Why Write?

Because...

If you haven't written it, you haven't done it.

“The writer wishes to make a a request in respect of an obstruction on the border or the thoroughfare in front of the writer’s residence. The said obstruction —*viz*. a large tree— impairs the vision of vehicles from the said thoroughfare in relation to entry and egress from the writer’s residence. I hereby request that the council take steps to remove the said obstacle at the first available opportunity.”

“I can’t see the traffic when I back out of my garage because of a tree in the street in front of my house. Would you please remove the tree as soon as you can?”

An example of sustained jargon.

This is the complete description of a job advertised by the Department of Agriculture, Forests and Fisheries in February 1999.

"The project is a joint initiative of AFFA and the Rural Industries Research and Development Corporation. The project will involved:

- *undertaking a needs analysis within the organisation(s) to determine and prioritisie the issues to be addressed;*
- *identifying and developing appropriate organisation change strategies;*
- *undertaking "action research" to guide organisational change processes within an organisation(s), including through both implementation and integration phases; and*
- *preparing a report on the outcomes of the case study activity.*"

Basic rules about getting started

- Never start to write anything before you work out how it should end.
- Reduce the work in front of you to a size that you can handle
- Write in the style that you would use in a conversation with a friend.....fix it later.
- Get something—anything—down and build up your confidence.....fix it later

The Hallmarks of Scientific Writing

- Precision
- Clarity
- Brevity

The two elements of successful scientific writing

- Structure
- Style

Structure

- Physical
- Logical

Physical Structure

- Title
- Summary
- Introduction
- Materials and Methods
- Results
- Discussion
- Acknowledgments
- References

Logical Structure

- Title
- Summary
- Introduction
- Materials and Methods
- Results
- Discussion
- Acknowledgments
- References

Tense in Scientific Writing

- Simple past tense for everything that has happened in the past. ie at least 90% of what you write
- Present tense for principles and “housekeeping”. ie the rest

The Title

- The most read part of your article (by about 100x)
- It should contain all of the key words
- It should hint at the main results, or conclusions, or both

Summary

- Why? (your hypothesis)
- How? (Brief Methods—not Materials)
- *Main* Results(Category 1 items only)
- *Main* Discussion points (Category 1 items only)

The introduction

- It must contain two elements.....
  - The hypothesis preceded by...
  - The reason(s) why the hypothesis was the most sensible statement of the phenomenon that you were testing—when you began the experiment
- .... and nothing else

Q. What is so important about the hypothesis?

A. If there is no hypothesis—there is no structure

Q. Why is the Introduction the most important part of the scientific article?

A. Because it contains the hypothesis

Why is it so important?

- You have to know the available information before you can propose one.
- You create reader expectation. (readers know what they are looking for in the rest of the article)
- Whether you eventually accept or reject it you are on a winner

The characteristics of an hypothesis

- It must fit all of the known information.
- It must be testable

Results

- Sort out what's important and give it prominence.
- Sort out what's unimportant and throw it out or bury it.
- Tables (or graphs) and text should both "stand alone".
- Use tables to be precise.
- Use text to be clear.

How do I know what result is important?

- Either...
- 1. It allows me to say something substantial about the hypothesis,
- 2. It allows me to say something that is relevant but less convincing about the hypothesis,
- 3. It allows me to say something substantial but not about the hypothesis or
- 4. It is not convincing and not about the hypothesis.

Incorporating Statistics into text in *Results*

- Statistical analysis revealed that there was a significant difference ($F=7.83$, $df=3$; $p<0.01$) between the treatments (Table 6)— or…
- Table 6 shows that treatment A was about 50% more effective in growing leaves than the other three treatments ($p<0.01$)

Working with tables and text

Table:

Table 6: Production of leaves in plants treated with four forms of nitrogen fertilizer

Form of fertilizer	A	B	C	D
Yield of leaves per pot (gm	72.6^{a}	33.7^{b}	36.8^{b}	35.1^{b}

*Numbers with different superscripts are significantly different (P<0.01)

Text:

Table 6 shows that fertilizer A was about 50% more effective in growing leaves than the other three fertilizers ($p<0.01$)

Discussion

- Sort out what’s important and give it prominence.
- Sort out what’s unimportant and throw it out or bury it.
- Use paragraphs for each complete argument in the the discussion.
- Use the best first!

Priorities for Arguments

1st order arguments:
Relevant to the original hypothesis and allow you to make a positive statement of acceptance or rejection.

2nd order arguments:
Relevant to the original hypothesis but are equivocal or may need further experimentation or clarification before acceptance or rejection.

3rd order arguments:
Not relevant to the original hypothesis but sufficiently new or interesting to warrant discussing

4th order arguments:
Not relevant to the hypothesis and of marginal interest.

Constructing paragraphs—the three components

- The topic sentence: *what the paragraph is about.*
- The development: *a series of logical sentences giving the information.*
- The conclusion: *a summary sentence punching home the message.*

- A large vehicle fleet operator mileage restriction has now been made imperative

- Precipitation-weighted average leaf-to-air vapour pressure deficit during the growing season

- Modern chemical effluent odour suppression compounds often Lead to difficult piglet birth problems

The maximum net returns above feed cost ration

The lower temperature without catalyst treatment

A separate previously ethics committee-approved DNA sample registry informed consent form

Thus, although we were forced by the dry season and the lack of early growth in many of the plants to take less samples than normal and there were too few plots to show all of the interactions which we sought, under the conditions of the experiment, there was an additive effect of copper and zinc.

- Weights [noun] of the animals were taken.
- Low temperatures caused a reduction [noun] in the rate of the reaction.
- Recordings [noun] of pulse rates were made.
- Temperatures [noun] showed and increase during the day.

Increases in ambient temperature resulted in a deterioration of the pasture, particularly where the fertilisation of the paddock was carried out after the commencement of the growing season.

28 words

When ambient temperature increased the pasture deteriorated particularly where the paddock was fertilised after the growing season had commenced.

19 words

- It is not uncommon..
- It is unlikely that it won’t work.
- It is not unreasonably inefficient

10 Problems
7 Compound prepositions.

As to whether.....

In respect of.....

In regard to....

As far as the plants are concerned....

A { considerable / marked / substantial / significant / rather large } number of subjects responded to treatment

Etcetera

Patients were observed by two people for signs of abnormal behaviour.

It is believed that, in this case, chemical analysis is better than bio-assay.

Infringements will be incurred for not displaying a valid permit

FSH and LH were measured by RIA and E2 was extracted with RTC, purified by TL□C and measured by CPB

Reader expectation

“Put in the topic position the old information that links backwards; put in the stress position the new information that you want the reader to emphasise”

Gopen, George D. and Swan, Judith A. (1990)*The Science of Scientific Writing*, American Scientist, **78**; 550-558.

Principles of reporting data

The average litter size in six piggeries

1. A simple description in text form

The litter sizes were 9.67, 8.35, 10.87, 7.06, 9.38, and 9.72 for the piggeries of Smith, Jones, Brown, White, Redman and Black, respectively

2. An improved version would be to put the number and the owner of the piggery side-by-side.

The litter sizes for the respective piggeries were: Smith, 9.67: Jones, 8.35; Brown, 10.87; White, 7.06; Redman, 9.38; and Black, 9.72.

3. A table may be better than text in this instance

Smith	Jones	Brown	White	Redman	Black
9.67	8.35	10.87	7.06	9.38	9.72

4. But can we make the table clearer by altering the axes?

Smith	9.67
Jones	8.35
Brown	10.87
White	7.06
Redman	9.38
Black	9.72

5. Now let us put in some order—sort the farmers alphabetically

Black	9.72
Brown	10.87
Jones	8.35
Redman	9.38
Smith	9.67
White	7.06

6. It makes more sense to sort the numbers—why?

Brown	10.87
Black	9.72
Smith	9.67
Redman	9.38
Jones	8.35
White	7.06

7. Do we need this level of precision?

Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1

8. Have we provided enough information?—would a mean help?

Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1
Average	9.2

9. Let us make the table visually helpful.

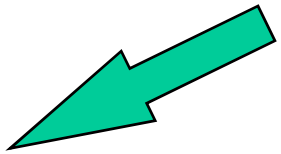
Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1
Average	**9.2**

Align the decimals

Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1
Average	**9.2**

Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1
Average	**9.2**

Separate the body of the material from the summarising information



Brown	10.9
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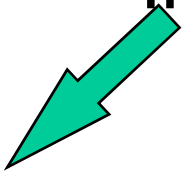
Average	**9.2**



Highlight the summarising information

10. Is the table self supporting?— It needs a title.

Table X. Mean litter sizes in 6 piggeries in the Snake Gully region in 1997.

Brown	10.9
Black	9.7
Smith	9.7
Redman	9.4
Jones	8.4
White	7.1
Average	**9.2**

10. Have we improved the presentation?

The litter sizes were 9.67, 8.35, 10.87, 7.06, 9.38, and 9.72 for the piggeries of Smith, Jones, Brown, White, Redman and Black, respectively

What are the principles?

• Numbers are easier to read when they are in tables than when they are in text.
• Numbers are easier to read in columns than when they are in rows.
•Tables should be arranged to demonstrate the patterns of numbers—descending, ascending, contrasts or similarities.
• Averages can help in demonstrating patterns—they are generally better than totals

(cont.....)

What are the principles? (cont.)

- Numbers should be rounded to the highest sensible level—preferably to 2 significant digits
- Tables should be self supporting—their heading should explain them.
- Think of tables as graphs made out of numbers.
- If you do, you may find that you don’t need graphs!

That’s the table of Results—what about the text?

The Principles

- Both tables and text must be self-supporting
- But don’t repeat yourself.
- Precision , Clarity, Brevity.
- Use the text to support the table and vice-versa

Options:

We could repeat the original text:

The litter sizes were 9.67, 8.35, 10.87, 7.06, 9.38, and 9.72 for the piggeries of Smith, Jones, Brown, White, Redman and Black, respectively

Not only is it almost impossible to read, it is repeating the figures already given in the Table

Options:

We could draw attention to the main features of the table:

Piggeries in the Snake Gully region averaged 9.2 piglets per litter (Table X) but varied widely from just over 7 to almost 11 in the best piggery.

Some of this text would be considered to be vague if it were not accompanied by the exact information in the table

Now let’s apply these principles to something a bit more complex

Table X: Yearly production (in '000 tons) of saw-logs from 7 forest leases

Lease	Year				
	1990	1991	1992	1993	1994
Cedar Junction	137.63	129.17	149.38	117.21	183.40
Dead Dog Hill	29.70	30.79	33.53	27.41	34.64
Heartbreak Hill	16.54	19.38	19.88	16.59	21.62
Millstream	142.63	137.60	171.79	162.40	194.26
Paradise	206.48	274.56	275.98	213.78	303.35
Queen's Ridge	47.32	51.83	53.73	49.10	60.23
Rapids Falls	63.54	77.82	81.76	54.20	89.49

How can we develop the patterns of numbers?

- Make the numbers simpler to read.
  - round to a sensible size
  - include sensible reference points.
    - totals? means?
- Look for logical sequences.
  - the mills
  - the years
  - the numbers themselves

Lease	1990	1991	1992	1993	1994	Average
Paradise	210	280	280	210	300	260
Millstream	140	140	170	160	190	160
Cedar Junction	140	130	140	120	180	140
Rapids Falls	64	78	82	54	89	73
Queen's Ridge	47	52	54	49	60	52
Dead Dog Hill	30	31	34	27	35	31
Heartbreak Hill	17	19	20	17	22	19
Average	92	100	110	91	130	110

- Is there a pattern within the pattern?
- If so how can we show it?

Table Z. Yearly production (in ‘000 tons) of saw-logs from 7 forest leases in Dry Gulch County

Lease	1990	1991	1992	1993	1994	Average
Paradise	210	280	280	210	300	260
Millstream	140	140	170	160	190	160
Cedar Junction	140	130	140	120	180	140
Rapids Falls	64	78	82	54	89	73
Queen's Ridge	47	52	54	49	60	52
Dead Dog Hill	30	31	34	27	35	31
Heartbreak Hill	17	19	20	17	22	19
Average	92	100	110	91	130	**110**