Introductions

John F. Leslie, Professor & Head
Department of Plant Pathology
Kansas State University
Manhattan, Kansas USA

In cooperation with
The American Society for Microbiology

March 2011

IMRAD - What & Why

- Introduction, Materials & Methods, Results and Discussion
- A standard recipe for formal papers
- Variations not encouraged
- Saves space & $$$ for journals
- Facilitates review process

The Logic of IMRAD

- Introduction - What question (problem) was studied?
- Materials & Methods - How was the problem studied?
- Results - What were the findings?
- Discussion - What do the findings mean?

The Introduction (Big Picture)

- Sets the context for the research by identifying a significant problem and explaining how addressing it advances the field
- Identifies a hypothesis and how it will be tested
- Explains the novelty and significance of the research
- No data and usually no figures or tables
- May vary significantly in length

Four Important Questions I & II

- What message do I want to convey?
  - What question did I ask?
  - What was my answer?
  - NOT, What was the purpose of this research?
  - NOT, What experiments did I do?
- What is the right format for my message?
  - Research article

Four Important Questions III & IV

- Who is the real audience for my message?
  - Be realistic in this assessment
- What is the right journal for my paper?
  - Check for suitability of audience & content – look at some issues of the journal
  - Circulation and impact
  - Speed & frequency of publication

Four Important Questions – Take-Home

- Answers define breadth and tone of paper
- Often help in framing the hypothesis and objectives
- May dictate format and length

When to do What

- Start writing while work is still in progress
- Identify the objectives
- Work from an outline or other organizational plan
- A common order:
  - Materials and Methods
  - Results (with Tables and Figures)
  - Introduction and Discussion
  - Abstract
- Make frequent back-ups

The Introduction Ties to:

- Title and Abstract
  - By providing background on the research topic
  - By setting up a particular research problem
  - With a literature review that orients the reader, but which is rarely exhaustive
- Materials and Methods
  - By identify novel approaches and procedures
  - By justifying methodology, as necessary

The Introduction Ties to the Results

- Prepares reader for your data
- Provides the context in which the data are relevant/significant
- Identifies hypothesis(es) and objective(s)

The Introduction Ties to the Discussion

- Every question in the Introduction must be addressed in the Discussion
- Every major point in the Discussion must be set up in the Introduction
- Last paragraph of each often is similar in form
- Focus on principles, relationships, generalizations, theoretical implications and practical applications of your work
- Through ties to the previous literature

Introduction – Last Paragraph

- Other than the abstract the most important paragraph in the entire ms.
- Multiple opinions on format and content
- Contains three sentences:
  - Objective(s)
  - Hypothesis(es)
  - Significance & how the field is advanced
- Mirrors the conclusion paragraph at the end of the Discussion
- Provides your measure of the criteria against which your paper should be evaluated

Prose Style

- Minimize verbiage (rhymes with garbage)
  - "I am writing a longer letter than usual, because there is no time to write a short one." - Pascal
- SVO matters
  - Child eats bear
  - Bear eats child
- Concentrate on subject-verb-object order (for top writers 75% of sentences are SVO)
- Is what the reader is expecting
- Passive voice tends to reverse the order

Voice

- Active voice - Subject of the sentence performs the action; more precise and less wordy
  - Your friends wrote this sentence.
- Passive voice – Subject of the sentence undergoes the action; usually the scientist's favorite
  - This sentence was written by your friends.
- It is okay to use personal pronouns (I, we)
- Active voice preferred form for scientific writing
- Learn to identify true subject (*e.g.*, your friends), name it, drop "to be" verb form(*e.g.*, was), and convert remainder to active voice

Sentences & Paragraphs

- Complexity of words and of sentences should be balanced
- Readability formulae – controversial and often fall apart when applied to technical literature
- Keep sentences in the range of 15-20 words (usually approximately 10 words per line). Never over 4 lines.
- Break long sentences at weak connectors (and, or, but, while)
- Paragraph length in general
  - Aim for 100-150 words (half page more or less)
  - Lengthen or merge if less than five lines
  - Cut or subdivide if over 2/3 of a page

General Writing Guidelines

- Write in blocks, but never stop at the end of one. Adding a few sentences or thoughts to the next section makes it easier to start again the next time.
- If stuck in one place, switch to another section, or even another paper
- Looking for a word/sentence – insert a thought/placeholder
- Keep at it – regularly and often

Scientific Writing

- "If it isn't worth doing, it isn't worth doing right"
- Organization more important than literary skill
- Simplicity and clarity - "The best English is that which gives the sense in the fewest short words."
- The thinking is what really counts
- Want to have the reader think the same as you
- Writing will be accompanied by new thoughts and insights (and increased understanding)
- "Good prose is like a window pane." – George Orwell

The End