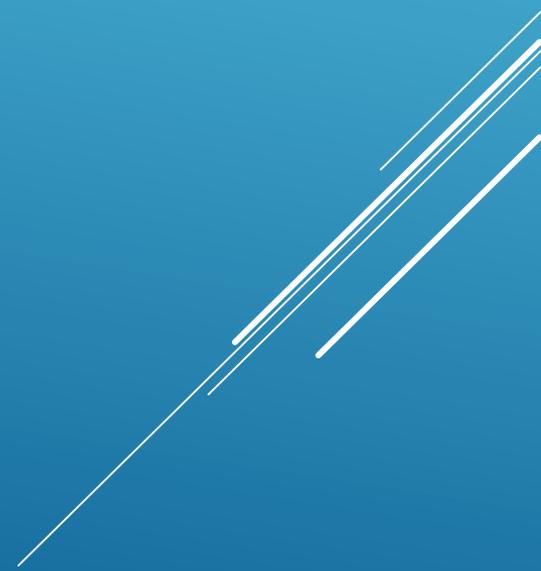


# ELEMENTS OF SCIENTIFIC AND TECHNICAL WRITING

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# Outline

- ❖ Introduction to Technical (Scientific) Writing
  - ❖ Writing Exercises
  - ❖ Essence of Writing: Clarity, Purpose, Organization & Language
  - ❖ Writing Exercises
  - ❖ Final thoughts ...
- 

# Introduction to Technical (Scientific) Writing

## General Comments

- Writing ability is highly correlated to successful career
- Improved reading is directly linked to better writing
- Distinction of writing purpose/audience is critical – memo, diary, creative, essay, report, manuscript, etc.
- Written versus spoken language

## Scientific Writing

- Technical writing is a method, skill and practice
- Communication of your research is a responsibility
- Literature review is critical – where do you fit?
- Good (no) data, tables and figures are essential
- Format/audience of scientific writing is established

# Structure of Journal Articles & Manuscripts

**Title** – states/implies major finding

**Abstract** – informative, screening device, keywords

**Introduction** – scope/background, problem, purpose

**Materials & Methods** – procedure, mechanics, analytics

**Results** – data, findings, statistics

**Discussion** – implications, relationships, advancement

**Acknowledgments** – funding, gratitude, incentive

**References** – bibliography, validation, thorough



# Structure of Journal Articles & Manuscripts

## Title

- states/implies major finding
- short and succinct
- refrain use of technical terms

## Abstract

- informative, screening device, keywords
- stand-alone text (includes all sections)
- preview of main points (so what?)

## Introduction

- scope/background, problem, purpose
- establish the field/context
- previous research and literature review
- indicate gaps, remaining questions
- extend findings and suggest hypothesis
- clear purpose and goals; research action!

# Structure of Journal Articles & Manuscripts

## Materials & Methods

- procedure, mechanics, analytics
- validation of the results
- repeatability and verification
- exact materials and conditions
- special conditions and criteria

## Results

- data, findings, statistics
  - major generalizations of data
  - data that supports argument
  - validity of the data
  - never imply the meaning of the data!
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted diagonally from the bottom right towards the top right, located in the lower right quadrant of the slide.

# Structure of Journal Articles & Manuscripts

- Discussion**
- implications, relationships, advancement
  - implications of results (data)
  - relates data to context of field (intro)
  - importance of results; hypothesis?
  - advancement of field; new hypothesis
  - make argument; never opinion

## Acknowledgments

- funding, gratitude, incentive
- project names and numbers
- authors should not be included
- authors make “intellectual contribution”

- References**
- informative, validation, thorough
  - use references from submitting journal

# Exercise #1

Identify which statements belong to manuscript sections (Intro., M&M, Results, Discussion), and explain why.

1. *Data results suggest DVM is dependent on K*
2. *OD was measured using a scanning spectrophotometer*
3. *Variability of UVR correlated with DOM concentration*
4. *10 ml of 90% acetone was used to extract chlorophyll*
5. *Depth contours showed increase in sea surface T*
6. *Experiment showed X, Y, Z, were 1, 2, 3, respectively*
7. *Sunlight is important for biogeochemical processes*
8. *Studies have shown increased PP in upwelling areas*
9. *Purpose of this study is to identify X under Y conditions*
10. *Increase in Y implies X will nominally decrease*
11. *Bacteria contribute significantly to chemical cycles*

# Essence of Writing: Clarity, Purpose, Organization & Language

Each word, sentence, paragraph has a clear and focused purpose – be concise! Remember ...

- Stick to structure and design – consistency
- A paragraph is the fundamental unit of composition
- Use active voice and positive form
- Use definitive and specific language
- Omit needless words
- Avoid succession of loose sentences – rhythm
- Keep related words together
- Keep one tense – attention to tense in general!

# Essence of Writing: Clarity, Purpose, Organization & Language

- **Stick to structure and design (organization)**

  - Follow the manuscript style

  - Be deliberate throughout

  - Shape your thoughts

- **A paragraph is the fundamental unit of composition**

  - Topics are divided into paragraphs

  - Start with a topic sentence, or statement

  - Follow with specifics, focus or support

  - End with summary, conclusion or transition

# Essence of Writing: Clarity, Purpose, Organization & Language

- **Use active voice (not passive)**

More direct and vigorous – concise!

Shorter in length – brevity!

e.g. ...was determined → We determined...  
...is increased → ...increases

- **Use positive form**

Avoid convoluting a sentence

Careful when using “not”

e.g. ...was not low → ...was high  
...did not change → ...fixed, or ...stable

# Essence of Writing: Clarity, Purpose, Organization & Language

- **Use definitive and specific language**

Be specific and clear!

Pick words carefully

e.g. Perform an analysis of... → analyze  
...period of unfavorable weather →  
...50 mm of rain in 3-days

- **Omit needless words**

Continuously revise sentences

Beware of “wordiness”

e.g. ...this is a subject that → this subject  
...the reason why is that → because

# Exercises #2

The following is an exercise on concision and simplicity. Please omit needless words, change to simple words, use simple subjects and limit adjectives.

1. Most dynamic changes of solar irradiance clearly and seasonally are, on average, approximately related to high/low solar elevation depending on fixed latitude and time of year, or solar declination.
2. The mechanistic connections among levels of phenotypic variation, for example, between spatial and temporal patterns of gene expression and morphology, determine how development constrains or channels evolution.

# Final Thoughts

**Scientific manuscripts convey a story...**

Motivation: context, need, task, object

Outcome: findings, conclusions, perspectives

**The story is developed with a working system...**

Macrostructure: select content and organize it

Mid-structure: one message per paragraph using clear, accurate, and concise sentences

Microstructure: Polish all the way to details of language (verbs, voice, adj.)

**The story must convince a reader that the research/work is important, valid, and relevant.**

**Keep writing, it gets easier with practice!**

# Exercise #3

Write an outline (abstract) on a technical topic

1. **Title**
  2. **Introduction** – scope/background and hypothesis
  3. **Material & Methods** – procedure and mechanics
  4. **Results** – two (2) significant findings
  5. **Discussion** – implications of two (2) findings
  6. **References** – potential literature (keywords)
- 

# References

*Technical Writing and Professional Communication for Non-native Speakers of English, 2<sup>nd</sup> Edition (1991)*

T. N. Huckin & L. A. Olsen

McGraw-Hill International Editions, 746 pgs.

*The Elements of Style, 4<sup>th</sup> Edition (2000)*

W. Strunk, Jr. & E. B. White

Pearson Education, 105 pgs.

*The Process of Composition, 3<sup>rd</sup> Edition (2000)*

J. M. Reid

Prentice Hall Regents, 348 pgs.

<https://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/writing-scientific-papers-14239285> (retrieved August 1, 2018)

<https://cgi.duke.edu/web/sciwriting/> (retrieved August 1, 2018)