A Research Paper

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What is a Research Paper?

- Document of scientific findings.
- Scientific papers are the heart of the scientific community.

- A research paper is an expanded essay that presents ones interpretation or evaluation or an argument.
- When anyone write's a research paper they build upon what they know about the subject and what other experts know.
- A research paper involves surveying a field of knowledge in order to find the best possible information in that field.

What are the areas in which one can publish a research papers?

- Science
- Arts
- Humanities
- Religion
- Management
- Language etc.

What is the essence of a science publication?

- Science is
  - Public
  - Objective
  - Predictive
  - Reproducible
  - Systematic
  - Cumulative
- Publication makes this possible
  - Final step in discovery

EXAMPLE

BIOMEDICAL RESEARCH

Why should I read?

- To find out whether to use a (new) diagnostic test or treatment
- To learn clinical course and prognosis of a disease or treatment
- To determine etiology & causation
- To distinguish useful from useless (or harmful) therapy

Interpretation

- Body of a research paper
  - Introduction
    What question was studied?
  - Methods
    How was the question studied?
  - Results
    What was found?
  - Discussion
    What do the results mean?

Other parts of a paper

- Additions
  - Title, authors, affiliations
  - Abstract
  - Subsections
  - Tables & figures
  - References
  - Acknowledgements & disclosures
  - Appendices
  - Electronic supplements

How do I read a research paper?

Read a scientific paper as a critic

- Understand the problem
- Understand the proposed solution
- Understand competing approaches / designs
- Evaluate the paper

- Peer review is the cornerstone of the scientific publishing process

Evaluating a Paper

- What is the problem being solved?
  - Is it important? Relevant? Why?
  - What is the prior work in this area?
- Is the proposed solution clever?
  - Cleverness is orthogonal to importance!
- Are the assumptions and model reasonable?
- **Impact**
  - Easier to evaluate for older papers
  - Does other work build on it? Do other papers uses techniques and solutions proposed in this paper?

Evaluation Process

- Read slowly, take notes as you read
  - Question assumptions, importance of the problem
  - Write questions to track what you don't understand
- Sometimes what is not in the paper is more important than what is in it
  - Is there something the authors have overlooked?
- Don't let ideas or design details pass until you understand them!
- Do not assume the paper is correct, even if published in a prestigious peer-reviewed venue

Ground Rules

- Try to understand
- Don’t be afraid to ask
- Be constructive
- Be polite
- Don’t be afraid to criticize (constructively!)

Two Types of Scientific Papers Containing Two Types of Information

- ✓ Review articles: give an overview of the scientific field or topic by summarizing the data and conclusions from many studies.

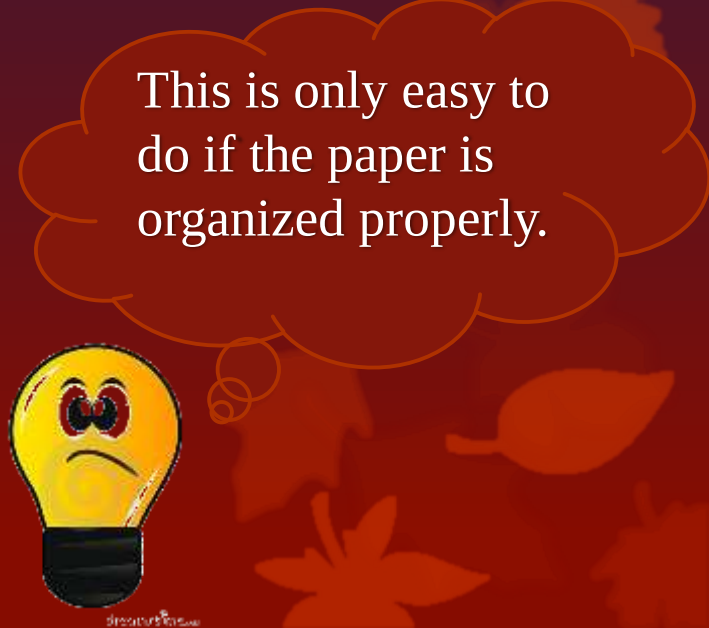
- ✓ Primary research articles: contain the original data and conclusions of the researchers who were involved in the experiments and how the experiments were done.

First read the abstract in order to understand the major points of the work.

- It clarifies whether you in fact know enough background to appreciate the paper.
- It refreshes your memory about the topic.
- It helps you as the reader to integrate the new information.

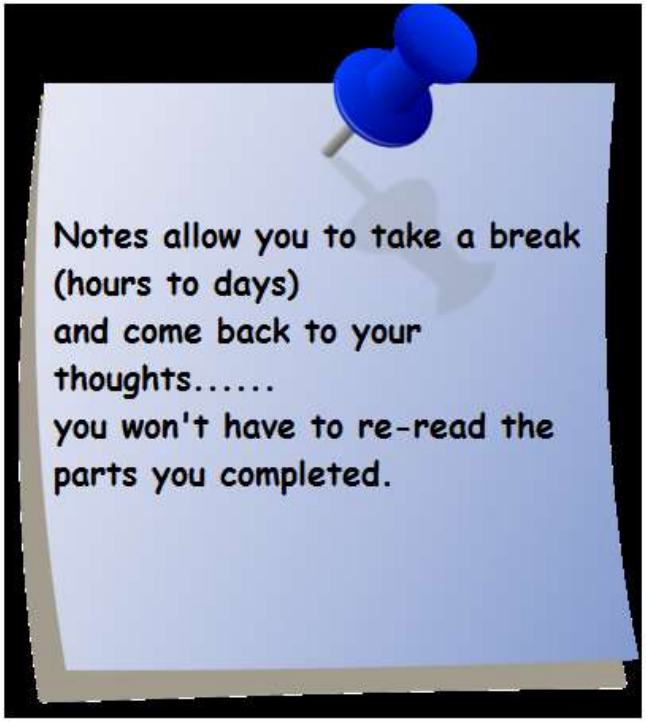
Continue…

- Introduction can be skimmed.
- The logical flow of papers goes straight from the Introduction to Results.
- Then to Discussion for interpretation of the findings.



How to read the results…

- ✓ Examine the figure
- ✓ take notes
- ✓ with each experiment/ figure you should be able to explain:
  - The basic procedure
  - the question it sought to answer
  - The results
  - the conclusion &
  - Criticism



How to read a discussion

Take notes and answer these questions:

- ✓ What conclusions did the authors draw?

Opinion/ interpretation?

- ✓ Ask yourself why is this data significant?

Does it contribute to knowledge or correct errors?

- By now, you may be tired of this paper…

  But don’t relax yet…

- save energy for the overall reflection and criticism.

Reflection and Criticisms

- Do you agree with the authors' rationale for setting up the experiments as they did?
- Did they perform the experiments appropriately?
- Were there enough experiments to support the major finding?
- Do you see trends/patterns in their data?
- Do you agree with the author's conclusions?
- What further questions do you have?
- What might you suggest they do next?

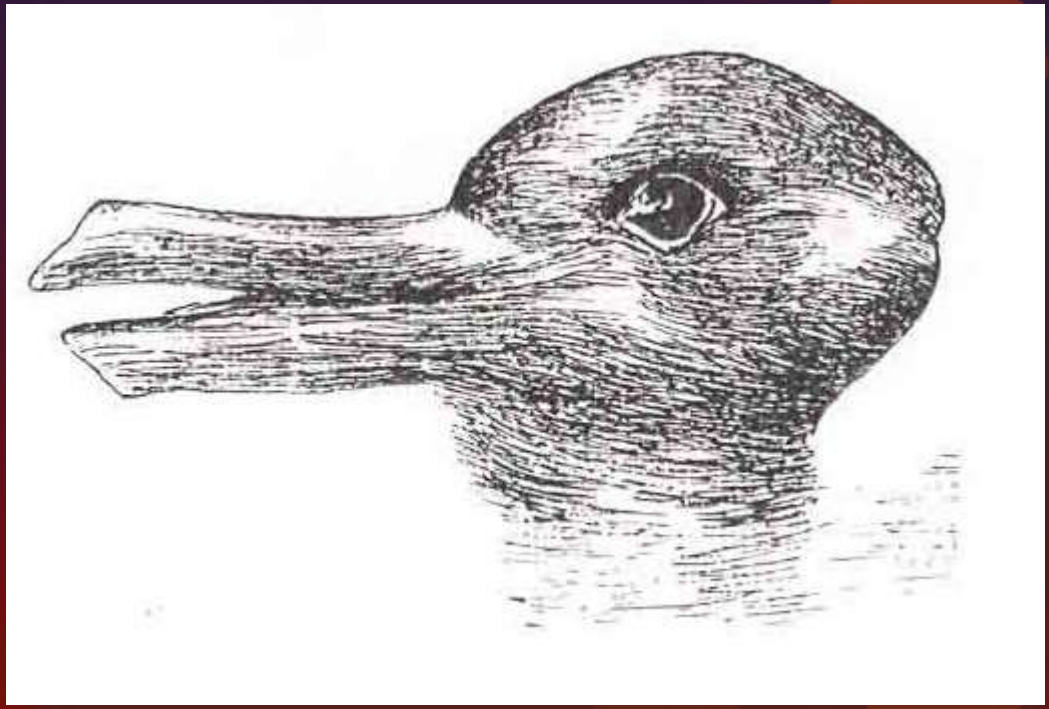
Reading a scientific paper

- ✓ Struggle with the paper
  - Active not passive reading.
  - Use highlighter, underline text, scribble comments or questions on it, make notes.
  - If at first you don't understand, read and re-read, spiraling in on central points.

DO NOT highlight whole sentences or paragraphs

The famous duck-rabbit ambiguous image.

- When one looks at the duck-rabbit and sees a rabbit, one is not interpreting the picture as a rabbit, but rather reporting what one sees.




Thank you!

MEDICAL WRITING

The Medical Writer

- The best preparation for writing scientific papers is to
  - Write papers as a time and lifetime priority
  - Respond responsibly to referees' reviews of your paper
  - Referee papers—become a reviewer, editorial board member, maybe even an editor!

Doctors as Writers

- Write a scientific paper like you would take care of a patient having a procedure
  - Preprocedure preparation
  - Goals (patient care plan)
  - Sequence of procedure
  - Postprocedure care

Best Preparation for Writing

- A good protocol for study in the first place!
  - Important question / hypothesis
  - Clear set of objectives to answer question
  - Analyses organized by these objectives
- See reporting template…

Writing Order

- Preparation
  - Review materials, methods, results
- Goals
  - Establish paper's message & audience
  - Select purposes tied to message
- Sequence
  - Finish methods & results
  - Discussion, introduction, references
  - Definitive title & authors
- Post-writing
  - Out to co-authors & revise
  - Revise (seriously) after journal review

Get Down to Business!

Section-by-Section

Overview

What to Look For

Title

What is paper about?

Title

- Introduces the work
- First thing read
  - Usually it is ONLY thing read
- Serves to entice intended readers

Title

- How do you evaluate a title?
- Characterize a good title

Title

- Characteristics of good titles
  - Short, but specific (not an abstract!)
  - Truly represents content
  - Might…
    - Be provocative or controversial
    - Ask a question
    - Make statement of conclusion
  - Indexable
- Avoid
  - Qualifiers, jargon, abbreviations, filler

Title

- Evaluation
  - Does title tell you what paper is about?
  - Does it overstate contents?
  - Is it too bland to entice readers?
  - Is it “too cute”?
  - Does it mislead?

Authors

Who wrote this?

Authors

- Why are authors important?
- Who should write the paper?
- Who should be on author list (if any)?
  - How many?
  - What order?
  - What roles?

Authors

- Why important?
  - Like it or not, it is an issue of authority or expertise or experience (sociology)
- Where was work done?
  - Credibility
  - Generalizability
  - Assists evaluating apparent negative results

Authors

- Controversies
  - Who should be an author?
  - Number of authors
  - Author order
  - Conflicts of interest / disclosures
- Subject all its own…

Authors

- Evaluation
  - “This paper suffers from lack of input, guidance, and expertise from the senior authors”

Ultra-Mini Abstract

What is the essence of this study—the "take home" message?

If reader is interested…

- Robert Day
  - Clearly stated problem
  - Clearly stated conclusion
- Steven Laureys
  - Develop a central message and write everything else to support it
- JWK / EHB
  - Ultramini Abstract: essence of findings for writer and reader

Ultramini Abstract

- For readers
  - Scanning tool
- For authors (~3 hour's effort)
  - Best preparation for writing paper—the roadmap!
- Content
  - Truest 1-3 sentences (~50 words) about the essence of the study—its message—its inferences

Ultramini Abstract

- Evaluation
  - Analogous to the "elevator pitch" for a business
  - It is not a summary of study purpose or results
  - It is congruent with conclusions of abstract and paper
  - It is hard work
  - It is often done poorly

Should I read the article?

Abstract

Abstract

- Meeting abstract
  - Purpose: to get on program
- Paper abstract
  - Summarizes information and data contained in more complete form in IMRD aspects of manuscript
  - States conclusions (“bottom line”)
  - Self contained
  - #2 item read (after title)

In fact…

- For most readers reading selectively and strategically
  - Skim first line to understand problem addressed
  - Skim last line for conclusions
- No sense
  - Concluding by merely again summarizing results that have already been summarized!

Abstract

- Evaluation
  - If not structured, read it in structured fashion
  - Are purposes clearly stated?
  - Do conclusions match 1:1 the purposes of study
  - Do methods clearly tell me the study group (e.g. animals, patients)?
  - Is there supporting data for each stated purpose & conclusion?

Introduction

Introduction

- What I like
- What I hate
- What should it accomplish?

Introduction

What is the Problem?

Why is it Important?

What is the Approach?

Introduction

- 4 short segments
  - Problem statement
    - Does not review field
  - Why is it important?
  - What is context?
  - Purpose of study
    - Sets complete roadmap for paper
    - Slavishly followed in order and with same words for rest of paper

Introduction

- What reader reads (if at all)
  - First sentence or two
  - Last sentence or two

NIH Illustration

- 7,000 patients will be diagnosed with esophageal cancer this year…
- It is a killer…
- Its location differs around the globe… Staging system is not data-driven…
- Cause is unknown, but environment may play a role. For example…
- Barrett esophagus is widely thought to be a precursor… Tums and pizza…
- Therefore, we investigated cell signaling related to transformation of squamous epithelium to columnar configuration in nude knockout mice.

Alternative First Sentences

- Discovering the cell signaling by which esophageal epithelial cells transform into columnar configuration by gastric acid reflux may lead to better understanding of the pathogenesis and possible prevention of esophageal cancer…

Introduction

- Evaluation
  - Does it rapidly tell me where this paper is headed?
  - Can it be better focused (“boiled and distilled”)?
  - Does it make a case for itself?
  - Are we talking people or animals?
  - Are purposes clearly laid out AND does the author follow the map?

How was the study done?

Should I believe this study?

Materials and Methods

Materials & Methods

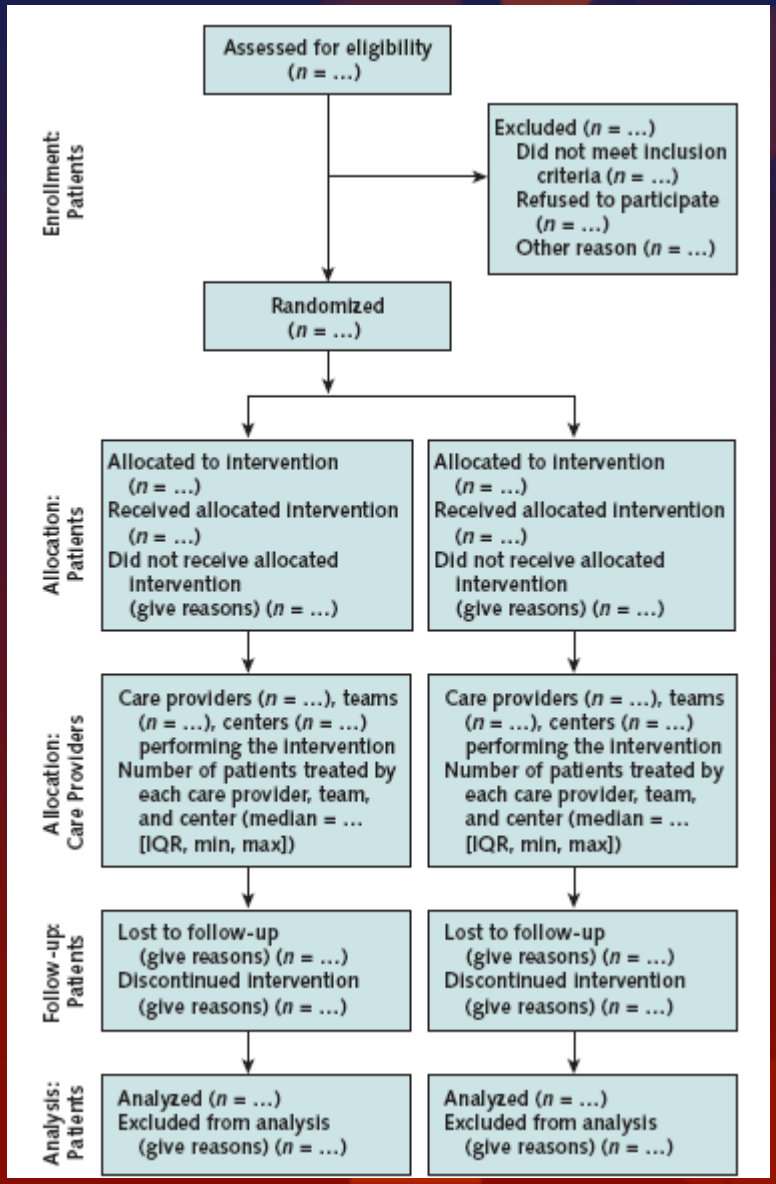
- For selective, strategic readers
  - Rarely read in entirety if at all
  - Assumes this section has been vetted by peer review process
- For reviewers
  - Inadequacies often identified
- For science
  - Is study valid?
  - Is it replicable?

Materials and Methods

- If patients (for example)
  - What was done?
  - Where?
  - Time frame?
  - Context?
  - Inclusion/exclusion criteria?
  - How many (CONSORT diagram)?
  - Characteristics of patients?

CONSORT Flow Diagram

- How was study group assembled?
  - Base group included
  - Specific exclusions
  - Analysis group



Materials and Methods

- Intervention
  - Details
  - Study protocol

Materials and Methods

- End points
  - Define (eg, all-cause mortality)
- If patient follow-up
  - Passive vs. active
  - Systematic (vs. opportunistic)
    - Anniversary
    - Cross-sectional
  - Completeness

Materials and Methods

- Data analysis
  - Organize according to purposes of study
  - Provide detail or references to technical methodology
  - BUT don't leave loopholes!
    - Most common error is not listing variables considered in analyses

Materials and Methods

- Presentation
  - Format of summary statistics
  - Confidence limits & level
  - Other special features of presentation

Materials and Methods

- Evaluation
  - A checklist is valuable for authors, evaluators, and readers
  - CONSORT is one, but journals may have their own
  - Often contentious
    - Old methods
    - Unfamiliar methods
    - Complex methods

Results

What was found?

Results

- What do you look for?
- What should be there?
- What shouldn’t be there?

Results

- Often read selectively and strategically
  - Figures looked at the most—even though they are the first thing reviewers suggest eliminating
- This is core of paper

Results

- What results should be shown?
  - Selected, well-digested data & findings
  - Relate directly to purposes of paper, organized according to purposes, using identical words
  - No interpretation
  - No repetition of text, tables, figures

Results

- Part of the truth
  - Not the whole truth
- Themes
  - Accuracy
  - Brevity
  - Clarity
- Future
  - Repository of raw data for reanalysis

Results

- Evaluation
  - Are data presented that convincingly support conclusions?
    - Logical pieces all there
    - Results stated accurately
  - Are there appropriate expressions of uncertainty?
  - Do negatives reflect underpowered study?
  - Are methods mixed with results?

Results

- Evaluation
  - Tables
    - Appropriate
    - Complete for their purpose
    - Statistically sound
  - Figures
    - Appropriate information content
    - Complete legend
    - Readable

Discussion

Discussion

- What I like
- What I hate
- What is purpose?
- What order?

Discussion

So what?

Who cares?

Discussion

- Failure
  - If the reader finishes discussion and wonders “So what?”

Discussion

- What do results mean?
  - Interpretation
  - Relationships among results
  - Generalizations
  - Theoretical implications

Discussion

- What do results mean?
- How do they relate to cumulative knowledge?
  - Support
  - Contradict
  - Completely new
- How should I use them?
  - Practical application

Discussion

- Suggested outline
  - Summarize findings (controversial)
  - Principal findings
    - Organized by purpose-driven roadmap
    - Put results in context of others
  - Limitations
  - Conclusions
    - inferences
    - Recommendations

Discussion

- Evaluation
  - Is it concise and focused strictly on purposes of study?
  - Is interpretation of study reasonable?
  - Have others been quoted and represented accurately?
  - Are inferences supported by results?
  - Is speculation identified?
  - Are there promissory notes?
  - Are new results presented?

References

Can I verify claims and arguments?

References

- Not exhaustive
  - 30 or less is sufficient
  - Not just recent literature
- Contextual
  - Place subject in context
  - Represents all sides of controversy
  - Truly relevant
- Cited accurately
  - NLM has a problem!

Summary

- Science = publication
- Format stereotyped (signposts)
- Readers selective and strategic
  - They rely on reviewers to vet scientific validity
- Conclusions (message) key
  - May have life-and-death implications—and more
- Impact of use unstudied!