Araştırma Yöntemleri ve Bilimsel Etik

Yrd. Doç. Dr. Z. Cihan TAYŞİ

(Slides mostly based on “How to Write & Publish a Scientific Paper” by Robert A. Day.)

Scientific Writing

- What is it ?
- Origins of scientific writing...
  - The IMRAD story
- What is scientific paper ?
  - definition, organization, and so on...
- How-to write a scientific paper
  - Title, authors, keywords, introduction, ...

What is Scientific Writing

- *State your facts as simply as possible, even boldly. No one wants flowers of eloquence or literary ornaments in a research article.*

  R. B. McKerrow

- The need for clarity
- Receiving the signals
- Understanding the signals
- Language of a scientific paper

Origins of Scientific Writing (1/3)

- The early journals published papers that we call "descriptive." Often the observations were in simple chronological order
  - Typically, a scientist would report that "First, I saw this, and then I saw that“
  - "First, I did this, and then I did that."
- Pasteur found it necessary to describe his experiments in exquisite detail.
  - Because reasonably competent peers could reproduce Pasteur's experiments, the principle of *reproducibility of experiments* became a fundamental tenet of the philosophy of science, and a segregated methods section led the way toward the highly structured IMRAD format.

Origins of Scientific Writing (2/3)

- As miracles were pouring out of medical research laboratories after WWII, it was logical that investment in research would greatly increase.
- Money produced science. And science produced papers. Mountains of them.
  - The result was powerful pressure on the existing journals.
  - Journal editors, in self-defense if for no other reason, began to demand that manuscripts be tightly written and well organized.
  - Journal space became too precious to waste on verbosity or redundancy.

Origins of Scientific Writing (3/3)

- The **IMRAD format**, which had been slowly progressing since the latter part of the nineteenth century, now came into almost universal use in research journals.
  - Some editors espoused IMRAD because they became convinced that it was the simplest and most logical way to communicate research results.
  - Other editors, perhaps not convinced by the simple logic of IMRAD, nonetheless hopped on the bandwagon because the rigidity of IMRAD did indeed save space (and expense) in the journals and because IMRAD made life easier for editors and referees by "indexing" the major parts of a manuscript.

What is Scientific Paper ? (1/3)

- Definition (**Simple**)
  - A scientific paper is a written and published report describing original research results.
  - A scientific paper must be written in a certain way and it must be published in a certain way, as defined by three centuries of developing tradition, editorial practice, scientific ethics, and the interplay of printing and publishing procedures.

- The Council of Biology Editors (CBE), 1968
  - An acceptable primary scientific publication must be the first disclosure containing sufficient information to enable peers (1) to assess observations, (2) to repeat experiments, and (3) to evaluate intellectual processes; moreover, it must be susceptible to sensory perception, essentially permanent, available to the scientific community without restriction, and available for regular screening by one or more of the major recognized secondary services.

What is Scientific Paper ? (2/3)

- Instructions to Authors, Journal of Bacteriology, January 1998
  - A scientific paper or its substance published in a conference report, symposium proceeding, or technical bulletin, posted on a host computer to which there is access via the Internet, or made available through any other retrievable source, including CD-ROM and other electronic forms, is unacceptable for submission to an ASM journal on grounds of prior publication. A manuscript whose substance was included in a thesis or dissertation posted on a host computer to which there is access via the Internet is unacceptable for submission to an ASM journal on the grounds of prior publication.
- Organization of a scientific paper
  - A scientific paper is organized to meet the needs of valid publication. It is, or should be, highly stylized, with distinctive and clearly evident component parts.
  - The most common labeling of the component parts, in the basic sciences, is Introduction, Methods, Results, and Discussion (hence, the acronym **IMRAD**).
  - Actually, the heading "Materials and Methods" may be more common than the simpler "Methods," but it is the latter form that was fixed in the acronym

What is Scientific Paper ? (3/3)

- If "scientific paper" is the term for an original research report, how should this be distinguished from research reports that are not original, or are not scientific, or somehow fail to qualify as scientific papers?
  - Several specific terms are commonly used: "review paper," "conference report," and ''meeting abstract.“, ...
- **A review paper** may review almost anything, most typically the recent work in a defined subject area or the work of a particular individual or group. Thus, the review paper is designed to summarize, analyze, evaluate, or synthesize information that *has already been published.*
- **A conference report** is a paper published in a book or journal as part of the proceedings of a symposium, national or international congress, workshop, roundtable, or the like.
  - Such conferences are normally not designed for the presentation of original data, and the resultant proceedings (in a book or journal) do not qualify as primary publications.
  - Conference presentations are often review papers, presenting reviews of the recent work of particular scientists or recent work in particular laboratories.
  - Usually, these preliminary reports do not qualify, nor are they intended to qualify, as scientific papers. Later, such work is validly published in a primary journal; by this time, the loose ends have been tied down, all essential experimental details are recorded.

How-to write a scientific paper

- How to prepare the title
- How to list the authors and addresses
- How to prepare the abstract
- How to write the introduction
- How to write the materials and methods section
- How to write results
- How to write discussion
- How to state the acknowledgments
- How to cite references

How to Prepare the Title (1/2)

- Importance of the title
  - Perhaps few people, if any, will read the entire paper, but many people will read the title, either in the original journal or in one of the secondary (abstracting and indexing) publications.
- What is a good title?
  - the fewest possible words that adequately describe the contents of the paper.
- Length of the Title
  - “On the addition to the method of microscopic research by a new way of producing colour-contrast between an object and its background or between definite parts of the object itself”, ***(J. Rheinberg, J. R. Microsc. Soc. 1896:373)***
- Need for specific titles

How to Prepare the Title (2/2)

- **The title of a paper is a label. It is not a sentence!**
  - Because it is not a sentence, with the usual subject, verb, object arrangement, it is really simpler than a sentence (or, at least, usually shorter),
  - but the order of the words becomes even more important!
  - A bad example
    - "Oct-3 is a maternal factor required for the first mouse embryonic division“, **(*Cell 64*:1103, 1991)**
    - “in some cases the assertive sentence title (AST) boldly states a conclusion that is then stated more tentatively in the summary or elsewhere" and "ASTs trivialize a scientific report by reducing it to a one-liner."
- Abbreviations and jargon
  - Titles should almost never contain abbreviations, chemical formulas, proprietary (rather than generic) names, jargon, and the like.
  - In designing the title, the author should ask: "How would I look for this kind of information in an index?

How to List the Authors and Addresses (1/3)

- The Order of the Names
  - "If you have co-authors, problems about authorship can range from the trivial to the catastrophic“, ***(O'Connor, 1991).***
  - What is the right order?
    - Unfortunately, there are no agreed-upon rules or generally accepted conventions.
    - Some authors, perhaps to avoid arguments among themselves, agree to list their names alphabetically
- **Definition of Authorship**
  - An author of a paper should be defined as one, who takes intellectual responsibility for the research results being reported!
  - The sequence of authors on a published paper should be decided, unanimously, before the research is started!

How to List the Authors and Addresses (2/3)

- The preferred designation normally is first name, middle initial, last name.
  - If an author uses only initials, which has been a regrettable tendency in science, the scientific literature may become confused.
  - If there are two people named Jonathan B. Jones, the literature services can probably keep them straight (by addresses).
  - But if dozens of people publish under the name J. B. Jones (especially if, on occasion, some of them use Jonathan B. Jones), the retrieval services have a hopeless task in keeping things neat and tidy.
  - Many scientists resist the temptation to change their names, knowing that their published work will be separated.

How to List the Authors and Addresses (3/3)

- Listing the Addresses
  - With one author, one address is given.
    - If, before publication, the author has moved to a different address, the new address should be indicated in a "Present Address“ footnote.
  - When two or more authors are listed, each in a different institution, the addresses should be listed in the same order as the authors.
  - The primary problem arises when a paper is published by, let us say, three authors from two institutions.
    - In such instances, each author's name and address should include an appropriate designation such as a superior *a, b,* or *c* after the author's name and before (or after) the appropriate address.

How to Prepare the Abstract (1/2)

- Definition
  - An Abstract should be viewed as a mini version of the paper.
  - The Abstract should provide a brief summary of each of the main sections of the paper: Introduction, Materials and Methods, Results, and Discussion.

- The Abstract should
  - (1) state the principal objectives and scope of the investigation,
  - (2) describe the methods employed,
  - (3) summarize the results, and
  - (4) state the principal conclusions.

How to Prepare the Abstract (2/2)

- Usually, a good Abstract is followed by a good paper; ***a poor Abstract is a harbinger of woes to come.***
- The importance of the conclusions is indicated by the fact that they are often given three times: once in the Abstract, again in the Introduction, and again (**in more detail probably**) in the Discussion.
- Most or all of the Abstract should be written in the past tense, because it refers to work done.
- The Abstract should never give any information or conclusion that is not stated in the paper.
- References to the literature **must not be cited** in the Abstract
  - except in rare instances, such as modification of a previously published method

How to Write the Introduction

- Reading a scientific article ***isn't the same as reading a detective story***. We want to know from the start that the butler did it[1].
- Suggested rules for a good Introduction are as follows:
  - (1) The Introduction should present first, with all possible clarity, the nature and scope of the problem investigated.
  - (2) It should review the pertinent literature to orient the reader.
  - (3) It should state the method of the investigation. If deemed necessary, the reasons for the choice of a particular method should be stated.
  - (4) It should state the principal results of the investigation.
  - (5) It should state the principal conclusion(s) suggested by the results. Do not keep the reader in suspense; let the reader follow the development of the evidence.
    - An O. Henry surprise ending might make good literature, but it hardly fits the mold of the scientific method.

[1] Ratnoff, O. D. "How to read a paper." *Coping with the biomedical literature* (1981): 95-101.

How to Write the Materials and Methods Section (1/2)

- In Materials and Methods, you must give the full details.
  - Most of this section should be written in the past tense.
  - The main purpose of the Materials and Methods section is to describe (and if necessary defend) the experimental design and then provide enough detail so that a competent worker can repeat the experiments
  - Many (probably most) readers of your paper will skip this section. However, when your paper is subjected to peer review, a good reviewer will read the Materials and Methods carefully
  - For materials, ***include the exact technical specifications*** and quantities and source or method of preparation.
  - The Materials and Methods section usually has subheadings.
    - When possible, construct subheadings that "match" those to be used in Results
- In describing the methods of the investigations, you should give sufficient details so that a competent worker could repeat the experiments.
  - If your method is new (unpublished), you must provide *all* of the needed detail.
  - If a method has been previously published in a standard journal, only the literature reference should be given.

How to Write the Materials and Methods Section (2/2)

- Because the Materials and Methods section usually gives short, discrete bits of information, the writing sometimes becomes telescopic
  - Details essential to the meaning may then be omitted.
  - The most common error is to state the action without stating the agent of the action.
  - And, of course, always watch for spelling errors, both in the manuscript and in the proofs.
- Ex #1 : "Blood samples were taken from 48 informed and consenting patients . . . the subjects ranged in age from 6 months to 22 years" (*Pediatr. Res. 6*:26, 1972).
  - There is no grammatical problem with that sentence,
  - The telescopic writing leaves the reader wondering just how the 6-month-old infants gave their informed consent.
- Ex #2"We rely on theatrical calculations to give the lifetime of a star on the main sequence" (*Annu. Rev. Astron. Astrophys. 1*:100, 1963).
  - find the word that is misspelled in the above sentence!!!

How to Write the Results

- There are usually two ingredients of the Results section.
  - First, you should give some kind of overall description of the experiments, providing the "big picture," without, however, repeating the experimental details previously provided in Materials and Methods.
  - Second, you should present the data. Your results should be presented in the past tense.
- The Results need to be clearly and simply stated because it is the Results that constitute the new knowledge that you are contributing to the world.
  - The earlier parts of the paper (Introduction, Materials and Methods) are designed to tell why and how you got the Results;
  - the later part of the paper (Discussion) is designed to tell what they mean.
- **Avoid Redundancy**
  - The most common fault is the repetition in words of what is already apparent to the reader from examination of the figures and tables.

How to Write the Discussion

- 1. Try to present the principles, relationships, and generalizations shown by the Results. And bear in mind, in a good Discussion, you ***discuss—you do not recapitulate—*** the Results.
- 2. Point out any exceptions or any lack of correlation and define unsettled points.
  - Never take the high-risk alternative of trying to cover up or fudge data that do not quite fit.
- 3. Show how your results and interpretations agree (or contrast) with previously published work.
- 4. Don't be shy; discuss the theoretical implications of your work, as well as any possible practical applications.
- 5. State your conclusions as clearly as possible.
- 6. Summarize your evidence for *each* conclusion.

How to State the Acknowledgments

- As to the Acknowledgments, two possible ingredients require consideration.
- First, you should acknowledge any significant technical help that you received from any individual, whether in your laboratory or elsewhere. You should also acknowledge the source of special equipment, cultures, or other materials.
  - You might, for example, say something like "Thanks are due to J. Jones for assistance with the experiments and to R. Smith for valuable discussion.“
- Second, it is usually the Acknowledgments wherein you should acknowledge any outside financial assistance, such as grants, contracts, or fellowships.
- A word of caution is in order. Often, it is wise to show the proposed wording of the Acknowledgment to the person whose help you are acknowledging
- ***Be careful about using wish!!!***

How to Cite the References

- Journals vary considerably in their style of handling references. One person looked at 52 scientific journals and found 33 different styles for listing references, ***[M. O'Connor, Br. Med. J. 1 (6104):31, 1978].***
  - Although there is an almost infinite variety of reference styles, most journals cite references in one of three general ways that may be referred to as **"name and year," "alphabet-number,"** and **"citation order.'‘**
- ***The name and year system*** (often referred to as the Harvard system) has been very popular for many years and is used in many journals and books.
  - Its big advantage is convenience to the author. Because the references are unnumbered, references can be added or deleted easily
- ***Alphabet-number system***, citation by number from an alphabetized list of references, is a modification of the name and year system.
  - Citation by numbers keeps printing expenses within bounds; the alphabetized list, particularly if it is a longlist, is relatively easy for authors to prepare and readers to use
- ***The citation order system*** is simply a system of citing the references (by number) in the order that they appear in the paper.
  - This system avoids the substantial printing expense of the name and year system, and readers often like it because they can quickly refer to the references if they so desire in one-two-three order as they come to them in the text.

Thanks & Questions

?