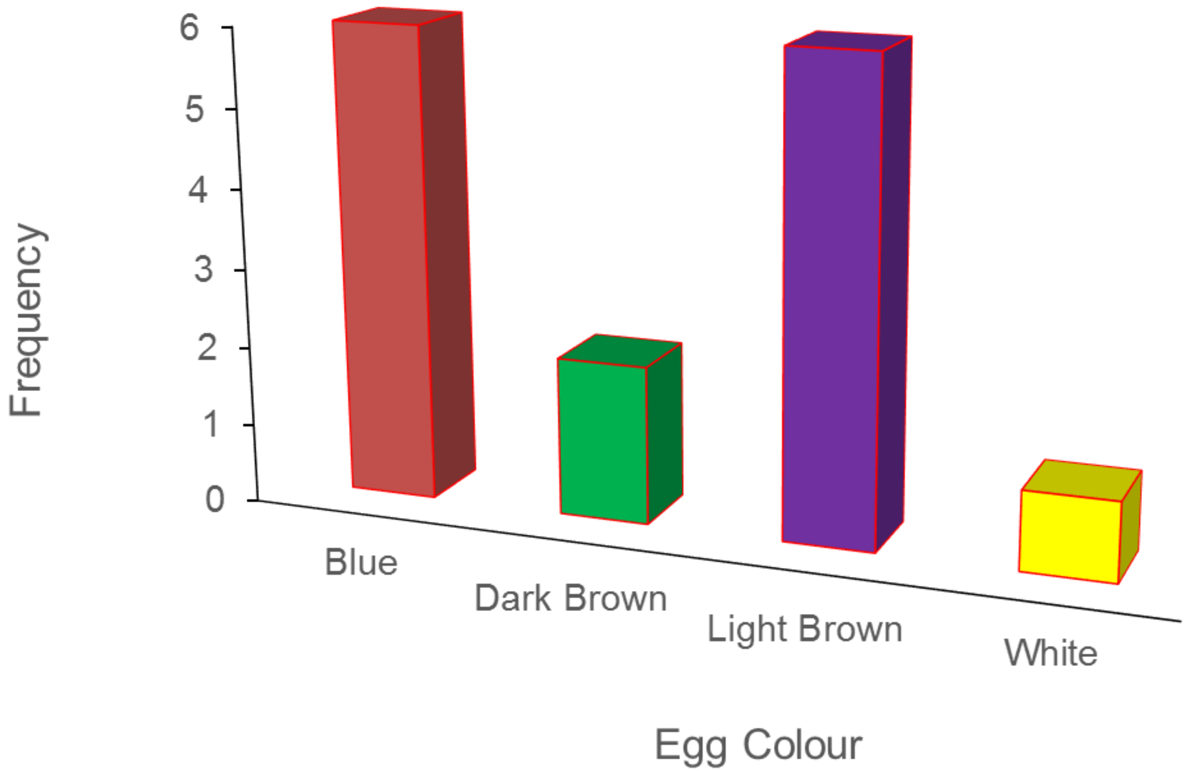


Figure 15. The colour of eggs laid during a two day period in October

Is better than.........

Keep It Simple



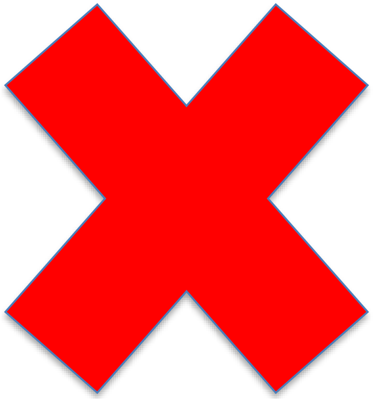


Figure 16. The colour of eggs laid during a two day period in October

The simplest representation is best

Graphing Results

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- The **Independent Variable** always goes on the **horizontal axis** (known as the 'x axis')

- The **Dependent Variable** always goes on the **vertical axis** (known as the 'y axis')

Which is Which?

I want to graph TIME SPENT STUDYING vs STUDENT GRADES.

Which variable is dependent?

Graphing Results

- The **Independent Variable** always goes on the **horizontal axis** (known as the ‘x axis’)

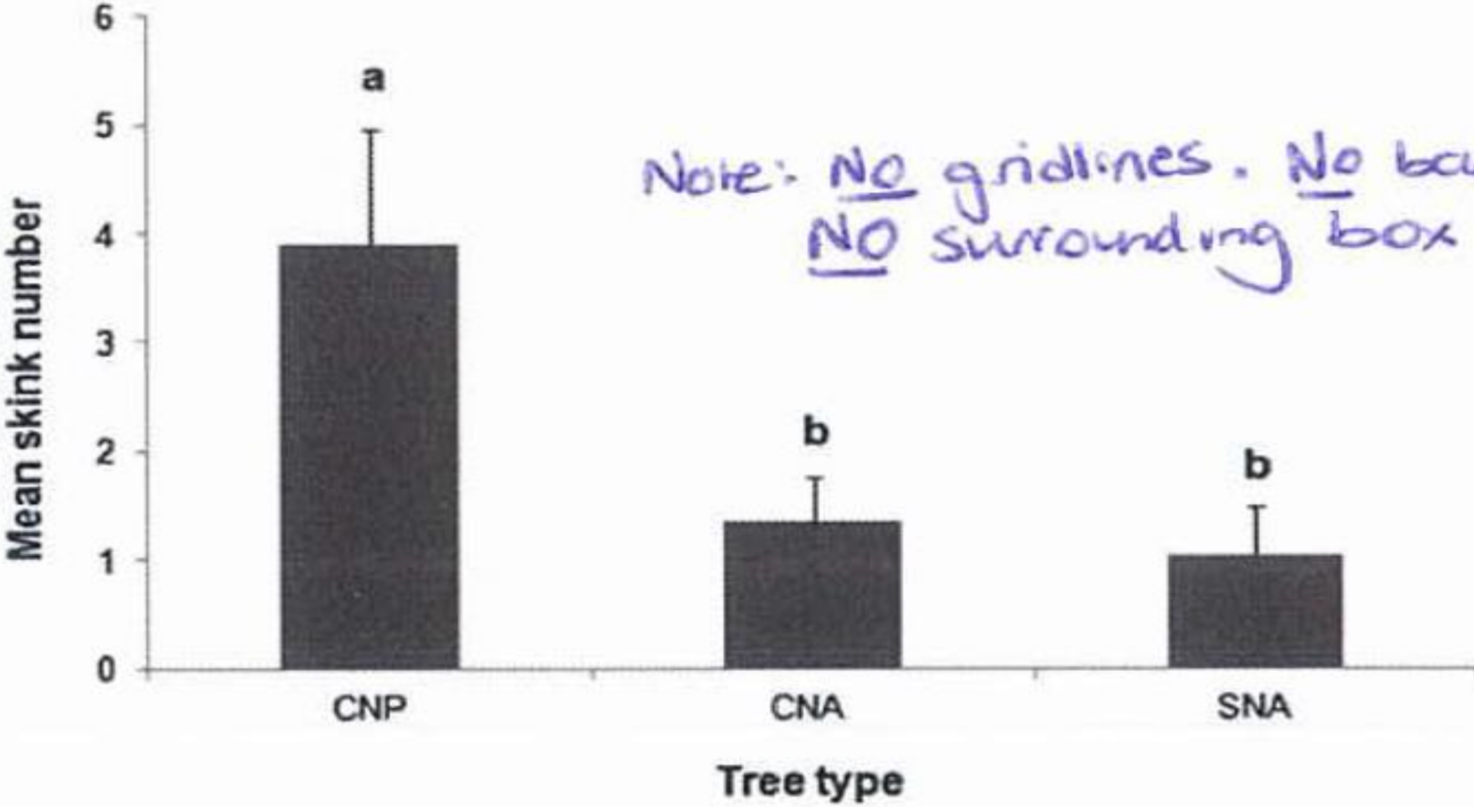
- The **Dependent Variable** always goes on the **vertical axis** (known as the ‘y axis’)

Which is Which?

I want to graph **TIME SPENT STUDYING** vs **STUDENT GRADES.**

STUDENT GRADES DEPEND on **TIME SPENT STUDYING**

The scale should be appropriate to the figure.



Note: No gridlines. No background. No surrounding box

Both axes must be labelled.

Fig. 2. Mean + 95% confidence interval of skink number on each of three tree types. CNP = camel thorn trees with sociable weaver nests, CNA = camel thorn trees without sociable weaver nests, SNA = shepherd's trees without sociable weaver nests. *Post hoc* comparisons were assessed using beta estimates and predicted means plots (not presented) and bars with different letters indicate significant differences.

For figures, captions always go below the figure.

Graphing Using Excel

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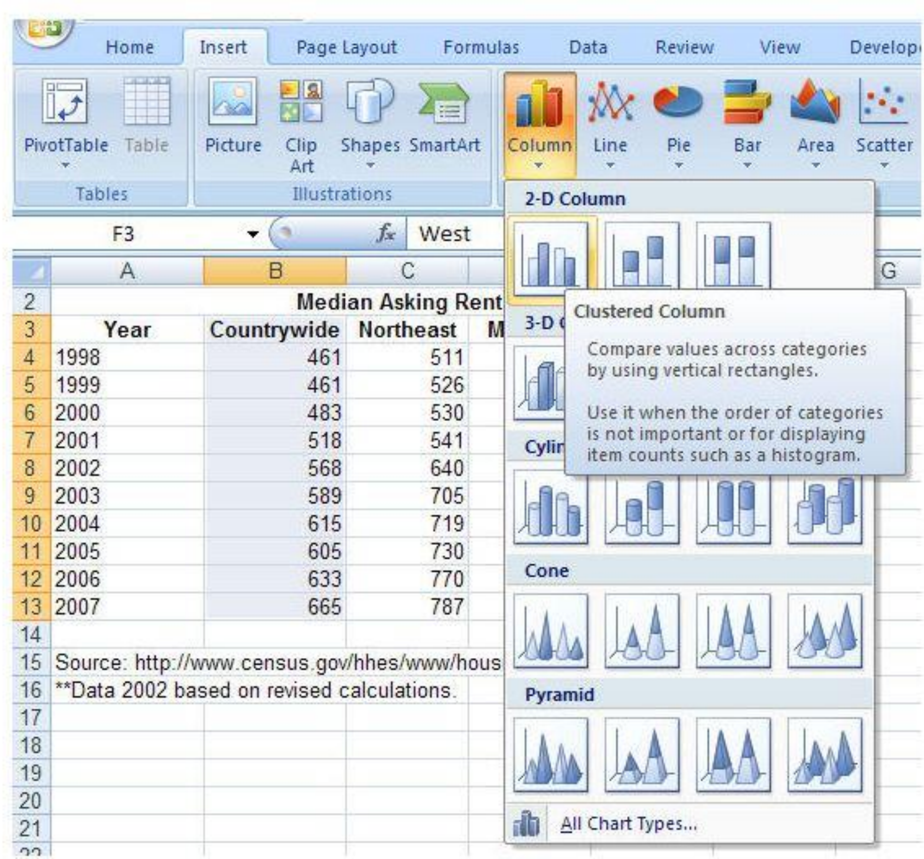
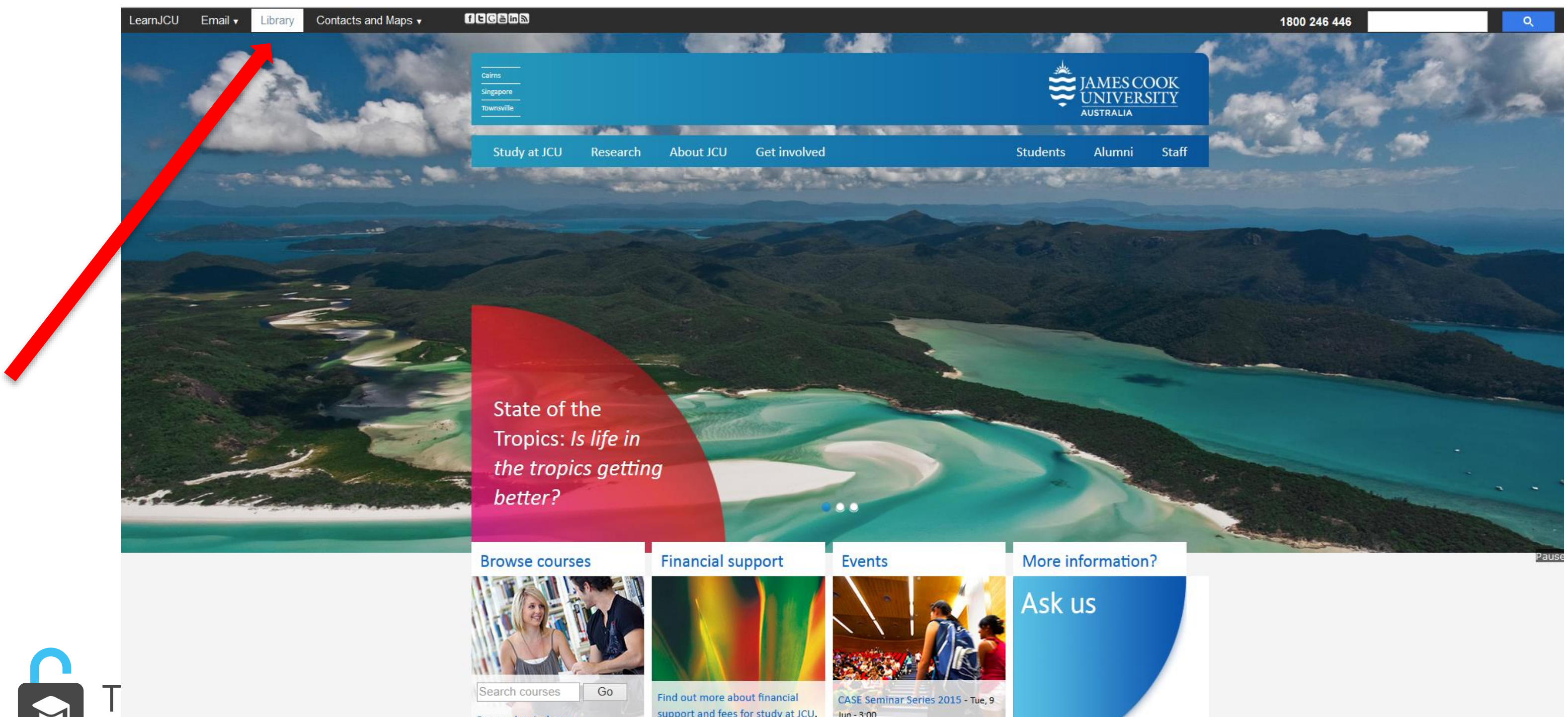
- Excel is a good data management tool
- With some practise, you ca produce and edit graphs quickly in Excel
- Search the internet and YouTube for videos and tutorials about creating graphs in Excel



Lynda.com

- You can find and access courses to help with your study through Lynda.com

1) Go to website www.jcu.edu.au
2) Click on "Library"



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Discussion

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- Interpret and explain your findings
- How do your results compare to previous knowledge in the field?
- Where do your results 'fit' in relationship to the hypothesis?
- You need to explain your results – hypothesis accepted or rejected? Why?
- Were there any unexpected results?
- Improvement in your experiments – usually methodology
- Do your results have any implication for future experiments?

Discussion

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- 1. Did you achieve your aim?
- 2. Did you accept or reject your hypotheses?
- 3. Explain and interpret the results: **Why** do you think you found what you did? **How** does this relate to the questions, problems or hypotheses presented in the introduction?
- 4. Compare your results with the literature: Can your results be placed in the context of the material presented in your textbook, other published work (journal articles) and with other class results? Is there a pattern and can you make any generalisations? If your results were different, why do you think this was so? Can you provide a justification for your investigation?

Introduced Predators Transform Subarctic Islands from Grassland to Tundra

D. A. Croll,[1*] J. L. Maron,[2] J. A. Estes,[1,3] E. M. Danner,[1] G. V. Byrd[4]

In total, our results show that the introduction of foxes to the Aleutian archipelago transformed the islands from grassland to maritime tundra. Fox predation reduced seabird abundance and distribution, in turn reducing nutrient transport from sea to land. The more nutrient-impoverished ecosystem that resulted favored less productive forbs and shrubs over more productive grasses and sedges.

These findings have several broad implications. First, they show that strong direct effects of introduced predators on their native prey can ultimately have dramatic indirect effects on entire ecosystems and that these effects may occur over large areas…

Organising your writing

- Be Clear
- Be Direct
- State information in as simple a way as possible

One of the really bad things you can do to your writing is to dress up the vocabulary, looking for long words because you're maybe a little bit ashamed of the short ones. This is like dressing up a pet in evening clothes.

Stephen King

The results of this randomised, double-blind, placebo controlled trial demonstrated that this drug is effective for the treatment of seizures in children and adults. This is the first study to demonstrate a statistically significant effect of this drug compared with a placebo in patients with seizures.

- The results of this randomised, double-blind, placebo controlled trial demonstrated that this drug is effective for the treatment of seizures in children and adults. This is the first study to demonstrate a statistically significant effect of this drug compared with a placebo in patients with seizures.

- This is the first time that this drug has been shown to be effective for the treatment of seizures.

Conclusion

- Many scientific reports include a conclusions section

- Check if required for your subject – can be incorporated into discussion

References

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- In text citations – introduction and discussion
- Reference list at the end of report
- Check referencing style for your subject

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Checklist for completed (or so you might think!) reports

	Yes	No
1. Is my title both concise and informative?		
2. Is my abstract concise?		
3. Does the abstract contain all the relevant information that will allow it to be read and understood on its own?		
4. Does my introduction convince the reader that this is an interesting question to be asking?		
5. Does the introduction explain or define all the important terms?		
6. Have I cited other studies to support my ideas (i.e. referred to other studies using the author name and date) in the introduction?		
7. Have I included a section near the end of the introduction that clearly sets out the aim of this particular study, including any hypotheses that are being tested and my predictions?		
8. Have I written in the first person?		
9. Could somebody else repeat the experiment and get similar results using the description of the methods that I have written?		
10. Are the methods written in the past tense?		
11. If relevant, do my methods include a description of the study site and the date of the study? (Note: details of how class was split up or how we got to a site are unimportant)		
12. Have I written out what I found in my results section (probably two or three paragraphs in a 1000 word report)?		
13. Have I referred to all my tables and figures when appropriate, highlighting which data are of most interest, and pointing out the trends etc.?		
14. Are the results written in the past tense?		
15. Does every table and figure have a title and a caption, and are all columns, rows and axes labelled and have units? (Note that all tables are called tables, but all drawings, diagrams, maps, graphs, histograms etc. are called figures.)		
16. Have I presented any data more than once (e.g. raw data in a table and then drawn as a histogram)? If 'Yes' then leave out the table!!		
17. In the discussion, have I explained the importance of all the results and their relevance to the points raised in the introduction?		
18. Have I presented any new data in the discussion (i.e. that are not given in the results section)? If 'Yes' then put them in the results!!		
19. In the discussion, have I cited other studies to support my arguments?		
20. Have I waffled? If 'Yes' then fix it!!		
21. Have I listed all the references that have been cited in the main text of the report in the reference list?		
22. Have I listed any references that have not been cited? If so, remove them!		
23. Have I given the names of all the authors for each reference, and their initials (do not include first names)?		
24. Is the format of the references consistent?		
25. Are the references listed in alphabetical order?		
26. If I have appendices, are they really necessary? If 'No' then leave them out!!		

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