Writing convincing research proposals and effective scientific reports

a learning module

Part B: Scientific writing

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A learning module

Part B: Scientific writing

Sylvester Dickson Baguma, Ponniah Anandajayasekeram
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Editing, design and layout—ILRI Publication Unit, Addis Ababa, Ethiopia.

ISBN 92–9146–240–3

Correct citation: Baguma SD, Anandajayasekeram P and Puskur R. 2010. *Writing convincing research proposals and effective scientific reports: A learning module. Part B: Scientific writing.* ILRI (International Livestock Research Institute), Nairobi, Kenya. 113 pp.

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Acknowledgements

This module could not have been produced without the support provided by ILRI senior management. We would like to record our deep appreciation and sincere thanks to Dr Carlos Sere, Director General of ILRI, Mr Bruce Scott, Director of Partnership and Communications, Dr John McDermott, Deputy Director General, as well as members of the Board of Directors for their continuous support and guidance.

We would also like to thank Dr Denis Keytere, Director General of the National Agricultural Research Organization (NARO), Uganda, for allowing Mr Sylvester Dickson Baguma to participate in this exercise.

This module is a direct response to a request made by Graduate Fellows of ILRI. The content of this module was drawn from a large number of sources. We are grateful for the authors of these various publications. The content of the module was presented during a training session for the Graduate Fellows in Addis Ababa and Nairobi. The feedbacks received from participants certainly added value to this module.

Finally, we would like to thank all those who either directly or indirectly contributed to the content as well as the development of this module. This is a work in progress and we would welcome any suggestions and comments.

Authors

Foreword

The growth in agricultural research investment was very rapid in the 1970s and slowed down since the mid 1980s. The rate of expansion of research staff has been more rapid than that of funding, resulting in a growing proportion of research funds being used to pay salaries and an acute shortage of operating funds for undertaking research. As national public sector spending on research is falling, many National Agricultural Research Systems are heavily depending on donor funds to support research. This situation is more acute in sub-Saharan Africa than anywhere else in the world. In order to keep the research agenda moving, it is critical for individual agricultural research scientists and their organizations to find new sources of funds. While the available research resources are declining, there has been a universal move towards the use of competitive funding for research. Many institutes also started moving towards results based contractual arrangements. That means a successful researcher will have to write convincing proposals to secure funds and be able to widely publish the results (outputs and outcome) of their work to attract more resources.

During one of the interactions between the management of the Capacity Strengthening Unit, and the Graduate Fellows of ILRI, the students identified the need for additional training in areas such as experimental design and data analysis, oral and poster presentation, scientific writing and proposal writing, project management, and leadership training. ILRI also noted that although a large number of theses were produced by the Graduate Fellows, they were not prolific enough in writing scientific papers and journal articles. This module is a response to this request. The training module was primarily intended to assist the Graduate Fellows to write convincing proposals to access the available competitive funds, and also to write and publish the results of their work widely. Once the Graduate Fellows leave ILRI, we also want them to train their own colleagues in the systems they come from. To enable this, the learning module is designed to include learning objectives, handouts (teaching notes) and the PowerPoints used during the presentations for every session. Where relevant, exercises and additional references are also provided. The materials are presented in the form of 'Reusable Learning Objects' so that the users can make use of the relevant sections based on the target group and purpose.

The materials have been drawn from many sources, but the key ones are the training module prepared by the former ISNAR ('How to write convincing proposals' 2003) and a book titled 'Writing and presenting scientific papers' (Malmfors et al. 2004).

Although the primary audiences of this module are ILRI Graduate Fellows, the materials can be easily adapted by our national research partners. The users are expected to modify and change the content to suit their specific context and need. We are planning to update this module periodically to respond to the changing needs and circumstances. Hence, any feedback and constructive comments from the users are very much appreciated.

Ponniah Anandajayasekeram
Manager, Capacity Strengthening Unit
ILRI

Introduction to the workshop

Workshop objectives

Writing convincing research proposals and effective scientific reports:

A learning module

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Goal of the training workshop

To strengthen the skills of:

- Project proposal writing and resource mobilization in agricultural research and
- Effective scientific writing

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Objectives of the workshop

- To provide participants with knowledge and skills to be able to conceive projects and write them up in a way that will convince donors to fund them
- To improve participants' ability to mobilize resources for agricultural research
- To impart necessary knowledge and skills for effective scientific writing

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Expected outputs of the workshop

- Improved knowledge and skills in research project proposal writing
- Participants able to mobilize resources required for conducting agricultural research projects
- Participants able to produce high quality research papers/communication products

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Thank you!

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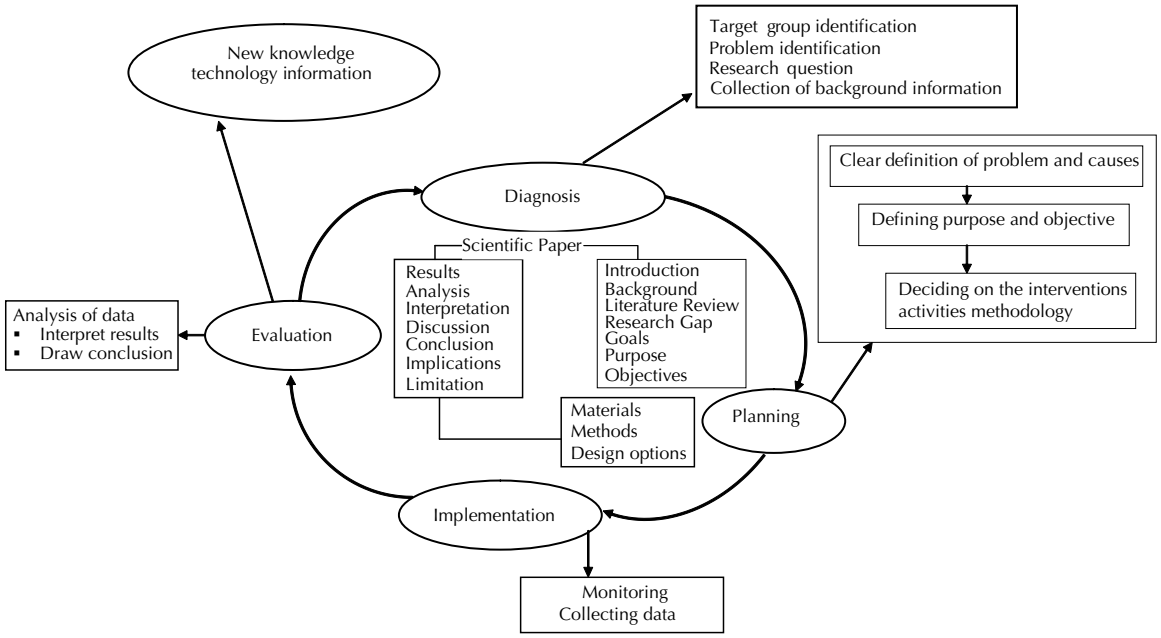
Project cycle, research process, scientific paper



Trainer's guide

Session 12: When and why should a scientist report research?

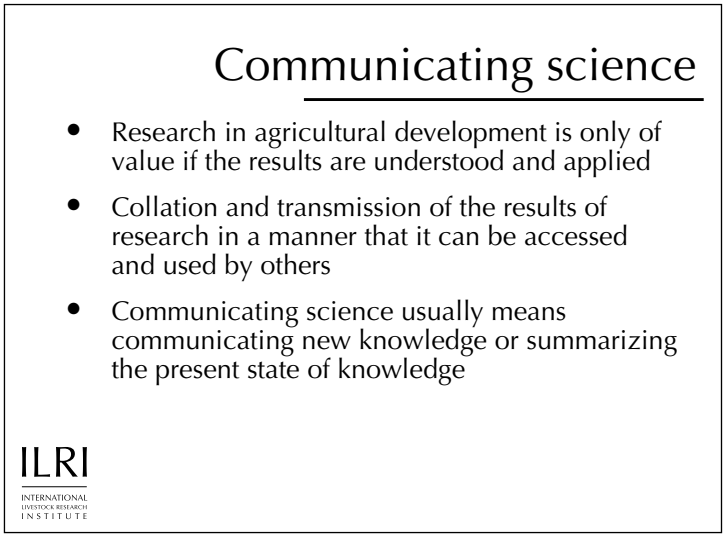
Session objectives	By the end of this session participants will: • Apply the ABC of reporting and communicating research results • Know when to communicate research results
Training materials	• Assorted markers • Felt pens • Flip charts
Time needed	1:30 hrs
Method of facilitation	

Activities	Contents	Time
Plenary discussion	Brainstorm with participants on why scientists should report their research results	20 min
Plenary presentation	When and why should a scientists report research	5 min
Group exercise	Participants share in subgroups what best practice and challenges they have experienced. Write on cards—green for best practices, red for challenges.	10 min
Summary	Trainer summarizes the session	5 min
Break	Health break	
Handouts and reference materials	PPT: when and why should a scientist report research Reading notes on when and why should a scientist report research	

Session 12: Summary of presentation slides: When and why should a scientist report research?

12.1

12.2



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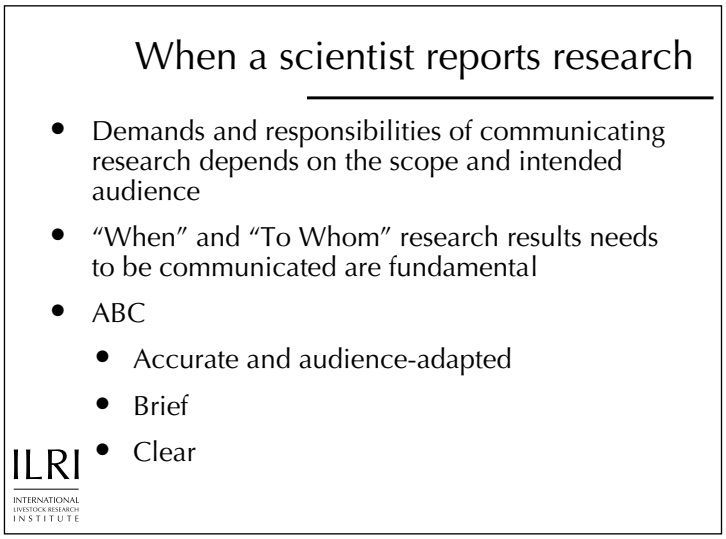

12.4

Key questions to be addressed..

- Who are you addressing - scientists who are specialists in your field of research, a wider group of scientists, fellow students, or public audiences?
- Why is your message important? Why are you communicating it?
- What are your main findings or "take-home" messages?
- How can you best deliver your message and satisfy the audience's needs?

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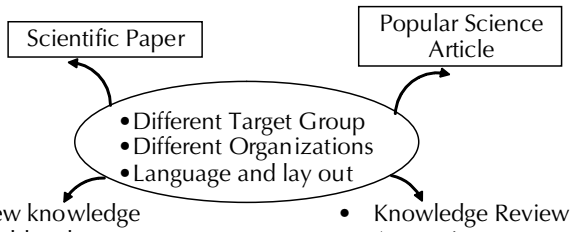
12.5

Scientific vs. popular science writing



- New knowledge
- Enable others to repeat experiment and check info – references
- Logical and clear IMRAD format
- Technical terms
- Tables and figures

- Knowledge Review
- Arouse interest
- Teach/influence the reader
- Illustrations and headings as a tool to facilitate reading and understanding
- Examples

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12.6

Audiences for research results

- Peers or peer group — colleagues or competitors
- Decision makers — administrators, donors, or policymakers
- Other stakeholders
  - Farmers
  - Extension workers
  - Farmer organizations
  - Private sector
- The general public – 'educated', 'general', 'student'

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12.7

Platforms for communicating research

Written presentations

- Books and book chapters
- Review papers
- Journal articles
- Science magazines
- Newspaper articles

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12.8

Platforms for communicating research (cont'd….)

Written presentations

- Extension leaflets and posters
- Conference posters
- Annual reports, quarterly reports, and project reports
- Conference abstracts
- Conference/Workshop proceedings
- Letter to journals and book reviews

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12.9

Oral presentations

- Conferences
- Seminars and workshops
- Project planning and donor meetings
- Outside talks and media interviews

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12.10

Why do research scientists report

The reasons may be personal and/or institutional and range from the noble to the less-than-noble

- Communicating for the good of others
- Publish or perish
- Establishing a reputation
- Getting connected to the conference world
- Financial rewards
- Contributing to science
- Communicating "public goods"
- Describing and publicizing new animal breeds/ varieties

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12.11

Timing – when there is no deadline

- Researchers can sometimes choose the timing of their communication
- Refereed journals, for instance, will accept papers at any time
- Popular outlets (radio, television, newspapers, and magazines) are interested in any good story whenever it occurs
- A newsletter can be published at regular intervals
- Special editions can be prepared whenever research results suggest.
- Unsolicited (sole source) proposals can be prepared and submitted whenever the researcher is ready

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12.12

Timing — when there is no deadline

- Researchers can sometimes choose the timing of their communication
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12.13

Timing, when a deadline is critical….

- Researchers may be involved in consultancy work
- The researcher's reputation as a consultant rests on the delivery of well-written and timely consultancy reports
- In cases with a strict deadline, timeliness must always take precedence over other motives for communication.

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12.14

Thank you!

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Session 12: Notes to participants: When and why should a scientist report research?

12.1 Introduction to scientific writing

Research in agricultural development is of value only if the results are understood and applied. Although how this is done is a matter of great debate, clearly of major importance is the collation and transmission of the results of research in a manner that it can be accessed and used by others. However, much research in agricultural development often remains in files, notebooks, document folders, on computers or in little seen or distributed 'internal' reports and is never exposed to the judgment or scrutiny of the broader research community. One of the reasons for this is a lack of training, experience and confidence in the skills and processes of bringing results to other potential users in an acceptable form.

12.2 Scientific communication occurs in many forms

Science can be communicated in different forms. The notable ones are: Papers in scientific journals, reports, conference papers and abstracts, graduate and postgraduate theses, review papers, proposals, popular science articles, newspaper articles, oral presentation and posters. They do have some commonalities but also differ in certain aspects. The audiences may be different, and the objectives may also change. Communicating science usually means communicating new knowledge or summarizing the present state of knowledge.

12.3 The ABC of science communication

Any scientific communication should be:

- Accurate and audience-adapted
- Brief
- Clear

Communication is a two way process. Information cannot merely be delivered; it must be received and understood as well.

Some components of effective communication

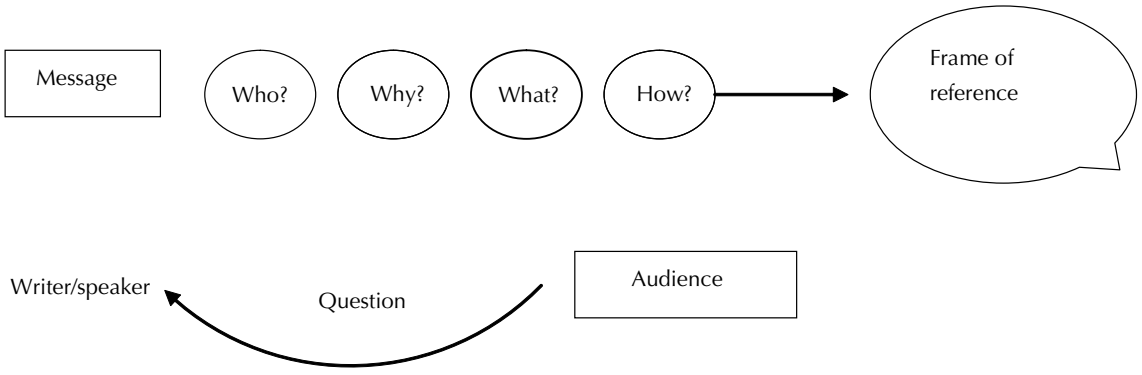


Figure 1. *Components of effective communication.*

12.4 Key questions to be addressed

Who are you addressing scientists who are specialists in your field of research, a wider group of scientists, fellow students, or public audiences?

- Why is your message important? Why are you communicating it?
- What are your main findings or 'take-home' messages?
- How can you best deliver your message and satisfy the audience's needs?

12.5 Scientific vs. popular science writing

- Scientists usually communicate the same topic in various ways and to different audiences
- Conference papers and posters presented at a conference are not peer reviewed
- The core communication of new research results is a paper published in scientific journals.

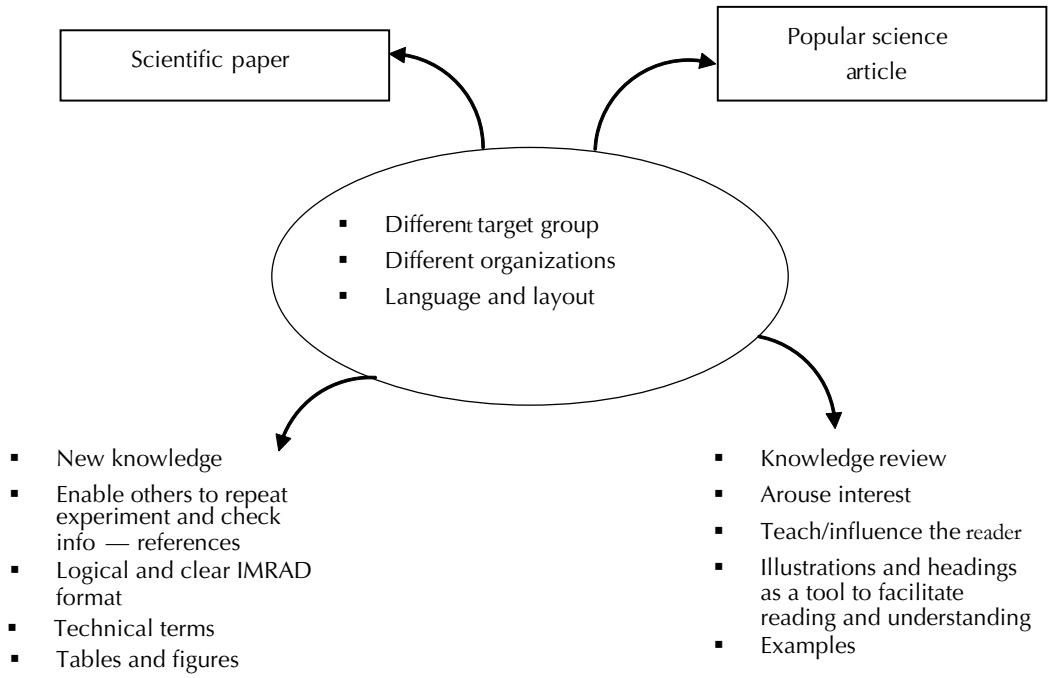


Figure 2. *Scientific vs. popular science writing.*

However, a scientific paper should be original documentation of research results and requires precision. It should be logical and clear (others can repeat and check) and always give reference to original source. The common features to both are that they awaken the interest of the reader and present reliable information.

12.6 When a scientist reports research

12.6.1 Introduction

During the career of a researcher, including that of a natural (or social) scientist working in agricultural development, the demands and responsibilities of communicating research will clearly vary both in their scope and their intended audience. Junior scientists will communicate research for which they are responsible differently from the manner in which Program Leader, Head of Station, or even the Director General of an International Centre communicate work for which they are (ultimately if indirectly) responsible.

At the individual level, be it junior researcher or Director General, questions of 'When' and 'To Whom' research needs to be communicated are fundamental to later 'How' decisions—the main focus of this module. While the most common and obvious audience for research findings are others working in the same field, researchers will at times communicate to a hole range of other audiences, with more or less interest and involvement in the research and its potential contribution to science and development.

12.6.2 Audiences for research

Peers

A peer group is an undefined, but broad group of researchers, trained and specializing in the same general area, to an equivalent or higher level, and with equivalent or higher levels of experience and seniority. These qualities remain the foundation of judgments as to the quality and relevance of research, most obviously through the practice of 'independent peer review' by which research journals decide whether to accept articles and papers for publication.

A peer group may be divided into specialists, who understand precisely and closely the area of research and are up-to-date with recent developments, and scientists in closely related areas with a greater or lesser interest and involvement in the work. Your 'peers' are your colleagues. But in some instances, they are also your competitors, for both ideas and for research funding (and of course promotion). In an era of intense competition for all of these, the concept of a community of researchers collaborating in joint pursuit of a common 'higher' goal (to which the open communication of research may contribute) may well seem outdated and naïve.

Decision-makers

In public research (whether national or international), researchers generally work within institutes. These institutes are themselves generally part of larger organizations and research systems. For example, a 'Dairy Research Station' may be part of an 'Institute for Animal Research', which is in turn a component of a nation's 'Agricultural Research Council'. Such public systems rely on donor funding from various sources, whether private, national, or international. A researcher may be working at an institute, with laboratories, field trial facilities, etc. However, decisions concerning areas and priorities for research for funding may often be taken at places and levels far removed from where such work will be carried out.

Researchers may therefore have a direct interest in attempting to communicate both the success and significance of their activities to 'decision-makers'—administrators, donors, or policymakers—at institutional, national, and international levels. If you truly believe your work is valuable, these people are an audience you will want to influence. Although in some cases, members of this audience may be former researchers, most administrators, donors, and policymakers have different educational backgrounds, perspectives, and priorities, as well as different budgets and time horizons. They are not researchers, and they do not think like scientists.

Administrators will answer to senior directors and political masters (for example Government ministers). Donor representatives will have to justify their grant decisions both to their host and home governments, and ultimately, if indirectly, their home country taxpayers. Policymakers at all levels must answer to supervisors far removed from the individual researcher trying to explain the importance of his or her work.

Other stakeholders

This module does not seek to identify the precise place of researchers in agricultural development. However, scientists today are expected to do more than 'simply' conduct and publish research. Many national agricultural research systems (NARS) have made great efforts to integrate research with extension activities. The whole concept of what constitutes the NARS of a country is increasingly flexible and open. The 'Farmer First' paradigm, and the current emphasis on participatory research, requires researchers to be aware of, learn from, be involved with and address a much wider group of those involved in agriculture than simply the researchers' own 'peer group'.

Clearly, addressing extension agents or farmers requires totally different styles and methods of presentation than that of the peer-reviewed journal article. Understanding these differences, and being able to communicate plainly and appropriately to a broad and diverse constituency, is a necessity for researchers today. Unfortunately, many researchers, despite their years of specialist training, often lack the skills needed to address lay audiences or untrained farmers to whom their results ultimately are most directly relevant.

The general public

Although farmers are part of the public, 'the general public' in this case is defined as those not directly involved or influenced by agricultural research. There are special skills in communicating with the public. Media stars (for example, the botanist David Bellamy in the UK and the evolutionist, the late Stephen Jay Gould in the US) exist, and can make the world of science come alive for audiences with no training whatever in their fields. But most researchers often have little training and experience in directly communicating with the public.

For convenience, the public may be divided into 'educated', 'general' and 'students'. Whilst the educated public may be prepared to read the results of research in 'serious' newspapers, magazines, or radio or programs, the 'general' public may only become aware of results through more popular channels. In both cases, control of what is presented resides with the journalist and his/her editor, along with the simplification and inaccuracy their own lack of training may imply.

A researcher may communicate with 'students' by direct teaching, for example in project work for university degrees. At institute open days, researchers may address visiting schoolchildren or other members of the public with little training or specialist knowledge. Communicating with the general public will likely often play only a minor role in a researcher's life, and be perhaps viewed as an annoyance and distraction from 'more important' things. However, such advocacy may play an important role in both creating awareness of research findings and generating and maintaining support for research. Ultimately, it is the general public that pays for most agricultural research.

12.7 Why do research scientists report?

Researchers have occasion to communicate with many different audiences as a normal part of their professional lives.

Some of these audiences include:

- Other researchers (in their discipline, or in related fields)
- The intermediate and end users of their research (e.g. extension agents and farm families)
- Those that fund their research (national treasuries, international donors, the private sector)
- The general public (interested in their field, or otherwise).

As also discussed in the previous session, there are many different ways in which researchers can communicate their work. These include:

- Research journals, reviews, conference papers, theses, etc.
- Extension manuals, posters
- Newspaper and magazine articles, radio broadcasts
- Newsletters, brochures, leaflets
- Concept notes and proposals

This session looks at the various reasons why researchers communicate. The reasons may be personal and/or institutional and range from the noble to the less-than-noble. All motives exist, and all need to be recognized as operating in the context of agricultural research.

12.8 Communicating for the good of others

Many researchers are motivated by the desire to make the end users of their research better off. They want farm families to be better nourished by the improved crop varieties they are breeding. They want farm incomes to increase as a result of the better water management techniques they have identified. They want widows in war-torn regions to have a source of income from the poultry practices they have identified as being the most suitable for a given region.

This is the sort of motivation that attracts development donors. It also appeals to the general public, who can now understand why their governments support agricultural research. This form of motivation involves communicating research results to intermediate and end users. In agriculture, this usually means extension workers and the staff of NGOs and farmers.

To communicate successfully to audiences like this, a researcher needs to know the strengths and limitations of his audience. Researchers need to know about the literacy levels of their readers, and their level of scientific sophistication. It is important not to talk down to an audience; it is equally important not to talk above the heads of a readership. The more researchers know about the people who will use their research, the better they can communicate, and be sure their research is being used to best effect. Time spent in understanding the self-interest of extension agents, field workers, NGO staff, female farmers, rural youth, and similar groups will pay off in more targeted and relevant publications. It will reflect well in project proposals and attract the interest of development donors.

12.8.1 Publish or perish

It is a fact of life that research publications are critical to the professional development of all researchers, including those in agriculture. Some employers (e.g. at least one CGIAR Centre) expect all staff to publish at least two papers a year in a refereed journal, or risk not having their contract renewed. More commonly, promotion is dependent on a growing list of publications. At universities, tenure almost always requires a respectable publishing pattern.

In all cases, research organizations love to have their staff publishing regularly, in both academic and popular journals–institutional prestige comes in large measure from the publishing performance of staff. And the fame of an institution sets up a virtuous circle in which the best researchers, who publish the most, are attracted to the institutions whose personnel have the ‘best’ publishing records. For all these reasons, the ambitious researcher seeks to establish and maintain a regular habit of publishing research results in journals with as strong a reputation for selectivity as possible.

12.8.2 Establishing a reputation

Fame and prestige are good motivators for some individual researchers too. In all countries, a few researchers appear on radio and television frequently to comment on issues in their fields that are of current public interest. Nowadays, such topics include the safety of genetically modified crops, the effects of HIV/AIDS on rural livelihoods and agricultural labour, and rural–urban migration and its effect on national food security. If a researcher is called upon for comments in writing or on oral broadcasts on such issues of the day, he or she may achieve a level of fame that can make a significant difference to future employment prospects.

12.8.3 Getting connected to the conference world

Recognition comes from achieving respect from peers. One way to do this is through the written word in journal articles. Another is face to face at scientific conferences. The way into the world of national, regional, and international conferences is to have abstracts, papers, and posters for such meetings accepted by the organizers. If the paper is of sufficient interest, the author may have his or her way paid to the conference, and may be called upon to chair or moderate workshops within the conference.

Attendance at conferences allows researchers to network with peers, meet potential collaborators, make their research known, and become exposed to the conventions and opportunities within the field. To take advantage of these benefits, and to enjoy the travel opportunities of the conference world, researchers need to learn how to prepare papers that will be attractive to conference managers.

12.8.4 Financial rewards

Few people get rich from writing journal articles. Textbook authors may receive advances and royalties from book sales, but this is rare—academic publishing in the age of the Internet is a precarious business. On the other hand, serious financing for research can be obtained by researchers who learn to write convincing concept notes and proposals to attract donor support. This type of writing is both an art and a science. It involves writing to persuade as well as writing to inform.

12.8.5 Contributing to science

Some of the most important motives for communicating research are the centuries-old motives for contributing to science. The scientific method, to which serious researchers adhere, requires the sharing of research outcomes as the bricks on which scientific advances are made, person by person, experiment by experiment, thought by thought. This steady building of reliable testable knowledge is the cornerstone of international research in agriculture, as in all other fields.

Sharing knowledge with peers one may never meet through journals is the tried and tested method of building knowledge. Among the benefits are reductions in duplicated efforts. More importantly, reading about the work of colleagues can inspire readers to new and exciting avenues of research.

12.8.6 Communicating ‘public goods’

Researchers whose work is funded by public sources—e.g. the staff of NARS, most universities, and international research organizations—are generating public goods. Public funds come from governments, and governments raise funds from taxes. So it is the people who fund this research, and

they are entitled to reap the rewards. So the goods produced by publicly funded researchers are by definition 'free'. In that context, researchers publish their research results to show how they have spent the public funds, and to make the results widely available.

Researchers whose work is privately funded, will be generating outcomes which are 'proprietary' and 'belong' to the funders. Their research results are protected by patents and other intellectual property restrictions. However, they, too, seek to publish in refereed journals. For one thing, they want to share ideas with others working on similar topics. For another, they wish to gain recognition for their work.

No matter how they are funded, researchers are colleagues. The history of the development of the Human Genome Project, which rests equally on the work of public and private scientific work, is a model of how progress can be made in a complex world.

12.8.7 Describing and publicizing new crop varieties

In some countries, publication in journals is used as a method of establishing and promoting the existence of a new crop variety. For example, in the United Sates, certain journals accept 'crop registration notes' or articles. These will generally contain at a minimum, the genetic background of any new varieties and details of field performance characteristics, although the amount of detail varies with the journal. In much publicly funded research (such as that carried out by CG Centres), publication and disclosure of such information in journals is an important part of the 'international public good' aspect of such work.

12.9 Timing—when there is no deadline

Researchers can sometimes choose the timing of their communication. Refereed journals, for instance, will accept papers at any time. Popular outlets (radio, television, newspapers, and magazines) are interested in any good story whenever it occurs. A newsletter can be published at regular intervals. However, special editions can be prepared whenever research results suggest.

Although many donors have regular funding cycles, unsolicited (sole source) proposals can be prepared and submitted whenever the researcher is ready. So, in the absence of deadlines, researchers can indulge other motives when choosing the timing of research communication.

12.10 Timing—when a deadline is critical

Papers, abstracts, and posters to be shared at national, regional, or international conferences have to be prepared to strict deadlines. Similarly, when reporting to donors, the timing is specified in the grant agreement. Depending on the donor and the type of project, reporting may be required quarterly, half-yearly or annually. Punctual, full and well-written reports are essential elements of good donor relations.

Researchers will be required by their Management personnel to make regular and timely contributions to various documents and meetings. Each year, an annual report will be needed to share with all the stakeholders of the institute, and each researcher will likely have to make their written contribution. Similarly, some sort of reporting, perhaps through a Program Leader or Research Director, will be needed for internal staff meetings and regular Board meetings.

Finally, researchers may be involved in consultancy work. There is a growing trend for government researchers to augment their scope of work through such activities. The final report is often the key product that the client is buying, and it therefore needs to be carefully prepared and delivered on time. The researcher's reputation as a consultant rests on the delivery of well-written and timely consultancy reports. This is the key to repeat business, and the meaningful financial and recognition rewards this implies. In cases with a strict deadline, timeliness must always take precedence over other motives for communication.

Trainer's guide

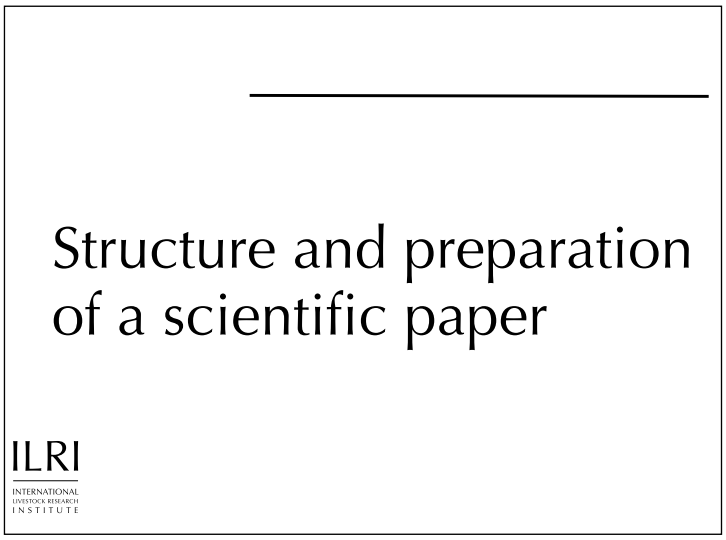
Session 13: Structure and preparation of a scientific paper

Session objectives	By the end of this session participants will: • Understand the different outputs of research • Structure a scientific paper in an acceptable manner • Know when to communicate research results • Acquire the knowledge necessary for preparing a scientific paper
Training materials	• Assorted markers • Felt pens • Flip charts
Time needed	2:15 hrs
Method of facilitation	

Activities	Contents	Time
Plenary discussion	Ask at least 2 participants give a simple structure of a scientific paper	5 min
Plenary presentation	Structure and preparation of a scientific paper	1:40 hrs
Participant interaction	The trainer gives an opportunity to participate to ask questions, contribute or raise their opinions. If there are any 'light bulbs', participants are encouraged to share them with others.	20 min
Summary	The trainer summarizes the salient features of the session	10 min
Break	Lunch break	
Handouts and reference materials	PPT: structure and preparation of a scientific paper Reading notes on structure and preparation of a scientific paper	

Session 13: Summary of presentation slides: Structure and preparation of a scientific paper

13.1



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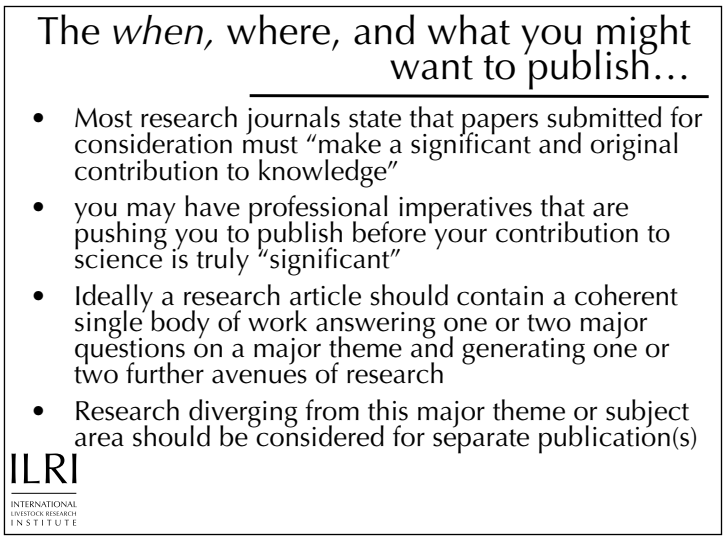
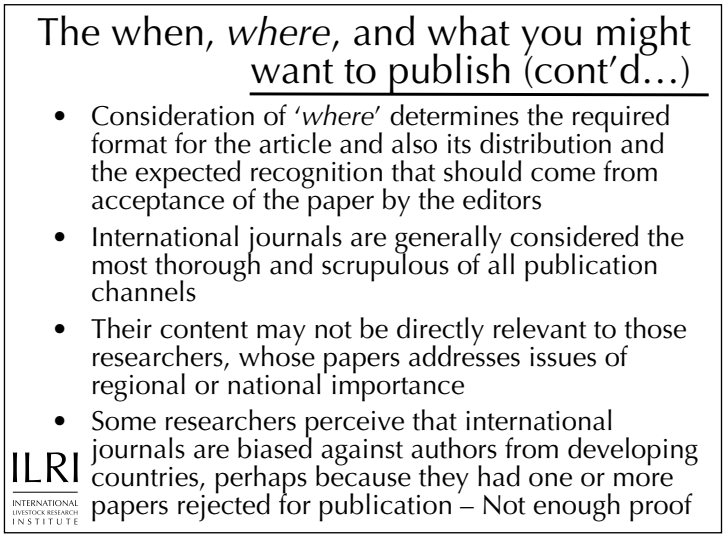


13.3



13.4

The when, *where*, and what you might want to publish (cont'd…)

- All researchers should look carefully at the contents of some recent issues of the journal of their choice to see whether the published articles address similar topics as their own article is going to discuss
- On reflection, a better journal for the paper to be written could then be a regional or national journal of science rather than the international one
- While both important and scientifically valid, research may not have the broad general applicability demanded by some well-known international journals
- A regional or national agricultural science journal could be a sensible choice, even though regrettably publishing in such journals may not carry as much scientific prestige as comes with publishing in a recognized international journal

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13.5

The when, where, and *what* you might want to publish (cont'd…)

- Research articles and papers (in particular in the natural sciences) convey certain information in addition to new results, and generally do so in a standard manner and sequence.
- In broad terms a research paper:
  - Typically presents experimental work—usually a minimum of two experiments, or field work conducted over two or more three seasons
  - Explains the motivation for conducting the work
  - Explains the design and conduct of the work
  - Presents the results of the work
  - Proposes an interpretation and meaning of the results
  - Considers the significance of the results and of the interpretation proposed

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13.6

The structure of a research paper

- The major sections required in a paper are often abbreviated in the acronym "IMRaD" meaning: Introduction, Methodology (Materials and Methods), Results, and Discussion – meat of the paper.
- Other sections are clearly necessary (a title, abstract, references, etc.) but the main substance of a paper is contained within the four sections of the IMRaD acronym
- These four components can be thought of as covering and describing different stages of the research process, those stages of "past research", "present research", and "future research

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13.7

IMRaD

- Introduction – "Why".
  - The nature and scope of the problem being considered
- Methodology (Materials and methods) - "Where, When, and How"
  - Describing the design (plus duration, location, and climate) and conduct of the experiment in sufficient detail that another researcher could repeat the work if necessary—including the statistical design used and the analysis performed.
- Model sampling procedure, method of data collection, type of analysis etc

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13.8

IMRaD (cont'd….)

- Results - "What" was found?
  - Describes what was found, giving summaries of data obtained, as text, tables, figures, or graphs
- Discussion - "So What?" What does this mean?
  - Contains an interpretation of the results. The discussion talks about the relationship of the results to the questions posed in the introduction, and explains how these results contribute to answering the "Why" of the research

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13.9

In addition to IMRaD, you will also need……

- A title: In preparing the title, you should use the fewest possible words to accurately describe the content of the paper
- The authors: You will need to include the names and addresses of those who conducted the research and contributed to the writing of the paper, generally with the major contributor mentioned first, as "senior author".
- How do you determine the listing of the authors?

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13.10

In addition to IMRaD, you will also need (cont'd…)

- An abstract: This is a short (generally 200-250 words in one paragraph) summary of the objectives of the work, the methodology used, the main results, and the major conclusions.
- Acknowledgments: Here you will mention any institutes or individuals who helped in the work, provided funding, etc.
- References: You will need to prepare references for all the works cited in the text. (As you probably already know, this is one of the most time-consuming and frustrating parts of the paper to prepare!)

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13.11

Materials and methods

- Should describe (and if necessary defend) the design and conduct of work that **has been** done and **is now** being reported
- You should use the past tense and present the section as a narrative of steps taken by the author(s)
- You can assume that the reader has the technical vocabulary to read and understand the paper
- If the subject is unusual or highly current, it would be wise to define in lay terms any unusual technical term included in the paper

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13.12

Materials and methods (cont'd…)

- The underlying principle behind the 'Materials and methods' section is that its contents must be presented in sufficient detail that a competent reader could repeat the work
- In agricultural research, the 'Materials and methods' section will often include details of:
  - study site
  - soil type
  - rainfall and other climatic information
  - any animals and plants (scientific name, subspecies, strain/variety)
  - Design, replication
  - Sampling procedures, sampling size, data collected

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13.13

Materials and methods (cont'd…)

- If you are reporting standard, recognized techniques they need not describe the procedures in detail. The name of the technique, plus a reference, if the technique or procedure has been described in a recognized journal is sufficient
- Do include details if the technique has been modified. You also do not need to provide detailed descriptions of simple processes such as measuring /mixing/applying fertilizer
- All names and abbreviations used should be clear and understandable and all measurements should be presented in internationally recognized SI Units and notation

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13.14

Statistics are methods!!

- You should include all details of experimental design and statistical analysis in the 'Materials and methods' section (e.g. ANOVA, $\chi 2$).
- With equipment and chemicals, ordinary procedures can be used without comment – chemical names, **trade names??**
- Consider using subheadings, setting out activities in chronological or narrative sequence, to make the section easier to read
- **In summary**, the 'Materials and methods' section
  - includes all necessary details
  - excludes all unnecessary details
  - and therefore contains only what you need to present
  - Should include all details so that someone else can repeat

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13.15

Results

- You present the output of the work
- These results are directly related to the objectives outlined in the Introduction
- It is helpful to summarize results in text and illustrate these words with tables and/or figures
  - **Tables:** if you want the reader to focus on numerical values
  - **Figures**: focus on relationship between variables
- The 'Results' section is often the shortest section of a research publication, but also the most important
- Do not present raw, unanalyzed data
- Be selective, presenting only that which is relevant to making the conclusions that you will present in the following 'Discussion' section
- Outliers can be left out but this requires explanation

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13.16

Results (cont'd…)

- Unanalyzed results are sometimes presented as appendices in PhD dissertations, and in some annual reports such as those from individual research stations
- It is often difficult (even painful!) to leave out results obtained through hard, long work
- The results should clearly describe what was found, including statistical tests, differences, and probabilities
- Statistical significance is reported in the 'Results' section
- Sometimes combine with discussion

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13.17

Tables and figures

- Are good tools to make your results easy to read and understand
- A table or a figure enables readers to see the (summarized data) for themselves, but the results remain the subject of the text (and not the tables or figures)
- You can state: "There was an inverse relationship between A and B (Figure 4)." but it should NOT say, "Figure 4 shows the relationship between A and B"

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13.18

Tables

- Useful for presenting analyzed summary data (e.g. means ± standard errors), level of significance
- Use them to show precise figures, as well as other (non-numeric) details, including words or symbols, to indicate location, treatments, variety, etc.

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13.19

Presenting tables

- Number and present your tables sequentially, in the order in which they are referred to in the text
- If you have many tables presenting related data, use the form "Table 1.1", "Table 1.2" *(chapter 1 table 1, chapter 1 table 2, chapter 2 table 1 etc)* rather than "Table No.1a", "Table 1b", etc
- A table should have a clear and concise title which tells what the table *shows*, not what the table is about
- Place your table numbers and titles above each table

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13.20

Here are the key elements of a good table

- A table has **column headings**, which should be short and easily understood
- A table has **row headings** (or **stub headings**)
- A table has a **field,** the "boxes" of information in the body of the table
- A table often has **footnotes**, either to explain any abbreviations or symbols being used or to provide a reference if the table (or field items within it) are taken from a source other than the Results being presented
- Footnote makes tables concise and clear

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13.21

Constructing tables

- Avoid using long numbers, particularly in column headings. These should be presented with abbreviations e.g. 4.38 x 10^7 not 43,800,000
- 10^7 included in a column heading and then "4.38"
- If a number is less than zero, a '0' should be included, e.g. 0.25
- Do not put too many items in a table, because it will become crammed and hard to interpret. If you have too few items, the table may be unnecessary
- If you have less than eight field items, you probably do not need a table and can present the results as text

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13.22

Constructing tables (cont'd…)

- Arrange comparisons in columns (vertically) rather than rows (horizontally)
- Should never use more significance digits than your method justifies
- Never use a dash (-) or zero (0) to indicate absence of results – can be confused with –ve sign. Use "ND" to indicate no data

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13.23

Constructing tables (cont'd…)

- A table should include the same group of elements down columns, and NOT across rows
- Columns with the same value throughout should not be included
- If a column has the same value all down its length (and if the value is needed) it could perhaps be better included as a footnote
- **In summary**, tables should be able to "standalone", be self-explanatory (with their title and footnotes), and help to convey the results of the experiment or study

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13.24

Constructing tables (cont'd…)

- A text may refer to a table but a table should not to a text, or figure or another table
- Where possible, a table should be organized in a "**portrait**" format
- Double space every five lines for easy reading
- Avoid the use of vertical lines between columns and use few horizontal lines except as needed
- Where should a table appear in a text?
  - Near the comment that refers to it
  - In a manuscript to a journal, tables are put in a separate section at the end. But please indicate in the text (Table x name here)

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13.25

Figures

- Figures are visual presentations of results that can save you hundreds, if not thousands of words
- Figures should be numbered separately from tables (i.e., a paper can have both a Table 1 and a Figure 1) and referred to by number in the text
- Present and number your figures sequentially, in the order in which they are referred to in the text
- Figures need a clear and concise title, which tells what the figure illustrates and allows the reader to interpret the figure without referring to the text
- Unlike with tables, the numbers and titles of figures are placed BELOW the figure
- Should focus on relationships among numbers

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13.26

Major types of figures for presenting results

- Several different and commonly used types of figures available to illustrate your research paper
- Each has advantages and limitations and is best suited for the presentation of particular types of information
- The type and quantity of **data** help decide if an illustration is necessary
  - Pie charts show proportions of a single variable.
  - Histograms compare quantities, such as yields, for different classes of variable.
  - Line graphs show trends and relationships or other dynamic comparisons of continuous variables
  - Scatter diagram

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13.27

Constructing a figure

- A figure should be simple enough to get the message across instantly
- Figures should be in black and white if possible - Color and grey shading can look good, but add to costs
- Changes from the original colors may occur during printing and cause further confusion
- If axes are used they should have brief informative titles (legends) and include any units of measurement
- Axes should not extend much beyond the range of the data
- **Remember, results may be presented as either tables or figures, NEVER as both**

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13.28

Discussion

- Discussion section of a scientific paper contains an interpretation of the results
- The results are related to the original objectives (as set out in the Introduction section)
- The discussion answers the readers' question "So what?" by explaining what the results "mean"
- Can also include limitations
- Indicate future research if evident
- You should not include in this section material on the research background and scientific context

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13.29

Discussion (cont'd…)

- Discussion draws on the information in the 'Results' section, explaining and interpreting the results, and showing how they have answered the questions set out in the 'Introduction'
- Sometimes you will include in the 'Discussion' section shortcomings, errors, inadequacies, or difficulties encountered during the research
- This is also the section for pointing out how your results compare with the findings of others, and explaining any differences from previously published research

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13.30

Discussion (cont'd…)

- Discussion interprets and draws theoretical principles and generalizations from the results
- You should avoid proposing principles and generalizations beyond what is DIRECTLY supported by the results
- You may wish to conclude the 'Discussion' section with some broad generalizations and speculations, based on the results and other (published) work (with references)
- You may also end this section by identifying further problems and the next steps and additional research needed—limitations and areas for further research

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13.31

Conclusion

- If you are reporting on a long and complex piece of research, and if you have complicated results, you may well want to include a separate 'Conclusion' section.
- If so, you may begin this section with a very brief summary restatement of the major results and highlights of the 'Discussion' section as they relate to future needs and activities.
- Before preparing a separate 'Conclusion' section, check on the style and format instructions to authors of the journal to which you are planning to submit your paper

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13.32

Introduction

- The 'Introduction' section of a research paper presents the nature and range of the problem investigated
  - where, when, and how does the problem appear?—magnitude
  - how wide are its impacts? - scope
  - in what way is present knowledge and understanding inadequate?
  - what is the purpose of the work, what benefits will an answer bring?

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13.33

Introduction (cont'd…)

- In the 'Introduction' you will include:
  - a review of relevant and pertinent literature
  - results and conclusions of previous work
  - an explanation (rationale) of why the work being described was needed
- Include only information that is directly relevant to your research
- Resist any temptation to dress up your work with unnecessary and irrelevant references—not impress the journal editor, only irritate

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13.34

Introduction (cont'd…)

- Do include widely available review papers or book chapters as background references, and try to avoid hard-to-obtain journals, MSc/PhD theses, and internal reports
- The 'Introduction' sets the problem in the context of current knowledge and should move from describing the general setting to describing the specific situation
- If you think it important, you may include broad details of the study area and the region in which the problem or crop/animal being investigated occurs (with both common and scientific names)

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13.35

Introduction (cont'd…)

- A key section of the introduction is the listing of your objective(s). These will often lead logically to a suggested hypothesis
- The 'Introduction' is also the place for a broad description and justification of the method(s) you have chosen
- If you have more than one objective, present these in a logical order. This order will then be repeated elsewhere in the paper, making it easier for the reader to follow and understand

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13.36

Introduction (cont'd…)

- In a well-constructed paper this sequence :
  - will **probably** be repeated in the 'Materials and methods' section to show how the stated objectives were investigated
  - **should be** the sequence for reporting outcomes in the 'Results' section
  - **should be** the sequence in which results and objectives are interpreted and discussed in the 'Discussion'

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13.37

Introduction (cont'd…)

- The 'Introduction' sets out Questions 'A' 'B' 'C'
- The 'Materials and methods' describes how to Answer 'A' 'B' 'C'
- The 'Results' reports answers to 'A' 'B' 'C'
- The 'Discussion' interprets the answers to 'A' 'B' 'C'

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13.38

Title

- A title is a 'label' and not a grammatical sentence
- The title of a research paper should accurately and adequately describe the subject and contents of the paper in as few words as possible
- It should be easy to understand. Journals often limit the number of words that can be used to, e.g., 25 words or less
- Only the first word in the title (except for proper nouns) has a capital letter
- A title has no verb and does not end with a full stop (period).

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13.39

Title (cont'd…)

- Describe the subject of the work, not its results
- Titles are used in cataloguing and abstracting, in electronic/internet databases, and will be in the reference list of other research publications
- Should contain as many "key words" as possible—most important one comes first, or early in the title
- **Include** the name of any plants or animals, either as common names (if these exist) or scientific names, but not both
- **avoid** abbreviations, formulas, brand names, and unusual terms
- Generally should **not** have dates
- **Avoid** unnecessary words and phrases, such as "Observations on", "An investigation into", etc

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13.40

Types of titles

- a) **Indicative:** Effects of deficit irrigation on maize growth and yield on a clay soil
- b) **Informative:** Deficit irrigation decreases maize growth and yield on a clay soil
- c) **Question**: Does deficit irrigation affect maize growth and yield on a clay soil?
- d) **Main title/Subtitle (Hanging):** Deficit irrigation: effects on maize growth and yield on a clay soil

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13.41

Titles for non-technical audiences

- When writing for lay people, such as donors, you will need to provide a simpler and catchier title for your work
- A good strategy is to use a two-part title – perhaps using the main sub-title' or the 'Question' title categories
- The main title could be the catchy, attention-grabbing part of the title in lay-person's language, with a more scientific subtitle

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13.42

Titles for non-technical audiences: Examples….

- Fishes for the future: identification and characterization of endangered aquatic species in selected tropical sites
- More beans for Africa: sustainable bean productive through germplasm enhancement and input use efficiency
- Why do the chickens die? Developing low-cost and simple techniques for aflatoxin estimation in foods and feeds
- Did we make a difference? Assessment of past and expected impact of livestock research in the 1990s

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13.43

Authors

- In principle the authors of a research paper or article are those who have contributed substantially to the conduct of the research AND the preparation of the research article
- This may include an intellectual contribution, for example supervisors of research papers arising from Ph.D. theses
- Names of authors should be complete enough to ensure proper identification
- For authors with the same surname or family name, it may be necessary to add full names instead of initials
- The major contributor to the research work and the writing of the research paper is named as first ("Senior") author, with other authors following in decreasing order of their level of contribution to the work
- If there are many authors, with broadly equal levels of contribution, alphabetical listing may be used
- Include addresses of all the authors, following the journal style

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13.44

Abstract

- The abstract (or summary or resumé) is a concise summary of the paper and generally should not exceed 250 words
- An abstract is *definitive (NOT descriptive)*, i.e., it gives the hard facts in the form of statements concerning what is contained in the research paper
- The abstract should not repeat any information contained in the title; together with the title, the abstract is a self-contained account of the research being presented
- Abstracts are included in catalogues and electronic/ Internet databases and are of major use in enabling others to quickly and easily decide if they wish to read the full paper
- Your abstract should follow the IMRaD structure
- Consider writing the abstract after you have written all the other parts of the research paper

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13.45

The abstract includes…..

- The objectives and purpose of the work
- An outline of the 'Materials and methods' (with details of new techniques or equipment)
- Scientific and common names of organisms - complex names (e.g. of chemicals, or terminology) may be set out at first mention with an abbreviation that is used subsequently

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13.46

The abstract does not include or refer to……

- Details of materials and methods, and only mentions the most important results and conclusions
- Any figures or tables presented in the main paper
- References or literature cited in the main paper
- The above can be included in a summary (difference between abstract and summary)

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13.47

Keywords

- Keywords are a list of important words (or short phrases) used in the main text and or abstract but NOT already present in the title.
- Keywords are included with the title and the abstract in the indexing of the published article in electronic databases.
- Choose your key words carefully to complement those in the title to attract the largest number and broadest range of potential readers.

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13.48

Acknowledgements

- The acknowledgements consist of a short paragraph (one or two sentences) thanking individuals or institutions who have contributed to the work.
  - These might include:
  - Technicians - if closely and significantly involved
  - Supervisors - if they have contributed to the work
  - Outside institutions or companies that supplied equipment or facilities (e.g., land for experiments)
  - Colleagues who gave advice or with whom you discussed ideas
  - Statisticians who helped with the analysis and interpretation of results
- **Remember** to include donors in your acknowledgments. Give the name of the agency, the name of any large program of which the work forms a part, and perhaps a grant code or number. If the work derives from a thesis **not** referred to in the text, this can be mentioned in the acknowledgments

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13.49

Citations and references

- The reference list contains full details of all articles specifically referred to in the text. These are called the text citations.
- Text citations generally give the name(s) (generally the "surname" or main name) of the author(s) of the article and its year of publication. This system of text citation is often referred to as the "Harvard" or Name-Year system.
- Other systems also exist; some medical and biochemical science journals, for instance, use numbering systems.
- References may be used either in explaining and justifying the need for the work, the conduct of the work, or the implications of the work.
- The purpose of the reference list is to enable other researchers to trace and obtain any previously published research used to describe and support the new work being presented.
- Equally importantly, references allow readers, should they wish, to arrive at their own opinions as to whether this previously published work has been interpreted and used correctly, and from this judge the value of the new work being presented

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13.50

Text citations - 1. *The Harvard (author-year) system*

- Harvard system varies between journals, for example in the use of upper case or the placement or absence of commas
- When a reference written by two authors (a "joint-authored" citation) is cited in the text, the names are linked by "and"
- Citing a reference written by three or more authors (a "multi-authored" citation) the name of the first author is followed by "*et al*."
- A close study of the particular journal's "Notes for Authors" and of a recently published paper is necessary

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13.51

Some examples of text citation styles

- "…those of Stutzel (1995) and Manschadi *et al.* (1998)…"
- "…up to 80 cm (Anderson 1985; El-Shatnawi and Goshesh 1988; El-Shatnawi *et al.* 1999)…" (Australian Journal of Agricultural Research)
- "…in cinnamon (Bullerman et al. 1977, Jay 1986, Chang 1995, Holt and Gomez-Almonte 1995)…" (Food Microbiology)
- "…milk composition (Jelinek et al. 1996; Burriel, 1997)…" and "…similarly, Culioli & Sherman (1978), Schmutz & Puhan (1978) and Garnot et al. (1982) found…" (Journal of Dairy Research)

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13.52

2. Numbered citation systems

- Numbering with alphabetical reference listing.
- The complete reference list is numbered in alphabetical order and these numbers assigned to the citations in the text. eg.: "...as Franzel *et al*.(2) and Ajayi (1) have shown…"
- 1. Ajayi, O. (1987) The effect of different types of farmer participation on the management of on-farm trials. Agricultural Administration and Extension 25: 235–252
- 2. Franzel, S.; Lagesse, D.; Colburn, F. & D. Getahun (1989) *Grain marketing and peasant production in Ethiopia*. Research Report No.5. Addis Ababa: Institute of Agricultural Research. 48p
- In some review papers, which may include well over 100 citations, to save space this may be reduced further by omitting the authors' names. eg.: "...as has been shown (1, 2)..."

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13.53

3. The Vancouver system

- Numbering with sequential reference listing
- References are numbered in the text as they are first cited, and are listed in the reference list in this sequence. e.g.: "...as Franzel et al.1 and Ajayi 2 have shown…"
- 1. Franzel, S.; Lagesse, D.; Colburn, F. & D. Getahun (1989) *Grain marketing and peasant production in Ethiopia*. Research Report No.5. Addis Ababa: Institute of Agricultural Research 48p.
- 2. Ajayi, O. (1987). The effect of different types of farmer participation on the management of on-farm trials. Agricultural Administration and Extension 25: 235–252.

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13.54

The reference list

- The reference list should contain all the details of a text citation necessary to find and photocopy the work being cited, either in an institute or university library or from any other source
- In general the list is prepared in alphabetical order of the surname (or main name) of the first author, then by initials if there are two authors with the same surname/main name, then by date (year)
- There are some general rules in alphabetical listing:
  - All works by an author alone precede any co-authored or multi-authored work where s/he is first author
  - Works *written* by an author precede works *edited* by the same author
  - Works by the same author (or authors in the same sequence) in the same year are arranged by alphabetical order of the **titles** and then marked by letters, e.g. (Smith 1999a), (Smith 1999b)

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13.55

Citing a *journal article* comprise

- Author(s)
- Date (generally year)
- Title of work being cited (with only the first word and proper nouns having a capital letter)
- Name of the Journal. Volume (and sometimes issue number of the volume, e.g. 4(2) means Volume 4 (Issue 2).

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13.56

Citing a *complete book* comprise

- Author(s) or editor(s)
- Date of publication (year)
- *Title of book* (often in *italics*)
- Edition of book if not the first edition
- City of publication + publisher
- Total number of pages or start page number – last page number of section being cited
- (Titles of "grey literature", internal or "self-published" reports, working papers, etc., are not italicized)
- The country, state, or province of the city should be added if the city is not well known or there is the possibility of confusion

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13.57

Citing a *chapter in a multi-authored volume* comprise

- Author(s) of chapter being cited
- Title of chapter being cited
- Start (first) page number of the chapter cited – last page number of chapter cited
- Editor(s) of volume in which chapter appears
- *Title of volume* in which chapter appears (often in *italics*)
- City of publication + publisher

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Some final examples

- **Keisler DH, Andrews ML & Moffatt RJ** 1992. Subclinical mastitis in ewes and its effects on lamb performance. Journal of Animal Science **70** 1677–1681 (Journal of Dairy Research)
- Glass, K. A. and Doyle, M. P. (1989). Fate of *Listeria monocytogenes* in processed meat products during refrigerated storage. *Appl. Environ. Microbiol.* **55,** 1565–1569. (Food Microbiology)
- **Crosby, D.G.** 1981. Environmental chemistry of pentachlorophenol. Pure Appl. Chem. **53:**1052–1080. (Journal of Bacteriology)
- Nyczepir, A. P., and Lewis, S. A. 1979. Relative tolerance of selected soybean cultivars to *Hoplolaimus columbus* and possible effects of soil temperature. J. Nematol. 11:27–31. (Plant Disease)
- Anghinoni I, Barber SA (1980). Predicting the most efficient phosphoros placement for corn. *Soil Science Society of America Journal* **44**, 1016–1020. (Australian Journal of Agricultural Research)

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13.59

Scientific publications 1. Review articles

- Reporting from several sources – a common form in university training, journals and conferences
- Review of literature – longer form
- Should be comprehensive and critical
- Collect both +ve and –ve information
- Compare and contrast
- Give a balanced perspective
- Can draw definite conclusion, identify gaps in research and new areas of research

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Structure of the review paper

- Introduction – problem, why the review
- Preamble
- Various sub-sections
  - general to specific
  - Themes and sub-themes etc
  - A tentative summary for each section
- A general discussion – convince the reader with sound argument supported by evidence
- Conclusion – at least 2 references to support an idea
- References
- Note:
  - The major difference is the body is the literature review,
  - Make sure that the introduction and conclusion use similar words

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Scientific publications 2. Thesis

- Can be a monograph – collection of papers
  - Main difference is the style and layout
- Monograph
  - Use university guidelines
  - Extended literature review
  - Main body split into sections/chapters
  - A chapter on methodology
  - If number of experiments, then each can form a chapter
  - No right or wrong way of dividing/ sections or chapters
  - General discussion: compares with previous findings, discuss implications. Consider the whole picture as well as the individual pieces

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13.62

Scientific publications 2. Thesis

- Thesis – a collection of published papers
  - Each paper follows the journal article format
  - An introduction and discussion to link together
  - Discussion
    - Compare results with previous publications
    - Discuss implications
    - Relationship between the different papers
    - Consider the whole picture as well as individual pieces

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13.63

Scientific publications 3. Popular science article

- Audience is public
- Structure
  - Title – short exciting and informative
  - Preamble
    - importance of the topic
    - Content of the article
    - Should make the reader curious
  - Body
    - Do not follow any standard structure
    - Divided into sections
    - Headings and sub-headings short, informative and eye-catching
    - Visual can be very effective
    - Logical transition

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13.64

Scientific publications 3. Popular science article

- Layout
  - Determined by the style of the magazine
  - Do not make it too long
  - Look at articles previously published
- Language
  - Simple, layman language
  - If using scientific/technical terms, please explain
- Keep your audience in mind at all times

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Main sections of a scientific paper

Section	Intends to tell the reader
Title	What the paper is about
Abstract	A stand-alone short summary
Introduction	The problem, background and what is known already, and the focus of research
Materials and methods	What you did? How you did it?
Results	What you found
Conclusions	Possible implications, limitations, future direction
Acknowledgement	Who contributed to work and how
Reference	How to find the paper referred to
Appendix	Supplementary materials

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Thank you!

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Session 13: Notes to participants: Structure and preparation of a scientific paper

13.1 When, where and what to publish

We have looked at when and to whom you, as a researcher, need to communicate. We have also discussed the many different reasons why you need to communicate, and analysed some of the obstacles you need to overcome to successfully communicate your research.

In this session, we are going to examine the structure of a scientific paper and how you should go about preparing it.

13.1.1 When to publish

The decision as to when to publish may be made for a number of reasons, and is closely linked to 'why do researchers report'. Most research journals state that papers submitted for consideration must 'make a significant and original contribution to knowledge'.

In an ideal world, researchers would follow this by only publishing when they felt they had something worth saying. However these are subjective judgments, and you may have professional imperatives (need for promotion or tenure, for instance) that are pushing you to publish before your contribution to science is truly 'significant'. Ideally, a research article should contain a coherent single body of work answering one or two major questions on a major theme and generating one or two further avenues of research.

Research diverging from this major theme or subject area should be considered for separate publication(s). If several major themes of a substantial body of work are logically linked, a series of publications with a common major title and various more-specific sub-titles may be considered. However, preparing such research for publication will be a major undertaking. All papers should appear within the same journal, ideally within a short period of time. Will all be accepted by the journal? Will you have time to write them all?

13.1.2 Where to publish

The question for a researcher of where to submit the paper he or she is about to write is an important one. It not only determines the required format for the article but also its distribution and the expected recognition that should come from acceptance of the paper by the editors. International journals are generally considered the most thorough and scrupulous of all publication channels. But their content may not be directly relevant to those researchers, whose papers addresses issues of regional or national importance. Some researchers perceive that international journals are biased against authors from developing countries, perhaps because they had one or more papers rejected for publication. Rejection is no proof of such bias.

Well-known international journals reject a large number of the papers that they receive. All researchers should look carefully at the contents of some recent issues of the journal of their choice to see whether the published articles address similar topics as their own article is going to discuss. On reflection, a better journal for the paper to be written could then be a regional or national journal of science rather

than the international one. This is especially so when writing about agricultural development that is site-specific, and whose results are directly practical.

This sort of research, while both important and scientifically valid, may not have the broad general applicability demanded by some well-known international journals. Also, the people who will benefit most from access to site-specific and practical results are unlikely to have access to these (often expensive) international journals. So there may be both a need and an obligation to present this sort of research in more easily accessible regional or national journals. Hence, a regional or national agricultural science journal could be a sensible choice, even though regrettably, publishing in such journals may not carry as much scientific prestige as comes with publishing in a recognized international journal.

13.1.3 What to publish

Research articles and papers (in particular in the natural sciences) convey certain information in addition to new results, and generally do so in a standard manner and sequence. In broad terms a research paper:

- Typically presents experimental work–usually a minimum of two experiments, or field work conducted over two or more growing seasons.
- Explains the motivation for conducting the work.
- Explains the design and conduct of the work.
- Presents the results of the work.
- Proposes an interpretation and meaning of the results.
- Considers the significance of the results and of the interpretation proposed.

A good research paper will present all this in clear, concise, and unambiguous language.

13.2 Major sections of a scientific paper

The major sections required in a paper are often abbreviated in the acronym 'IMRaD' meaning; Introduction, Methodology (Materials and Methods), Results, and Discussion.

Other sections are clearly necessary (a title, abstract, references, etc.) but the main substance of a paper is contained within the four sections of the IMRaD acronym.

These four components can be thought of as covering and describing different stages of the research process, those stages of 'Past Research', 'Present Research', and 'Future Research'.

- Introduction—'Why'.
  - The introduction presents the nature and scope of the problem being considered. It addresses why is the topic important, how does it relate to previous knowledge and what was your hypothesis or objectives?
- *Methodology (Materials and Methods)*—'Where, When, and How'
  - This section is a narrative describing the design (plus duration, location, and climate) and conduct of the experiment in sufficient detail that another researcher could repeat the work if necessary—including the statistical design used and the analysis performed. The section describes how the study was conducted specifically focusing on project plan, experimental design, materials used, methods for making observation, data to be collected and how analysis of the data will be done.

Box 1: Components of a scientific paper

- Title
- Author
- Abstract
- Acknowledgement
- Introduction
- Methodology (Materials and Methods)
- Results
- Discussion
- References

- *Results*—'What'

This section describes what was found, giving summaries of data obtained, as text, tables, figures, or graphs.

- Discussion—'So What?'

This section contains an interpretation of the results. The discussion section talks about the relationship of the results to the questions posed in the introduction, and explains how these results contribute to answering the 'Why' of the research. In other words, results are discussed and interpreted in relation to the previous knowledge, formulated problems, your hypothesis/objectives.

In addition to IMRaD, you will also need:

Title

In preparing the title, you should use the fewest possible words to accurately describe the content of the paper.

Authors

You will need to include the names and addresses of those who conducted the research and contributed to the writing of the paper, generally with the major contributor mentioned first, as 'senior author'.

Abstract

This is a short (generally 200–250 words in one paragraph) summary of the objectives of the work, the methodology used, the main results, and the major conclusions.

Acknowledgements

Here you will mention any institutes or individuals who helped in the work, provided funding, etc.

References

You will need to prepare references for all the works cited in the text. (As you probably already know, this is one of the most time-consuming and frustrating parts of the paper to prepare!)

13.3 Preparing the paper—which sections to write first

Whilst the preceding paragraphs outline the structure and presentation of a typical research paper when published, many researchers approach the planning and writing of a paper in a very different order. Each person has their own preferred method, but the most important thing is to just get started—to begin putting facts and ideas on paper (or on computer)—in other words, overcoming writer's block.

A well-recognized and very successful approach is to actually write the sections of a paper and to follow the following order of preparing sections —'MRaDI'. Others prefer to start with writing a review of recent relevant literature. This helps in identifying which parts of the methodology are new and need to be discussed in more detail than the familiar or standard methods and techniques that were used. Having a good review of the literature also assists in answering the 'why' question of the Introduction and the 'So what' and 'What next' aspects of the Discussion

The Materials and Methods should be the most straightforward section to write, requiring least thought and interpretation on the part of the researcher. So you would do well to start with this section. Following this with the Results section (including any tables or figures that might be needed) makes sense. It is a relatively easy section to write that also involves presenting facts in a largely straightforward and objective manner. This section will also require the presentation of any data transformations or statistical analysis used in preparing the results. This may therefore also help in thinking through ideas and interpretations for the later 'Discussion' section.

By the time these sections have been completed, ideas and thoughts should be flowing thus leading smoothly to the writing of the Discussion and Conclusion sections. At this stage, the researcher should be able to place the whole report in the context of other work (including research that may have been published since the work being reported was first started) and enable the writing of a comprehensive and up-to-date Introduction.

In all cases, getting started is often one of the hardest parts, and one of the easiest ways of beginning a paper, even in this age of computers, is by simply writing subheadings, key words, ideas, and references down on a blank piece of paper with a pencil. If you often find yourself staring at a blank screen, try it! The actual writing of the sections should follow closely the guidelines set out in the 'introductions to authors', which are specific to each journal.

13.4 Methodology (Materials and Methods), Results, Tables, and Figures

13.4.1 Materials and Methods

This section of the research paper should describe (and if necessary defend) the design and conduct of work that has been done and is now being reported. You should use the past tense and present the section as a narrative of steps taken by the author(s).

You can assume that the reader has the technical vocabulary to read and understand the paper. However, if the subject is unusual or highly current, it would be wise to define in lay terms any unusual technical term included in the paper.

The underlying principle behind the Materials and Methods section is that its contents must be presented in sufficient detail that a competent reader could repeat the work. Check carefully to see that you have done this. In agricultural research, the Materials and Methods section will often include details of:

- Study site
- Soil type
- Rainfall and other climatic information
- Any animals and plants (scientific name, subspecies, strain/variety)

If you are reporting standard, recognized techniques they need not describe the procedures in detail. The name of the technique, plus a reference if the technique or procedure has been described in a recognized journal is sufficient. This is true, for instance, of techniques for preparing reagents or media (e.g., how to make nutrient agar is generally written on the jar!). However, do include details if the technique has been modified. You also do not need to provide detailed descriptions of simple processes such as measuring/mixing/applying fertilizer. Simple details of the quantities applied and method(s) of application are sufficient.

Use the generic names of equipment and chemicals ('a rotivator', '75% hydrochloric acid'). Only use proprietary or brand names if any differences between makers or suppliers would be significant and relevant to your work. Be sure to describe any modifications to equipment. All names and abbreviations used should be clear and understandable and all measurements should be presented in internationally recognized SI Units and notation.

Statistics are methods!! You should include all details of experimental design and statistical analysis in the 'Materials and Methods' section. As with equipment and chemicals, ordinary procedures (e.g. ANOVA, χ^2) can be used without comment. However, if you are using any advanced or unusual methods or procedures, provide a reference and details of any software used. The 'Material and Methods' section may contain a wide range of diverse information. So consider using subheadings, setting out activities in chronological or narrative sequence, to make the section easier to read. For example:

Materials and Methods

- Site selection and land preparation
- Experimental design, planting, and maintenance
- Data recording and statistical analysis.

In summary, the 'Materials and Methods' section

- Includes all necessary details
- Excludes all unnecessary details and therefore
- Contains only what you need to present the results section that follows.

13.4.2 Results

In the 'Results' section you present the outcomes of the work. These results are directly related to the objectives outlined in the 'Introduction'. It is helpful to summarize results in text and illustrate these words with tables and /or figures.

Remember: the 'Results' section is often the shortest section of a research publication, but also the most important. Do not present raw, un-analysed data. Do not feel that all data and results should be included. Be selective, presenting only that which is relevant to making the conclusions that you will present in the following 'Discussion' section. Being selective does not mean that you can disregard and delete data that differ from what you expected, e.g. the so-called outliers which are either much higher or lower than all the other data. You can only do so, if you are certain that those data are the result of faulty equipment or errors in data recording. If you cannot explain why they are so different and yet

wish to exclude them from the data set you used in the analysis, you need to mention this explicitly either in a footnote to the table or, better still, in the text of the 'Results' section.

(Note that un-analysed results are sometimes presented as appendices in PhD dissertations, and in some annual reports such as those from individual research stations). It is often difficult (even painful!) to leave out results obtained through hard, long work. The skill is to judge what results to include, and what results (however 'interesting' or 'important') should be left out. The results you do include should clearly describe what was found, including statistical tests, differences, and probabilities. Statistical significance is reported in the 'Results' section.

However, the interpretation of agricultural, biological, or scientific importance (or 'significance') is not; this is done in the 'Discussion' and /or 'Conclusion' section(s).

Tables and figures (see below) are good tools to make your results easy to read and understand. But you also need to state your results clearly in words. A table or a figure enables readers to see the (summarized data) for themselves, but the results remain the subject of the text (and not the tables or figures). This can be illustrated by an example: a 'Results' section might state: 'There was an inverse relationship between A and B (Figure 4)', but it should NOT say, 'Figure 4 shows the relationship between A and B'.

13.4.3 Tables and figures

Tables

Tables are useful for presenting analysed summary data (e.g. means ± standard errors). You can use them to show precise figures, as well as other (non-numeric) details, including words or symbols, to indicate location, treatments, variety, etc.

Presenting tables

Each table generally has a separate table number. Number and present your tables sequentially, in the order in which they are referred to in the text. (If you have many tables presenting related data, use the form 'Table 1.1', 'Table 1.2' rather than 'Table No. 1a', 'Table 1b', etc.). A table should have a clear and concise title which tells what the table *shows*, not what the table is about. Place your table numbers and titles above each table.

Here are the key elements of a good table:

- A table has column headings, which should be short and easily understood.
- A table has row headings (or stub headings).
- A table has a field, the 'boxes' of information in the body of the table.
- A table often has footnotes, either to explain any abbreviations or symbols being used or to provide a 'Reference' if the table (or field items within it) are taken from a source other than the Results being presented.

Constructing tables

If possible, avoid using long numbers, particularly in column headings. These should be presented with abbreviations e.g. 3.92×10^7 not 39,200,000; or 10^7 included in a column heading and then '3.92'. If a number is less than zero, a '0' should be included, e.g. 0.25.

Do not put too many items in a table, because it will become crammed and hard to interpret. If you have too few items, the table may be unnecessary. If you have less than eight field items, you probably do not need a table and can present the results as text. A table should include the same group of elements down columns, and NOT across rows.

However, columns with the same value throughout should not be included. If a column has the same value all down its length (and if the value is needed) it could perhaps be better included as a footnote. To make your tables easy to read, do not separate the columns with vertical lines.

In summary, tables should be able to 'standalone', be self-explanatory (with their title and footnotes), and help to convey the results of the experiment.

Figures

'A picture tells a thousand words'. Figures are visual presentations of results that can save you hundreds, if not thousands of words. Figures should be numbered separately from tables (i.e., a paper can have both a Table 1 and a Figure 1) and referred to by number in the text. As with tables, present and number your figures sequentially, in the order in which they are referred to in the text. (Also, as with tables avoid 'Figure 1a', 'Figure 1b', etc. and use 'Figure 1.1', 'Figure 1.2'). Like tables, figures need a clear and concise title, which tells what the figure illustrates and allows the reader to interpret the figure without referring to the text.

Notice that unlike with tables, the numbers and titles of figures are placed BELOW the figure.

For inclusion in a research paper a figure should be:

- Simple, clear, and visually attractive—not crowded
- Stand-alone (with its titles and any footnotes)
- Easy to understand without need to refer to any other part of the paper

Major types of figures for presenting results

You have several different and commonly used types of figures available to illustrate your research paper. Each has advantages and limitations and is best suited for the presentation of particular types of information. The type and quantity of data help decide if an illustration is necessary, the type of information to be conveyed helps decide what type of figure is most suitable.

- Pie charts show proportions of a single variable.
- Histograms compare quantities, such as yields, for different classes of variable.
- Line graphs show trends and relationships or other dynamic comparisons of continuous variables.

Constructing a figure

A figure should be simple enough to get the message across instantly. The inclusion of too much detail may just create confusion. Figures should be in black and white if possible. Colour and grey shading can look good, but add to costs. Changes from the original colours may occur during printing and cause further confusion. If axes are used they should have brief informative titles (legends) and include any units of measurement. Axes should not extend much beyond the range of the data. If needed, the items in a figure should contain simple and relevant legends.

Remember, results may be presented as either tables or figures, never as both.

13.5 Discussion, Conclusion, Introduction

13.5.1 Discussion

The 'Discussion' section should interpret results clearly, concisely and logically. Cite evidence from the literature that supports or contradicts your results and explain contradictions. Describe the limitations of your research. Results or references to tables or figures already described in the results section should not be repeated in the discussion. The 'Discussion' section of a scientific paper contains an interpretation of the results. The results are related to the original objectives (as set out in the Introduction section). The discussion answers the readers' question 'So what?' by explaining what the results 'mean'. You should not include in this section material on the research background and scientific context. This information is set out in the 'Introduction' and should not be repeated. Nor should you repeat the questions your work is attempting to answer—these too should be shown in the Introduction.

The discussion draws on the information in the Results section, explaining and interpreting the results, and showing how they have answered the questions set out in the Introduction. Sometimes you will include in the 'Discussion' section shortcomings, errors, inadequacies, or difficulties encountered during the research. This is also the section for pointing out how your results compare with the findings of others, and explaining any differences from previously published research.

The discussion interprets and draws theoretical principles and generalizations from the results. But you should avoid proposing principles and generalizations beyond what is directly supported by the results. You may wish to conclude the discussion section with some broad generalizations and speculations, based on the results and other (published) work (with references). You may also end this section by identifying further problems and the next steps and additional research needed.

13.5.2 Results and Discussions in the same section

Combining 'Results' and 'Discussions' in the same section may be a good way to avoid repetition.

It is recommended that you use past tense to refer to results of your own research, but you may use the present tense to refer to results that are generally accepted.

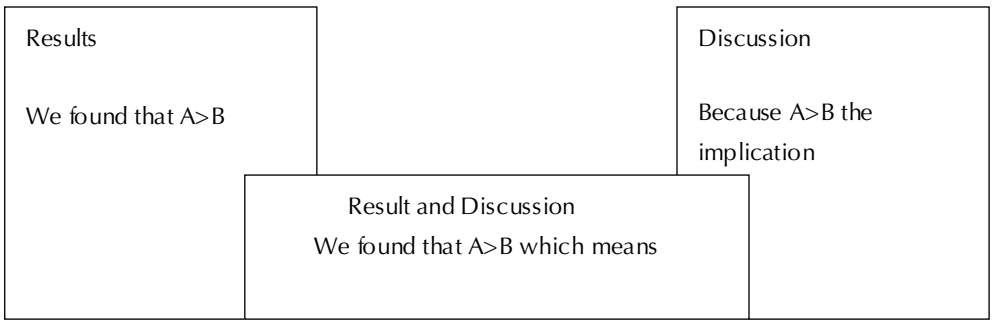


Figure 1. *Combining results and discussions.*

13.5.3 Conclusion

If you are reporting on a long and complex piece of research, and if you have complicated results, you may well want to include a separate 'Conclusion' section. If so, you may begin this section with a very brief summary restatement of the major results and highlights of the 'Discussion' section as they relate to future needs and activities. Before preparing a separate 'Conclusion' section, check on the style and format instructions to authors of the journal to which you are planning to submit your paper.

Introduction

- The 'Introduction' section of a research paper presents the nature and range of the problem investigated (Why is the topic important, how does it relate to previous knowledge, what was your hypothesis or objectives)
- Where, when, and how does the problem appear?
- How wide are its impacts?
- In what way is present knowledge and understanding inadequate?
- What is the purpose of the work, what benefits will an answer bring?

In the 'Introduction' you will include:

- A review of relevant and pertinent literature
- Results and conclusions of previous work
- An explanation (rationale) of why the work being described was needed
- Keep focused. Include only information that is directly relevant to your research. Resist any temptation to dress up your work with unnecessary and irrelevant references. These will not impress the journal editor, only irritate. Do include widely available review papers or book chapters as background references, and try to avoid hard-to-obtain journals, MSc/PhD theses, and internal reports. The 'Introduction' sets the problem in the context of current knowledge and should move from describing the general setting to describing the specific situation. If you think it important, you may include broad details of the study area and the region in which the problem or crop/animal being investigated occurs (with both common and scientific names). However, reserve more details on, for instance, soil type and plant variety for the later 'Materials and Methods' section. Any specialized terms or abbreviations should be explained in the 'Introduction'. A key section of the introduction is the listing of your objective(s). These will often lead logically to a suggested hypothesis. The 'Introduction' is also the place for a broad description and justification of the method(s) you have chosen. If you have more than one objective, present these in a logical order. This order will then be repeated elsewhere in the paper, making it easier for the reader to follow and understand. In a well-constructed paper this sequence :
- Will probably be repeated in the 'Materials and Methods' section to show how the stated objectives were investigated
- Should be the sequence for reporting outcomes in the 'Results' section
- Should be the sequence in which results and objectives are interpreted and discussed in the 'Discussion'
- Readers can then follow the logic of your research throughout the paper. In turn, therefore:
- The 'Introduction' sets out Questions 'A' 'B' 'C'
- The 'Materials and Methods' describes how to Answer 'A' 'B' 'C'
- The 'Results' reports answers to 'A' 'B' 'C'
- The 'Discussion' interprets the answers to 'A' 'B' 'C'

Titles

The title of a research paper should accurately and adequately describe the subject and contents of the paper in as few words as possible. It should be easy to understand. Journals often limit the number of words that can be used to, e.g. 25 words or less. A title is a 'label' and not a grammatical sentence. Only the first word in the title (except for proper nouns) has a capital letter. A title has no verb and does not end with a full stop (period).

A title should generally describe the subject of the work, not its results. The title will almost certainly be the most widely seen and read part of the research paper. Titles are used in cataloguing and abstracting, in electronic/internet databases, and will be in the reference list of other research publications. A good title will help future researchers identify your paper, so it should contain as many 'key words' as possible. The most important of these should come first, or early in the title. In most conferences and symposia, papers are presented under different themes and sub themes. Vague and uninformative title increase the risk that the abstract might be allocated to an inappropriate session or even be rejected.

The title should include the name of any plants or animals, either as common names (if these exist) or scientific names, but not both. If the work and its conclusions are restricted or relevant to a particular region this should be named (e.g. sub-Saharan Africa; the Indus Valley). The title should avoid abbreviations, formulas, brand names, and unusual terms.

A title should not have dates. A title should avoid unnecessary words and phrases, such as 'Observations on', 'An investigation into', etc. A title is often best written after completing the paper. It may even be the very last thing to be written!

Types of titles

In general, title can be categorized into one of four types:

a Indicative:
- Effects of deficit irrigation on maize growth and yield on a clay soil

b Informative:
- Deficit irrigation decreases maize growth and yield on a clay soil

c Question:
- Does deficit irrigation affect maize growth and yield on a clay soil?

d Main title/subtitle:
- Deficit irrigation: Effects on maize growth and yield on a clay soil

Box 2: Tips for developing a good title

1. Should attract people to your paper
2. Should tell what the paper is about
3. Should be informative, specific and concise
4. Should describe the subject of research and not the results
5. Put the most important words first
6. Describe the novel material used—to differentiate your research from others on the subject
7. Limit the title to not more than 7–10 words
8. Make sure that the final title is relevant to the content of the paper
9. For review papers, consider using a hanging title, e.g XXXXXXX: A Review

Titles for non-technical audiences

When writing for lay people, such as donors, you will need to provide a simpler and catchier title for your work. A good strategy is to use a two-part title—perhaps using the 'main-sub-title' or the 'question' title categories suggested above. The main title could be the catchy, attention-grabbing part of the title in lay-person's language, with a more scientific subtitle. Here are some examples, taken from successful project proposals. The lay-person's language part of the title might also be useful for articles in newspapers and other non-technical media.

- Fish for the future: identification and characterization of endangered aquatic species in selected tropical sites
- More beans for Africa: sustainable bean productive through germplasm enhancement and input use efficiency
- Why do the chickens die? Developing low-cost and simple techniques for aflatoxin estimation in foods and feeds
- Did we make a difference? Assessment of past and expected impact of XXX's work in the 1990s

Authors

In principle, the authors of a research paper or article are those who have contributed substantially to the conduct of the research and the preparation of the research article. This may include an intellectual contribution; for example supervisors of research papers arising from PhD theses. The choosing (or 'granting') of authorship can be a difficult issue.

Names of authors should be complete enough to ensure proper identification. If there are authors with the same surname or family name, it may be necessary to add full names instead of initials. Names of authors should be listed in a logical sequence. This usually means that the major contributor to the research work and the writing of the research paper is named as first ('senior') author, with other authors following in decreasing order of their level of contribution to the work. If there are many authors, with broadly equal levels of contribution, alphabetical listing may be used.

If alphabetical listing is used this should be mentioned. Include addresses of all the authors, following the journal style (this will be discussed later). Questions and queries ('correspondence') concerning the research paper by future readers would normally be sent to the senior author. If for some reason this is not the case and correspondence should be sent to someone other than the senior author, this should be indicated. This is usually by means of a symbol alongside the name of the chosen (corresponding) author with an explanatory footnote.

Abstract

The abstract (or summary or resumé) is a concise summary of the paper and generally should not exceed 250 words. In general, the shorter the abstract the better. The abstract should not repeat any information contained in the title; together with the title, the abstract is a self-contained account of the research being presented.

Abstracts are included in catalogues and electronic/internet databases and are of major use in enabling others to quickly and easily decide if they wish to read the full paper. For this reason, try to convey as much information as possible to have the greatest impact. Your abstract should follow the IMRaD structure, but you should write it as a single paragraph, with no tables of figures.

Box 3: Issues to note about abstract

- Abstracts are read on their own
- Read by most people and often it will determine whether they read the entire paper
- Should describe the problem and summarize the major points of the research in a brief and understandable forms
- Start with
  - Clear statement of the objectives
  - Approach
  - Main results
  - Should end with one or two sentences that emphasize important conclusions
- Depending on the journal, the length of the abstract is restricted to maximum number of words
- Should stand alone
- Do not cite references to literature, tables and 'figures'
- Avoid using abbreviations
- Use the same tense throughout the section or at least throughout a paragraph. Normally written in past tense.

The abstract includes**:**

- the objectives and purpose of the work
- an outline of the 'Materials and Methods' (with details of new techniques or equipment) and
- scientific and common names of organisms. Complex names (e.g. of chemicals, or terminology) may be set out at first mention with an abbreviation that is used subsequently

The abstract does not include or refer to**:**

- details of materials and methods, and only mentions the most important results and conclusions
- any figures or tables presented in the main paper
- references or literature cited in the main paper

An abstract is *definitive*, i.e. it gives the hard facts in the form of statements concerning what is contained in the research paper. It is not *descriptive*—i.e. it does not make general statements saying what the paper is 'about'. Along with the title you should consider writing the abstract after you have written all the other parts of the research paper.

Keywords

Keywords are used for indexing services and form the subject index of the journal. They are a list of important words (or short phrases) used in the main text and or abstract but not already present in the title. Keywords are included with the title and the abstract in the indexing of the published article in electronic databases. So you will want to choose your key words carefully to complement those in the title to attract the largest number and broadest range of potential readers.

Acknowledgements

The acknowledgments consist of a short paragraph (one or two sentences) thanking individuals or institutions who have contributed to the work.

These might include:

- Technicians—if closely and significantly involved
- Supervisors—if they have contributed to the work
- Outside institutions or companies that supplied equipment or facilities (e.g., land for experiments)
- Colleagues who gave advice or with whom you discussed ideas
- Statisticians who helped with the analysis and interpretation of results

Remember to include donors in your acknowledgments. Give the name of the agency, the name of any large program of which the work forms a part, and perhaps a grant code or number. If the work derives from a thesis not referred to in the text, this can be mentioned in the acknowledgments.

Citations and references

The reference list contains full details of all articles specifically referred to in the text. These are called the text citations. Text citations generally give the name(s) (generally the 'surname' or main name) of the author(s) of the article and its year of publication. This system of text citation is often referred to as the 'Harvard' or Name-Year system. Other systems also exist; some medical and biochemical science journals, for instance, use numbering systems. References may be used either in explaining and justifying the need for the work (those text citations generally in the 'Introduction'), the conduct of the work (those text citations generally found in the 'Results' section), or the implications of the work (those text citations generally in the 'Discussion' section).

The purpose of the reference list is to enable other researchers to trace and obtain any previously published research used to describe and support the new work being presented. Equally importantly, references allow readers, should they wish, to arrive at their own opinions as to whether this previously published work has been interpreted and used correctly, and from this judge the value of the new work being presented.

Compiling your reference list can be one of the most frustrating and time-consuming parts of writing a research paper. Each journal seems to have its own minor variations in the way references are presented, both in the text of the article and in the reference list. Getting these small details of style correct can be horribly time consuming. This is especially true if you are writing more than one manuscript at the same time, to be sent to different journals.

Consulting the 'Notes to Authors' prepared by the journal will help, but the best way is refer to a reprint or photocopy of a recently published paper by the journal. If your paper is likely to have many references (for example, over 25) it is recommended that you prepare a separate document file for the reference list. You can then add to your list as new sections are written. Going back through a long manuscript to look for references that have already been included in the text, and then assembling a reference list is not the ideal way. It may sometimes even be difficult to remember exactly which of several similar references is, or are, actually being referred to.

Text citations

The Harvard (author-year) system

The style used in the Harvard system varies between journals, for example in the use of upper case or the placement or absence of commas. Generally (although not always), when a reference written by two authors (a 'joint-authored' citation) is cited in the text, the names are linked by 'and'. When citing a reference written by three or more authors (a 'multi-authored' citation), the name of the first author is

followed by 'et al.' (an abbreviation of 'et alii', the Latin for 'and others'). However, some journals may require all the authors of a multi-authored reference to be named at the first text citation in the text, to be followed by first author + et al. at subsequent citations. Depending on individual journal style, *et al.* may be in *italics*. Again, a close study of the particular journal's 'Notes for Authors' and of a recently published paper is necessary.

Some examples of text citation styles:

- '…those of Stutzel (1995) and Manschadi *et al.* (1998)…'
- '…up to 80 cm (Anderson 1985; El-Shatnawi and Goshesh 1988; El-Shatnawi *et al.* 1999)…' (Australian Journal of Agricultural Research)
- '…in cinnamon (Bullerman et al. 1977, Jay 1986, Chang 1995, Holt and Gomez-Almonte 1995)…' (Food Microbiology)
- '…milk composition (Jelinek et al. 1996; Burriel, 1997)…' and '…similarly, Culioli and Sherman (1978), Schmutz and Puhan (1978) and Garnot et al. (1982) found…' (Journal of Dairy Research).

Numbered citation systems

Numbering with alphabetical reference listing

The complete reference list is numbered in alphabetical order and these numbers assigned to the citations in the text. E.g.: '...as Franzel et al. (2) and Ajayi (1) have shown…'

- Ajayi O. (1987) The effect of different types of farmer participation on the management of on-farm trials. Agricultural Administration and Extension 25: 235–252.
- Franzel S.; Legesse D.; Colburn F. & D. Getahun (1989) *Grain marketing and peasant production in Ethiopia*. Research Report No. 5. Addis Ababa: Institute of Agricultural Research. 48p.

In some review papers, which may include well over 100 citations, to save space this may be reduced further by omitting the authors' names. E.g.: '...as has been shown (1, 2)...'

The Vancouver System (Numbering with sequential reference listing)

References are numbered in the text as they are first cited, and are listed in the reference list in this sequence. E.g.: '...as Franzel et al. 1 and Ajayi 2 have shown…'

- Franzel, S.; Legesse, D.; Colburn, F. & D. Getahun (1989) *Grain marketing and peasant production in Ethiopia*. Research Report No. 5. Addis Ababa: Institute of Agricultural Research. 48p.
- Ajayi O. (1987) The effect of different types of farmer participation on the management of on-farm trials. Agricultural Administration and Extension 25: 235–252.

The reference list

The reference list should contain all the details of a text citation necessary to find and photocopy the work being cited, either in an institute or university library or from any other source. In general, the list is prepared in alphabetical order of the surname (or main name) of the first author, then by initials if there are two authors with the same surname/main name, then by date (year).

There are some general rules in alphabetical listing:

- All works by an author alone precede any co-authored or multi-authored work where s/he is first author.
- Works *written* by an author precede works *edited* by the same author.

- Works by the same author (or authors in the same sequence) in the same year are arranged by alphabetical order of the titles and then marked by letters, e.g. Smith (1999a) (Smith 1999b).

Major components of a reference required in citing a journal article comprise:

- Author(s)
- Date (generally year)
- Title of work being cited (with only the first word and proper nouns having a capital letter)
- Name of the journal. Volume (and sometimes issue number of the volume, e.g. 4(2) means Volume 4 (Issue 2).

Start (first) page number of the article cited—last page number of article cited. The name of the journal may be set out in full or abbreviated depending on the style of the journal *to which the article is being submitted*. The form of the abbreviation will be shown in the Notes for Authors of the *cited journal* (or in copies and reprints of articles in which the *cited journal* is referred to).

Major components of a reference required in citing a complete book comprise:

- Author(s) or editor(s)
- Date of publication (year)
- *Title of book* (often in *italics*)
- Edition of book if not the first edition
- City of publication + publisher OR publisher + city of publication
- Total number of pages or start page number—last page number of section being cited.
- (Titles of 'grey literature', internal or 'self-published' reports, working papers, etc., are not italicized).
- The country, state, or province of the city should be added if the city is not well known or there is the possibility of confusion.

The major components of a reference required in citing a chapter in a multi-authored volume comprise:

- Author(s) of chapter being cited.
- Title of chapter being cited.
- Start (first) page number of the chapter cited—last page number of chapter cited.
- Editor(s) of volume in which chapter appears
- *Title of volume* in which chapter appears (often in *italics*).
- City of publication + publisher OR publisher + city of publication.

Personal communications are only mentioned in the text and are not included in the reference list (and only if the journal permits their inclusion). Some journals permit unpublished work to be included in text citations, and the reference list (Smith J. 1999. *unpublished*). Other journals do not.

Some journals permit work in press to be included in the reference list. In this case the work must have been *approved for publication* and the name of the journal included (e.g. Smith J. 1999. *in press*. Journal of Agriculture). Within these broad guideline and rules many variations exist. These include abbreviations, the uses of commas (,) semi-colons (;) full-colons (:) and the use of **bold** and *italics*.

Here are some examples taken at random from recent issues of journals in an agricultural college library in England: **Crosby, D.G.** 1981. Environmental chemistry of pentachlorophenol. Pure Appl. Chem. **53:**1052–1080. (Journal of Bacteriology)

Nyczepir, A. P., and Lewis, S. A. 1979. Relative tolerance of selected soybean cultivars to *Hoplolaimus columbus* and possible effects of soil temperature. J. Nematol. 11:27–31.

(Plant Disease) Anghinoni I, Barber SA (1980) Predicting the most efficient phosphoros placement for corn. *Soil Science Society of America Journal* **44**, 1016–1020. (Australian Journal of Agricultural Research)

Keisler DH, Andrews ML and Moffatt RJ 1992 Subclinical mastitis in ewes and its effects on lamb performance. Journal of Animal Science **70** 1677–1681 (Journal of Dairy Research)

Glass, K. A. and Doyle, M. P. (1989) Fate of *Listeria monocytogenes* in processed meat products during refrigerated storage. *Appl. Environ. Microbiol.* **55,** 1565–1569. (Food Microbiology)

Notes to Authors

'Notes to Authors' contain a journal's rules for preparing manuscripts. The notes are generally printed inside the cover of an issue of the journal at least once a year. As well as details on use of italics, commas, parentheses etc., the notes will also describe preferred layout (size of paper, margins, fonts etc.) and suggestions for the names of the various sections of the research paper. If electronic submissions are accepted, the software and form these may be sent in will be stated.

When choosing a journal to which to submit your paper, the first consideration has to be the suitability of your subject to the editorial policy of the journal. The next thing to do is consult the notes for authors. Always do this before you start to write**.** This will enable you to adjust your own manuscript style, and include as many as possible of the conventions and style characteristics demanded by the particular journal, from the very beginning. Returning through a completed manuscript (especially a completed reference list) to make lots of small but necessary adjustments to make your style conform to that of a journal is a time-consuming and tedious task. This can be avoided with planning and foresight. It is, however, likely that the notes for authors will not contain all details of every minor question of style, and most Notes for Authors themselves recommend referring to a recent issue of the particular journal.

Getting as many (or all) details of presentation correct at submission is a major step in easing the refereeing process. Referees do not enjoy having to make corrections to errors of style that should be the responsibility of the author. Equally, it is frustrating for you as an author to have a manuscript returned with demands for corrections that could have been avoided.

A comprehensive set of notes for authors will help equally if you are a journal editor. For example, if you are leading a research program and having to collate contributions from different scientists into a program report, you will also benefit from having your own 'notes to authors'. Having the individual researchers follow a single style when they submit their individual reports will save you, as an editor/ compiler, a lot of time and effort as you prepare the program report.

Trainer's guide

Session 14: Different types of scientific publications

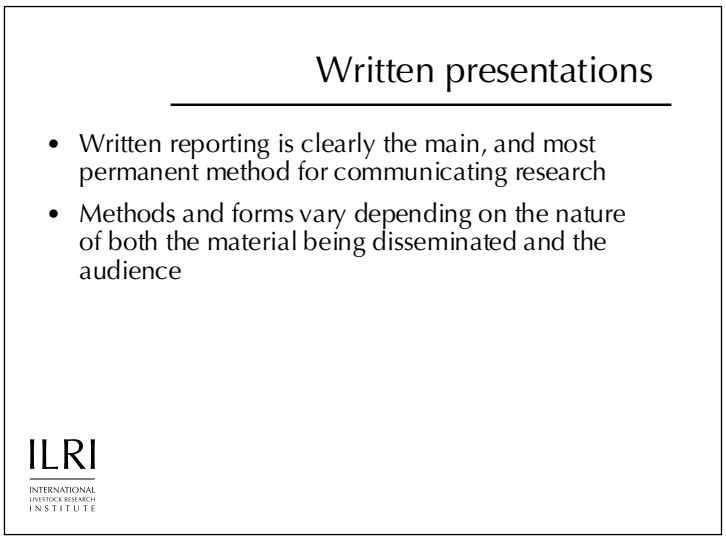
Session objectives	By the end of this session participants will: • Appreciate the different ways in which research results can be published • Understand the different outputs of research • Decide when to write what publication
Training materials	• Assorted markers • Felt pens • Flip charts
Time needed	30 min
Method of facilitation	

Activity	Contents	Time
Plenary discussion	Ask participants highlight the different types of scientific publications that they know	5 min
Plenary presentation	Different types of scientific publications	20 min
Participant interaction	Trainer gives an opportunity to participate to ask questions, contribute or raise their opinions. If there are any 'light bulbs' participants are encouraged to share them with others.	5 min
Summary	Trainer summarizes the salient features of the session and switch to session 15	
Handouts and reference materials	PPT: Different types of scientific publications Reading notes on the different types of scientific publications	

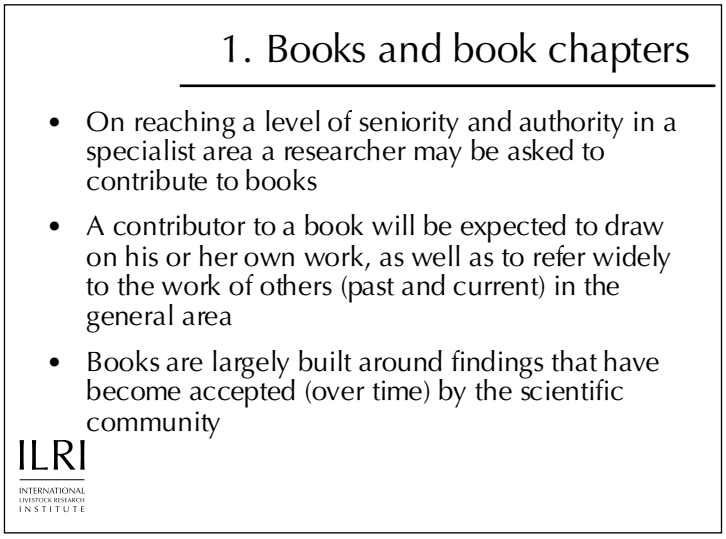
Session 14: Summary of presentations: Different types of scientific publications

14.1

14.2



14.3



14.4

2. Review papers

- Similar to book chapters (and often of equal or greater length), reviews draw on a recognized authority's knowledge and experience to provide an overview of a special area
- Reviews are generally provided for a more specialist readership than book chapters, and provide a detailed survey of the available research literature
- Reviews also serve as up-to-date and comprehensive reference list
- Good review papers are of great value to younger scientists by indicating what information is available, and where details may be found, as they provide a single reference for a wide range of generally accepted procedures and concepts

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14.5

3. Journal articles

- The writing most researchers do is writing journal articles
- Most likely these articles are submitted for publications in printed journals but it could also be for electronic journals which are now being published 'on line'.
- Most scientific journals operate an "anonymous independent peer review" process in their fields of specialization
- Peer reviews are not meant to unearth and investigate misconduct, but they form an essential and integral part of the process of consensus building and they are inherent in the growth of scientific knowledge
- The time between writing a paper and the publication of the work is long. Often it takes nearly a year even after the paper has been approved for publication before it appears in print

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14.6

4. Science magazines

- Science magazines may occasionally enable researchers to present their work in a less specialized manner, and to a broader audience
- Science magazines will likely focus on accessible topics with wide public appeal
- More specialized and esoteric topics will be less attractive, despite their international or national significance

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14.7

5. Newspaper articles

- The researcher will have little control over deciding what is considered interesting for a newspapers readership
- An interview or a contribution to a farming column, published in a widely read newspaper, may be an effective way of bringing a national message to wide audience

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14.8

6. Extension leaflets and posters

- Producing printed materials for a non-scientifically trained and educated, perhaps illiterate audience, is a special skill
- Some research will not be suitable for direct communication
- Extension workers and farmers are the intermediate and ultimate users of agricultural knowledge, and their need to understand and use research results is paramount
- Communication is essential, and needs to be appropriately presented
- Researchers will likely need to partner with specialist communicators to ensure the right choice of medium, language and illustration to get the messages across

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14.9

7. Conference posters

- A poster may well be the form in which a researcher first presents finding to peers
- Posters are often used to present preliminary findings
- Some major conferences are now so large that posters, rather than oral papers, are the main medium for researchers to present their work
- As posters become more important, researchers are devoting more time to their preparation

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14.10

8. Annual reports, quarterly reports and project reports

- Annual reports frequently represent the first presentation of research results often in a manner similar to a research paper, but rarely in similar detail as one would find in a journal article
- Some annual reports present research as ongoing, rather than completed work, along with more comprehensive reporting of results
- Quarterly reports provide an ongoing commentary of the progress of research activities, principally as a management tool for project monitoring
- Quarterly reports are often standardized with little analysis or interpretation
- Project reports are needed to report to external donors, who have required formats for appropriate reporting

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14.11

9. Conference abstracts

- Most conference organizers demand an abstract of an intended presentation prior to its acceptance by the conference
- This allows them to judge the suitability and quality of the intended presentation and choose a time for the presentation within the conference schedule
- The abstract themselves may appear in (supplements to) journals, and on occasions be referred to by other researchers

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14.12

10. Conference/Workshop proceedings

- Research papers may appear in workshop or conference proceedings
- Conference proceeding can be very useful, by bringing together much up to date and relevant information in a particular field
- There are many reservations about the independence of the peer review process

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14.13

11. Letter to journals and book reviews

- Researchers can demonstrate their expertise by writing letters to journals, perhaps in reply to articles published by others, or by raising new points of view
- Book reviews are also a way of highlighting experience in the literature
- Although an invitation to review a book represents wider recognition of expertise, this is not an important way for a researcher to disseminate the findings of his or her work , given the limited nature of the assignment and likely audience

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14.14

Oral presentations

- Conference: 10–5 minutes presentation
- Seminar and workshop
- Project planning and donor meetings
- Outside talks and media interviews

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14.15

Thank you!!

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Session 14: Notes to participants: Different types of scientific publications

14.1 Written presentations

Written reporting is clearly the main, and most permanent method for communicating research, and is the main focus of this module. While the journal article, to be discussed later, may be considered the primary form of such communication, methods and forms vary depending on the nature of both the material being disseminated and the relationship of the researcher to this material.

14.1.1 Books and book chapters

On reaching a level of seniority and authority in a specialist area, a researcher may be asked to contribute to books, whether produced by an independent commercial scientific publisher or by an international research centre. (The degree of research specialization nowadays means it is unlikely that any single researcher will be able to write an authoritative book alone).

A contributor to a book will be expected to draw on his or her own work, as well as to refer widely to the work of others (past and current) in the general area. Because of the time involved in publishing books, this is not seen as the right medium for new, cutting edge and largely untested results. Books therefore are largely built around findings that have become accepted (over time) by the scientific community. The authority of the author, however and the nature of the publishing process may allow the author of a book freedom to speculate and put forward ideas that would not necessarily be possible within the limits of, say, a journal article. An established authority in a given field can also exercise considerable research communication influence in other ways, such as in the role of journal editor.

A book can be a thesis or dissertation

Usually a monograph—a complete 'book' about your research program, a collection of draft or published papers. In this case an introduction and a discussion to link together. The main differences between the two are style and layout. Follow the university guidelines.

Introduction—set the schemes and outlines the approach adopted. Sometimes an extended introduction is required, which includes a review of literature, in some other cases literature review forms a separate section. This literature review section should conclude that there is a gap in the knowledge, then a reader can then turn the page and see that your research has filled that gap.

Main body is split into sections/chapters individual experiments or different aspects of the program. Each chapter describes one experiment, materials, methods result and discussion may be included in each chapter. Or a general chapter may be written for methods and discussions that are common to several experiments. There is no right or wrong way of dividing thesis into sections/chapters.

General discussion (irrespective of monograph or collection of paper) requires a slightly different approach from that in a scientific paper or review of literature. Compare your results with previously published information, and discuss the implications, but you also need to discuss the relationships among your individual experiments and state how the overall program fits your hypothesis—consider the whole picture as well the individual pieces.

14.1.2 Review papers

Similar to book chapters (and often of equal or greater length), reviews draw on a recognized authority's knowledge and experience to provide an overview of a specialist area. Reviews are generally provided for a more specialist readership than book chapters, and provide a detailed survey of the available research literature. Reviews also serve as an up-to-date and comprehensive reference list. Commercial publishers of scientific literature publish—sometimes annually—books with reviews in a branch of science or technology, with names such as 'Advances in…' (published by Academic Press) and 'Progress in…' (Pergamon Press), and others. However, there are considerable risks involved in publishing these books because of the rapid advances in science and technology. For that reason some publishers discontinued their series of reviews while others were taken over by not-for-profit professional associations.

In a review paper we report work from several sources; rather than one study/one experiment/research program. Review papers are found in journals and conference proceedings; a common form of writing in university training. Reviews of literature are also found, in a shortened form, in the introduction section of a standard scientific paper, and in a longer form, in the literature review section of a thesis or dissertation.

Main requirement of a review article

It should be comprehensive and critical. This does not mean that you criticize other authors, but collect all available information both +ve and –ve, compare and contrast them and give a balanced perspective.

- A review is just as much a part of the research process as conducting experiments
- Good reviews contribute to scientific knowledge by bringing data together so that new or more definite conclusions can be drawn.
- Reviews also can identify the gap in knowledge and new areas of research.

Structure of a review paper generally consists of: Introduction, various subsections, a general discussion, conclusions and reference list

Introduction: Similar to the old paper, state the problem and indicate why you want to review why you want to review the literature—but don't include the review

Conclusion and reference list—follow exactly the same principles; major difference is in the body of the review

Body

Split the body of the review clearly into themes or topics each of which can have its own section. Keep each topic separate and arrange them logically start from general to specific. You might be able to relate specifics back to general in your discussions.

Content

In a scientific paper, you normally have a hypothesis, which you accept or reject on the basis of your experimental results. In the case of a review, you have a theory or a message, which you support or reject on the basis of published results. You may have formed a theory based on your knowledge or review or you may be invited to review a subject for a conference or journal or you may be writing a review for a thesis or student assignment. You need to convince the reader with sound arguments,

supported by good evidence. Try to have at least two references that support the idea, make sure that you report reference that contradict your theory/opinion and say why it does not fit your theory.

You should never omit relevant references just because it conflicts with your ideas. You should also be cautious when using references that agree with you but not relevant. Never extract parts of a paper that disagrees with the original author's conclusions; unless you are looking at the data/information from a new angle. Do not report results that the author found were not significant as though they were. Always try to give some experimental details from the paper that shows how strongly the evidence supports your theory/view.

Quantitative data are useful for supporting theories and formulating new ideas. You can combine data from several studies in a table or figure (give examples), but be careful when trying to do statistical analysis on means from different studies; (meta analysis). It is good to consult a statistician first.

Do not produce a long list of references to support the print. Try to avoid referring to text books; they usually do not describe experimental results, they just state author's opinions.

When you get ideas or evidence from a paper that itself review, always check the original source of information; the reviewer might have misinterpreted the data.

14.1.3 Writing your review

It requires planning or careful thought. Lots of index cards, a folder with a number of sub folders or files with key words on them. Sort the files and cards into the order of your review sub-headings. Within each topic decide how you want to cover the materials and sort the cards into the same order.

Check there are any gaps (ideas without reference) and fill them by doing a further literature search. Then gather the papers or into the correct order. Write the review one section at a time, but do not duplicate the same information into sections. Check each section to make sure that you have enough evidence to support your position/argument, and make sure that you have quoted each author accurately.

When all sections are completed, read through the review and make sure that the flow between sections is satisfactory. You may need to add a sentence or two that link sections. It is also good to have a tentative summary at the end of each section. Make sure that your introduction and conclusions use similar words and that the conclusions use similar words and that the conclusions refer back to the introductions.

Good review papers are of great value to younger scientists by indicating what information is available, and where details may be found, as they provide a single reference for a wide range of generally accepted procedures and concepts. A phenomenon called 'twigging' describes the process in which each branch of science or technology produces new branches which focus on only part of the parent science or technology. Hence, the art of writing reviews has become more and more elitist with consequently a smaller group of interested readers, and less (commercial) benefit from the considerable efforts that go into the writing of good review articles.

14.1.4 Journal articles

The writing most researchers do is writing journal articles and this is the focus of a large part of the module. Most likely these articles are submitted for publication in printed journals but it could also be

for electronic journals which are now being published 'on-line'. Preparing articles for publication in journals is a complex task, requiring many different skills (in addition to those skills originally needed to carry out the work being reported). As a researcher you know that the number of articles you publish and the nature of the journals where your articles appear will likely be used to judge the quantity and quality of your work.

Journals publish different types of scientific paper. These can be: full length research papers, review papers, symposium papers, invited papers, and technical research notes. They give results of completed but limited experimental and methodological details, book review, and letter to the editor. Their purpose is to discuss, critique, or expand on specific points made in recently published papers and rapid communications. They deal with 'hot topics'.

The format of a journal paper varies from one journal to another. Generally, the standard format has the following components;

- Title
- Abstract
- Introduction
- Materials and Methods
- Results
- Discussions
- Conclusions
- References
- Acknowledgments, Annexes (Acknowledgement and appendices are optional, as are tables and figures)

Most scientific journals operate an 'anonymous independent peer-review' process in their field of specialization. Occasionally, the authors or their supervisors may be able to guess who the referees for a particular article are likely to be. Hence, to foster objectivity, the names of the authors may not be revealed to the referees. Alternatively, some argue that the names of both authors and referees should be revealed. The peer review system has been blamed for bias and the rejection of papers that were worthy of publication as became apparent when they later appeared in other journals of equal reputation. The earlier rejection then only contributed to the overall delay in the publishing process. Yet, the peer review system contributes to the integrity of the scientific record of a journal, which is the primary concern of science editors. Fortunately, legal misconduct in science and technology, such as plagiarism and fabrication of results, is rare but is not non-existent. Peer reviews are not meant to unearth and investigate misconduct, but they form an essential and integral part of the process of consensus building and they are inherent in the growth of scientific knowledge.

The metaphor of 'twigging' mentioned in the context of review papers is also apparent in the proliferation of scientific journals. Sometimes the need for new journals came about when new ideas were first perceived as too radical and shut out by the mainstream of science publishing. This happened for example with transmission of radio waves which was seen as unimportant by electrical engineers and scientists. More often, new journals are started when the existing ones have so many sections that none of the readers is interested in or capable of understanding all of them anymore. An example is the American Soil Science Society of Science Journal which covers the entire range of soil science from pedology to soil–water relations. Recently, a new journal was brought out by the American Soil Science

Society called Vadose Zone Journal, which focuses on transport mechanisms in the unsaturated part of the soil profile.

Another reason for starting a new journal may be found in the growth of scientific research in a particular country or region. This could be particularly true for agricultural journals in developing countries. For example, much of the research on soil and water quality in the western world deals with organic residues and heavy metals, whereas in many semi-arid countries soil and water degradation results from salinization processes. The result is that international environmental literature deals with a different set of issues than what is significant in scientific research in some developing countries.

The time between writing of a paper and the publication of that work is long. Often it takes nearly a year even after the paper has been approved for publication before it appears in print. The reason for this is that journal editors have to maintain a stock of papers ready to be published to fill every scheduled issue in turn. Pressure to reduce the time gap has been strong, but has had little effect on the printed journals. The inevitable time gap may have contributed to the demise of the monographs and substantial review papers in rapidly advancing fields of science and technology, as authors found they could never include reports on the most recent developments.

Electronic publishing of journals seemed a logical solution, but it was unclear whether there should be a fee for access to on-line journals. The British Medical Journal chose to make access to its entire website free to all, while some publishers charge a subscription fee for access. Examples of the latter include the virtual journals Environmental Sustainability and Industrial Effluents, published by Elsevier.

14.1.5 Science magazines

Where such magazines exist, science magazines may occasionally enable researchers to present their work in a less specialized manner, and to a broader audience. However, there are limitations. Science magazines will likely focus on accessible topics with wide public appeal (e.g. wildlife conservation), while more specialized and esoteric topics (e.g. 'phytopathology', or 'mine water and the environment') will be less attractive, despite their international or national significance. As with other forms of mass media communication, when publishing in science magazines, the researchers' control of choice of content and the manner of presentation becomes more limited.

14.1.6 Newspaper articles

The researcher will have little control over deciding what is considered interesting for a newspapers readership. However, an interview or a contribution to a farming column, published in a widely read newspaper, may be an effective way of bringing a national message to a wide audience (and enhancing national recognition).

14.1.7 Extension leaflets and posters

Producing printed materials for a non-scientifically trained and often poorly educated, perhaps illiterate audience is a special skill. Some research will not be suitable for direct communication. Extension workers and farmers are the intermediate and ultimate users of agricultural research, however, and their need to understand and use research results is paramount. Communication is essential, and needs to be appropriately presented. Researchers will likely need to partner with specialist communicators to ensure the right choice of medium, language, and illustrations to get the messages across.

14.1.8 Conference posters

A poster may well be the form in which a researcher first presents findings to peers. Posters are often used to present preliminary findings. With improvements in computer printing (software and hardware), more attention is being given to the production of posters. Also, some major conferences are now so large that posters, rather than spoken papers, are the main medium for researchers to present their work. As posters become more important, researchers are devoting more time to their preparation.

Research results can be presented very effectively in a poster. Main message can be highlighted. Viewers can study the message/information at this own pace. It provides an opportunity for questions and meaningful dialogue between poster presenter and viewed. The poster might be reused e.g. at the presenter's home institution.

In a poster, there is intense competition for audience attention. Phrasing of the title and the overall appearance of the poster are of utmost importance. You should have a brief and clear message and you can adapt to the audience. Think about probable questions when preparing a poster.

A poster is often structured like a scientific paper. It has headings such as introduction, objectives, methods, results and conclusions. Use more informal headings like short statements and/or questions.

Irrespective of the form used provide:

- Title of the poster, and its number in the meeting program must be given at the top of the poster and followed by the authors' name and address.
- In addition the poster should show:
  - Why the topic is important
  - The objectives of the study
  - The most important results
  - The main conclusions and
  - Possible implications
  - Methods used mentioned only very briefly

Designing the poster

- Check the requirements—height and width specified by the organizers
- Landscape orientation or portrait
- May also have/set rules for how to structure the poster content
- Make an attractive and informative poster

Tips on how to choose layout and content

Set up a one page model in proportional scale, either on paper or on the computer. The contents can be arranged in columns running down the poster or in rows running across. If the poster is wide, then best to arrange the content in column left to right. Especially if many people can be expected to read from the poster at the same time.

- Arrange contents in a logical order, start with the importance of the topic at the top—left and ending with the conclusions at the bottom right of the poster. Don't hide the conclusion at the very bottom of your poster.
- Place the conclusions centrally on the poster at eye-height for the audience.

- The poster should be self-explanatory and sub-sections could be numbered to guide the audience/ viewer.
- Visual displays such as tables, graphs, photos and other illustrations (e.g. Drawings, paintings and clip-art) can make the poster attractive and easy to understand assuming that they are relevant to the poster topic.
- Try to balance poster text and visual displays.
- Background—uniform, light e.g. Light beige or grey, but not pure white.
- Single sheet poster is often recommended
- Occasionally you see posters that consist of a number of individual sheets mounted directly on the poster board, often with a dark frame around each and some employ space between the sheets. This usually gives a spotted impression and it is not generally recommended.
- Each section of the poster should contain just a few messages. You do not need to write complete sentences.
- Don't overlook the poster.

Making a poster

Multipart poster. Where individual elements are produced separately and then mounted manually on a joint background paper or card. Single-sheet poster can be printed on soft paper (and might be also covered with plastic laminated or it can be printed on cloth which makes the poster easy to transport. For transportation, you may need a poster cylinder. Single sheet poster is simple to mount at the meeting site, but the equipment needed to produce it may not always be available or may be expensive to use.

If well done, a multi-part poster might be more 'alive' than a single sheet poster, but be prepared to spend time at the meeting site on the final mounting.

The ULTIMATE PREFERENCE IS A MATTER OF TASTE. Do not just enlarge your written paper to form a poster—unprofessional, may not catch the eyes of the viewer.

When making posters, think about the following:

- Colours will enhance the poster, but too many colours will distract or give a disjointed effect. Title can be in colour, but the text is usually easier to read in black or dark blue.
- Think of the background in choosing colours. Colours on a digitally produced poster may not look the same in print as on the computer screen.
- Bullet points are easier to grasp than the test paragraphs. Fonts used should be easy to read. Bold letters in the title and headings may facilitate reading from a distance. Words in lower case letters (or with initial capital) are easier to read than words in all upper case letters. Text sign must be large.
- Title should be easily read from a distance of 3–5 m and text from 1.5–2 m.
- 110–120 for title
- 60–70 for headings
- 30–40 for body text

} Generally recommended

Tables and graphs must be easy to read and understand. Use appropriate font size, limit the amount of information. A written conclusion/take home message directly over or under a table or graph might also keep the viewer. Clip-art can be useful to illustrate the poster. Attention gets—a striking photograph. A matt poster surface is usually preferred to a glossy one; because light reflecting from a glossy surface can make your poster impossible to read.

Presentation of poster

Bring what might be needed for the final mounting: push pins, glue, spray adhesive, tape etc. Photo of the presented can be fastened near the poster title. A small boss with your business card –people can contact you later if needed. On page print out of the poster—title, authors, addresses, (e-mail), summary of research, important tables and figures (reduced) and relevant literature or a reduced copy of a poster. Be there on time; stay there during the whole session. Prepare a 3–5 minute presentation. Remember the poster must be self explanatory. Role prepared to discuss topic, respond to questions and provide additional information. A folder with additional, easily viewed, information can be useful for this purpose. The poster discussion is more detailed and on a one-to-one basis. It is a dialogue that also gives you a splendid opportunity to establish valuable contacts.

14.1.9 Annual reports, quarterly reports, and project reports

Annual reports frequently represent the first presentation of research results, often in a manner similar to a research paper, but rarely in similar detail as one would find in a journal article. Some annual reports present research as ongoing, rather than completed work, along with more comprehensive reporting of results.

Although produced mainly for reasons of research management, annual reports may provide the most salient data and information to other researchers, especially if widely distributed. They may also provide an indication of the productivity and quality of the institute, the wider NARS, and the individual researcher. Quarterly reports provide an ongoing commentary of the progress of research activities, principally as a management tool for project monitoring. They are often standardized with little analysis or interpretation.

In addition, some institutions publish working papers or research reports on interim or final results for internal review and evaluation prior to attempts to publish in wider, in particular international, journals. Regrettably, sometimes the attempts to publish the results and analyses in a journal article for regional or international dissemination are then never made. Project reports are needed to report to external donors, who have required formats for appropriate reporting. The audience for these reports will most often be non-scientists, so their preparation may put extra and different demands on the researchers involved. However, timely project reports, written in the desired format as specified by the donor, are a key element of good donor relations, so it pays for researchers to obtain the necessary skills.

14.1.10 Conference abstracts

A conference paper may be in the form of a full scientific paper or a review; but often you are expected or asked to write a summary or abstract. Summaries are longer, so they can contain more details, including tables and figures.

Abstracts normally stand alone (you don't need to read any of the full paper) and often published as conference proceeding. Abstracts are submitted earlier so that the organizers can decide to which session the abstract/paper should go into. The purpose of the summary is to support your oral presentation/ poster presentation so that you can concentrate on getting the main message across the audience.

Often you are provided guidelines about the length and layout of your summary or abstract you need to follow these guidelines. Conference abstracts follow the same rules as it would be in a scientific paper—concise, standalone, no reference and no visuals. A conference summary is usually written

with the same sections as scientific paper—but you do not need to include so much detail in the introduction and discussion section.

There is no need for comprehensive references, give only a few key references if they are directly related to your work. Materials and methods section should be similar to what is in the scientific paper. Most important section is the results section, which should contain full details of the results that you are going to present.

Most conference organizers demand an abstract of an intended presentation prior to its acceptance by the conference. This allows them to judge the suitability and quality of the intended presentation and choose a time for the presentation within the conference schedule. The abstracts themselves may appear in (supplements to) journals, and on occasion be referred to by other researchers. This is generally considered only a temporary measure as most such work is later expected to appear in full in the form of journal publications.

14.1.11 Conference/Workshop proceedings

Many meetings bring out reports and compilations of papers. The presentation of a research paper for appearance in such proceedings may often be an expected condition of the invitation (and funding) to attend. Conference proceedings can be very useful, by bringing together much up to date and relevant information in a particular field. However, many of the reservations about the independence of the peer review process, mentioned in earlier connection with regional and national journals also apply to the publishing of conference proceedings.

14.1.12 Letter to journals and book reviews

Researchers can demonstrate their expertise by writing letters to journals, perhaps in reply to articles published by others, or by raising new points of view. Book reviews are also a way of highlighting experience in the literature. Although an invitation to review a book represents wider recognition of expertise, this is not an important way for a researcher to disseminate the findings of his or her work, given the limited nature of the assignment and its likely audience.

14.2 Oral presentations

14.2.1 Conferences

Conference presentations, frequently as short as 10 minutes, may be a major avenue for the dissemination of research results. As a result, much effort goes into their preparation, along with the associated slides, overheads, or PowerPoint presentations. Many researchers are poor presenters, lacking both skills and experience in public speaking. Most could probably benefit from at least some coaching and training.

14.2.2 Seminars and workshops

Seminars, with their often more relaxed and intimate atmosphere, in the company of fellow specialists, provide a more comfortable environment for oral presentations. However, because they are more relaxed affairs, researchers often treat them less seriously and pay less attention to the proper preparation of thorough presentations.

Workshops generally provide a very informal avenue for the dissemination of research results, and this informality may be very effective in conveying the major points of ongoing or completed activities.

As with written presentations, however, it will be important to understand the training and skills of the participating audience, and to tailor the content and language of workshop presentations to their understanding and needs.

14.2.3 Project planning and donor meetings

While sometimes demanding the presentation of results, project planning and related meetings are often equally focused on future activities. In such meetings the researcher must be able to present findings (and intended activities) to an audience that may be both nonscientific and with a wide range of demands and priorities to satisfy. This provides a contrast to that of the generally supportive and sympathetic audience of a researcher's peer group that may be found at a conference, seminar, or workshop.

14.2.4 Outside talks and media interviews

Whilst often less demanding (in terms of detailed content) than oral presentations to fellow specialists, presentations to non-scientific audiences make special demands precisely because of the audience's lack of specialized training or knowledge. Effort and preparation will be needed to be successful. Researchers may wish to consult or partner with media specialists to do a good job.

Trainer's guide

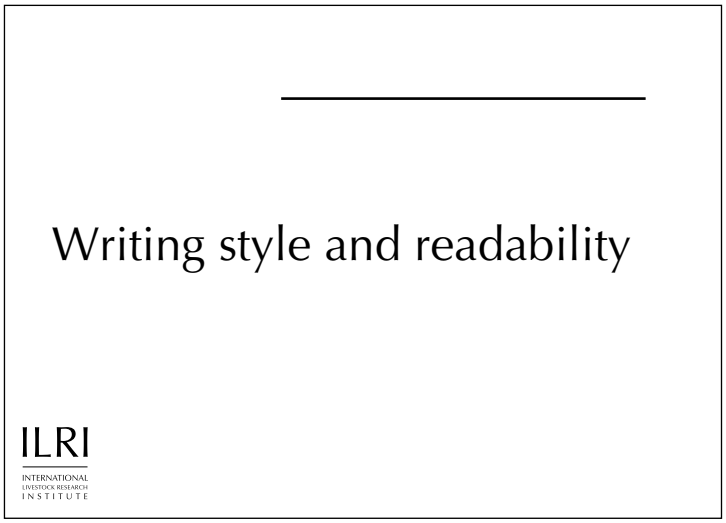
Session 15: Writing style and readability

Session objectives	By the end of this session participants will: • Decide when to write to convince or inform • Write easily and simply • Apply the issue that have to be considered before and during writing
Training materials	• Assorted markers • Felt pens • Flip charts
Time needed	1:30 hrs
Method of facilitation	

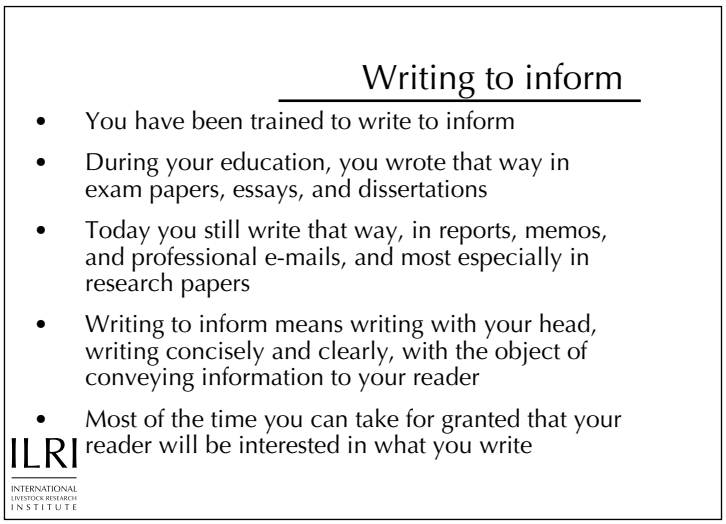
Activities	Contents	Time
Plenary discussion	Trainer gives an 'ice breaker' by reminding participants the different letters that they have written including love letters	10 min
Plenary presentation	Writing style and readability	40 min
Participants interaction	Trainer gives an opportunity to participants to ask questions, contribute or raise their opinions. If there are any 'light bulbs', participants are encouraged to share them with others	5 min
Summary	Trainer summarizes the salient features of the session and switch to session 16	5 min
Break	Health break	
Handouts and reference materials	PPT: Writing style and readability Reading notes on writing style and readability	

Session 15: Summary of presentations: Writing style and readability

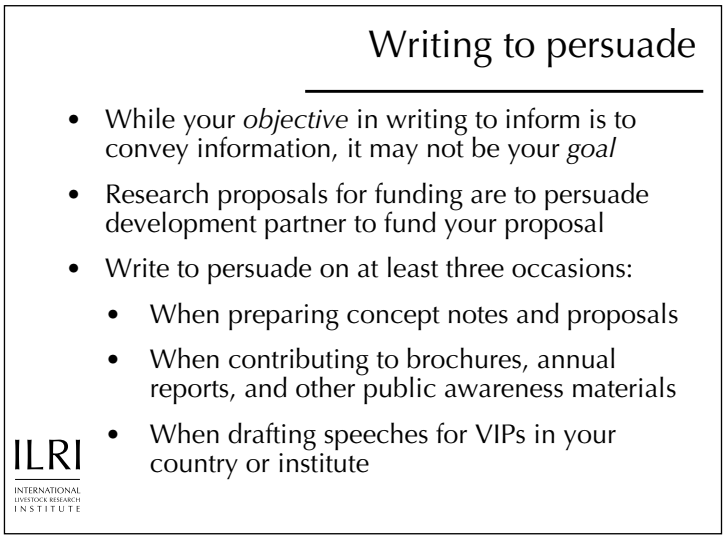
15.1



15.2



15.3



15.4

Tips for successful writing to persuade

- You need to appeal to the self-interest of your readers
- Write with passion

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15.5

Tips for your subject, your passion, shines through…..

- Use strong, emotional words like urgent, vital, essential, new and related ones
- Avoid vague words like *possibly, under certain circumstances*
- Short sentences convey urgency. Long sentences, with lots of subordinate clauses that go on and on and on and on, like this one, tend to put the reader to sleep!

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15.6

Tips for your subject, your passion, to shine through…..(cont'd)

- An arresting word or phrase can waken a reader to the importance of what you are saying. Making a timely reference can help too.
  - For instance: "The new devil weevil attacking millet in West Africa has the power to kill as many children as have died in Bosnia, Kosovo and Iraq – only, the weevil will kill more slowly; first through increased malnutrition, then through famine."
- Get your message across as quickly as possible, and in as few words as possible.
- Use the active rather than the passive voice

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15.7

Active and passive writing

- Passive
  - Sixty saplings were planted by the researcher
  - The road was crossed by five chickens
  - A weight gain of half a kilogram was recorded in the cows each month
- Active
  - The researcher planted 60 saplings
  - Five chickens crossed the road
  - The cows gained half a kilogram each month

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15.8

General writing tips

- Think about your readers before and while you are writing
  - Know as much as possible about your readers before you start to write
  - Spoon-feed your reader: make your writing as easy to read as possible

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15.9

General writing tips

- Use simple words

"The scientific members of the establishment seek to ascertain whether the electricity supply has been merely temporarily discontinued or if they are suffering a permanent disconnection."

"The scientists want to know if this is just a short power cut, or if the electricity has been cut off."

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15.10

General writing tips

- Use simple and direct sentences

"The policy environment within which research organizations operate sends signals about which types of research should be conducted and defines the structure and organization of the research bodies. It also establishes the level and nature of the resources provided to carry out the research mission. Financial policies for agricultural research strongly influence both the level of the research effort and the degree to which that effort is linked to particular sectoral or scientific goals and objectives."

"Government financial policies have strong, direct effects on agricultural research. Policies influence how much research is done, where it is done, and for whom it is done "

- Use short paragraphs, plenty of white space and plenty of subheads

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15.11

General writing tips

- Plan before you write
  - a. What are you writing? (report, journal article, proposal, term paper, letter of complaint)
  - b. Who will read it? (individual and organization)
  - c. What is its purpose? (to explain, convince, get money, request action, analyze, etc.)
  - d. What is the topic, and how many sections do you need

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15.12

Thank you!

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Session 15: Notes to participants: Writing style and readability

15.1 Writing to inform and writing to persuade

15.1.1 Writing to inform

You have been trained to write to inform. During your education, you wrote that way in exam papers, essays and dissertations. Today you still write that way, in reports, memos, and professional e-mails, and most especially in research papers. Writing to inform means writing with your head, writing concisely and clearly, with the object of conveying information to your reader. Most of the time you can take for granted that your reader will be interested in what you write—perhaps because your reader is a teacher or professor or fellow-scientist, then he or she is being paid to read your work—it is part of the reader's job description.

Notice, however, that while your *objective* in writing to inform is to convey information, it may not be your *goal*. All forms of writing have both an *objective* and a *goal*. As we have already noticed, there are many reasons why researchers communicate, from vanity to concern for the welfare of end-users. On any given occasion, your goal for writing to inform may be to attract comments and support, to become famous, to get tenure in your position, or to add to your publications list in hopes of future promotion.

15.1.2 Writing to persuade

You probably have less experience in writing to persuade. Think about love letters, which many of you may have written, at least in your head. Your objective in writing them may also be to inform—to let your loved one know how you feel. But you have a goal, too, one that likely involves persuasion. Your goal may be to win the love of your loved one, or you may be trying to relieve the stress of your strong emotions by expressing your feelings in words.

Advertising people are always writing to persuade. Their goal is to make you buy a certain product. Politicians, whose goal is to make you vote for them, also write and speak to persuade. Advertisers and others seeking to persuade you to do something use images as well as words. Thus famous athletes sell sports shoes, and the Marlboro man, macho, strong, outdoorsy, persuades some young men to buy and smoke Marlboro cigarettes. You are not in the advertising business, but even in the research business, there are times when you have to write to persuade.

When researchers have to write to persuade

As a researcher, you will have to write to persuade on at least three occasions:

- When preparing concept notes and proposals
- When contributing to brochures, annual reports, and other public awareness materials
- When drafting speeches for VIPs in your country or institute

In concept notes and proposals you need to write to persuade the reader to give you money. You need to persuade your reader that your proposed research is:

- Important (to the reader and the end users)
- Urgent (if the work is not done, something bad will happen, if it is done, something good will happen), and
- Cost-effective (you have put together a good project, and the right implementing team—you have thought through your project, and all you need is the money).

You can do this by using the right combination of writing to inform and writing to persuade in different parts of the project concept note or proposal. The places where you can use writing to persuade to entice a donor to give you support are:

- the background section
- the description of the beneficiaries
- the discussion of the project goal and impact

In public awareness materials, you are trying to persuade your reader of the importance and value of the work of your institute. You need to inform readers of what you are doing, but you need to present the information in an informal and reader-friendly style. You cannot assume that your readers are going to be interested in what you do; so you need to employ the tricks of the persuasive writing trade to make your material enticing. Similarly, in speeches you are trying to convey to a non-scientific audience the excitement of the work of the institute, and its contribution to the well-being of citizens of your country. If a speech is written only in the writing-to-inform style, it will not be very lively; but by using some of the tips in the next section, you can ensure that the speech will not send the audience to sleep!

Tips for successful writing to persuade

The single most important thing about writing to persuade is that you need to appeal to the self-interest of your readers. To do this, you first need to identify that self-interest, which in turn means that the more you know about your readers, the more you can tailor your writing to what you know. Here is what George Allen, a well-known American journalist, had to say on the subject a few years ago:

'The simple presentation of facts will rarely persuade an audience. They may find the facts interesting, but they will rarely be moved to change their attitudes or act in ways the communicator would like them to… Unless the message is addressed to a specific audience, and is tailored to engage the self-interest of that audience, it is merely a shot fired in the air with no particular destination. Most of the messages …(prepared by researchers)… are sent out c/o General Delivery.'

The second most important thing about writing to persuade is to write with passion. When you write to inform, it is very important to get your facts right, to calmly and logically lay out the issues, to be sure your meaning is crystal clear. This is not so important when writing to persuade. In writing to persuade you may wish to highlight some facts and downplay others.

You may even want to exaggerate—just a little. Persil probably doesn't wash any whiter than other detergents. You are allowed to take some liberties like this in persuasive writing, because your goal is to move people, to get them to take a new position, to do something new, or, in the case of a proposal, to give you money. How can you write so that your love of your subject, your passion, shines through? Here are some tips:

- Use strong, emotional words like urgent, vital, essential, new and related ones. At the same time, avoid vague 'weasel' words like *possibly, under certain circumstances.*
- Short sentences convey urgency. Long sentences, with lots of subordinate clauses that go on and on and on and on, like this one, tend to put the reader to sleep!
- An arresting word or phrase can awaken a reader to the importance of what you are saying. Making a timely reference can help too. For instance: 'The new devil weevil attacking millet in West Africa has the power to kill as many children as have died in Bosnia, Kosovo and Iraq—only, the weevil will kill more slowly; first through increased malnutrition, then through famine.'

- Get your message across as quickly as possible, and in as few words as possible. A short, punchy paragraph will have more power to move your audience than a longer piece, no matter how well written or strongly felt.
- Use the active rather than the passive voice. An *active* sentence is one in which a subject takes direct action. Here are three examples:
  - The researcher planted 60 saplings.
  - Five chickens crossed the road.
  - The cows gained half a kilogram each month.

A *passive* sentence is one in which the subject is acted upon. The three passive sentences below are much less punchy and urgent than the active sentences:

- Sixty saplings were planted by the researcher.
- The road was crossed by five chickens.
- A weight gain of half a kilogram was recorded in the cows each month.

You can create different feelings in your readers by your choice of words. In the recent US election campaign, one candidate always used the phrase 'climate change', while the other used 'global warming'. Which one makes the future look more frightening? Climate change is a much gentler phrase, and was used by the candidate who does not want to sign the Kyoto Protocol. Global warming is a stronger phrase, and was used by the candidate who wanted to scare readers or listeners into taking the problem seriously.

Another example from the campaign was the phrase 'inheritance tax'. This is a phrase most people have used and understood for many years to cover the tax that the government levies on people who die leaving a large amount of money to their heirs. One candidate wanted to cut this tax, which, of course, would be popular with the heirs of rich people! To make his point more forcefully, this candidate used a new phrase that was much stronger. He called it a 'death tax'. You can have similar effects on your readers by carefully selecting the words and phrases you use in your proposals.

15.2 Style, readability, editing

15.2.1 General writing tips

The suggestions in this topic are not only relevant for writing up proposals, but will help you with all your writing activities. However, written proposals are still by far the most common way of approaching a donor for money, so it will be essential for you to sharpen your writing skills if you want to be an ace in this field. Here are some simple rules about writing:

1. Think about your readers before and while you are writing

When you write a love letter, you have your beloved in mind. You would not say wonderful things about her long hair if it is short; you would not praise his muscles if he is rather thin. This approach is equally valid for all the writing you do. When you write a letter of complaint to a company, think about the company and its interests. Why should they care about you? Then think about the person who is going to open and read your letter first. What sort of person is this likely to be? What sort of feelings do you want that person to have when reading your complaint? What sort of action are you hoping that person will take? Notice that you are thinking not about your own feelings of anger or irritation, but about the feelings of the receiver. This will calm you and help you to write more clearly. You will also be more likely to get the action you want if you try to put yourself in the other person's place.

The same thing is true for writing to donors. Think about their needs, not your own needs for money, and you will be more likely to secure your grant. You cannot think about your audience if you know nothing about them. So part of the most important thing about writing is:

a) Know as much as possible about your readers before you start to write. Several sessions have tried to tell you a little about who will read your research proposals. This is the basis on which you can build your own donor intelligence, learning more and more about the people who have the money you need.
b) Spoon-feed your reader: make your writing as easy to read as possible. This is really part of thinking about your readers. You should assume that your readers are busy people, with many things to do other than read your work. To get their attention, and get the actions you want, you need to make your message as easy to read as possible. Here are some tips on how to make your writing readable.

2. Write simply

2a. Use simple word

Get into the habit of using the shortest and simplest word you can. You should have no difficulty in deciding which of the following two sentences is easier to read and understand.

(i) 'The scientific members of the establishment seek to ascertain whether the electricity supply has been merely temporarily discontinued or if they are suffering a permanent disconnection.' (ii) 'The scientists want to know if this is just a short power cut, or if the electricity has been cut off.' The attachment has some examples of long words and their shorter, and better, equivalents. You may also want to start a list of your own, and keep it on a notice-board in your office to remind you to use the short words whenever you can.

2b. Use simple, direct sentences

Do not be afraid to use simple language and short sentences. Readers will not think you are stupid but will thank you for making your meaning clear. In addition to using simple words, try to get into the habit of writing simple sentences. Read the following sentences:

'The policy environment within which research organizations operate sends signals about which types of research should be conducted and defines the structure and organization of the research bodies. It also establishes the level and nature of the resources provided to carry out the research mission. Financial policies for agricultural research strongly influence both the level of the research effort and the degree to which that effort is linked to particular sectoral or scientific goals and objectives.'

This is the opening paragraph of an article. It makes sense, but it is not easy to read, and certainly not easy to read quickly—it does not entice you to read more, if you are only partially interested. Below is a paraphrase of this paragraph that conveys almost the same meaning. It uses simple words, and simpler, more direct sentences. This version will certainly save the reader time and effort in absorbing the meaning. 'Government financial policies have strong, direct effects on agricultural research. Policies influence how much research is done, where it is done, and for whom it is done '

2c. Use short paragraphs, plenty of white space and plenty of subheads

Popular (or tabloid) newspapers are designed for lazy readers. Their material is very easy to read. They never have more than one idea per paragraph. Sometimes they have a new paragraph for every sentence.

They use pictures and headlines to break up the text into small, easy-to-read chunks. You can follow some of these rules. If you find your paragraphs going on and on, just break them into two. Set your word-processing program to use large margins. Never have a whole page of text without a subheading. Use bold text and italics to highlight the most important parts of your message. See how we have tried to make this course material as easy for you to read as possible. One tip that is particularly useful for scientific writing is to use bullets whenever you write a long list sentence. See which of the following you find easier to read:

i) 'There are several reasons why participation in regional cooperation is not always fully costed out. They include a lack of awareness; a general attitude among institutions, countries, and individuals that 'it is always better to be in than out'; a tendency to focus more on the expected gains than on the costs when making such decisions; managers' fear of being seen as uncooperative; and, failure of members to seek inputs from financial specialists, especially at the design phase.'

There are five reasons why participation in regional cooperation is not always fully costed:

- lack of awareness
- a general attitude that 'it is always better to be in than out'
- a tendency to focus more on gains than costs
- managers' fear of being thought uncooperative
- a failure to seek inputs from financial specialists, especially during design'

Notice that in addition to using bullets, we have also simplified the sentences without losing too much of the meaning. By making the bullets shorter, they are now easier to read.

There are other tricks to making your writing a pleasure to read. These include:

- using the active voice
- choosing lively verbs
- putting your points positively
- re-reading your work
- using graphs, tables, and pictures to illustrate your words

3. Plan before you write

Very few writers can write anything except a short note or e-mail without having to first think about the structure of what they want to say. Most writers will find that they write more clearly and more quickly, if they first prepare an outline of the whole document. Some people prepare their outlines in their head, but most people write it down, so that they can refer to it as they write. This is what we recommend you do, too.

We suggest that before you write anything you spend some time thinking about these four questions:

- What are you writing? (report, journal article, proposal, term paper, letter of complaint)
- Who will read it? (individual and organization)
- What is its purpose? (to explain, convince, get money, request action, analyse etc.)
- What is the topic, and how many sections do you need?

After thinking a while, you might find it useful to write out your answers along the lines of the following example. 'This is a report to the African Development Bank describing progress on the maize improvement project after the first year. The report will go to the AfDB Program Officer for Uganda. He needs to understand that the project is delayed because we have had poor cooperation from local

officials, and farmers were discouraged by the late arrival of the improved seed. But there is some good news too, so the report will have two sections—bad news and good news—and a final paragraph suggesting a revised project work plan.' You would probably then go on to sketch an outline of the report. We will be discussing outlines and formats for concept notes, proposals, and progress reports to donors later.

15.3 Writing and presentation for non-technical audiences

The obligation that researchers have to communicate with a wide range of audiences, other than their researcher peer-group, has been discussed. In topic 21, we have discussed the different writing styles that are appropriate for different audiences and occasions.

15.3.1 Who controls the content?

Some non-technical writing about research issues includes open-day posters, technical bulletins, or extension leaflets. These forms of communication target specific audiences. The publications are usually not written by researchers but by colleagues or collaborators with training in adult education and/or agricultural extension to ensure that the material meets the needs of development workers, farmers, and extension agents.

When writing for the popular media, the researcher may not have control over what is finally printed in the magazine or daily paper. Often the magazine initiated the demand for an article and the journalists and editors control the content. Obviously, when writing for a farming magazine, new techniques would be of interest; but when writing for a business section of a newspaper it would be better to stress the economic benefits and increased profits your research might lead to.

15.3.2 Capture your audience

In most writing for non-technical audiences, you do not have a captive audience. Any article must therefore compete for attention with many other articles. Headlines and attractive, attention-grabbing illustrations are consequently of much more importance in writing for non-technical audiences than for specialists reading research journals.

Two types of reader

Readers of information, including technical information, can be categorized as consummatory and instrumental.

Instrumental readers use the material they are reading as an instrument to solve a problem or fill a gap in knowledge. Because of this they are prepared to search for the information.

Consummatory readers view information and increased knowledge merely as interesting aspects of life. They do not perceive information as fulfilling a need.

Most researchers spend most of their time writing for instrumental readers. These may be technical (such as fellow researchers, perhaps administrators) or non-technical (such as donor representatives or politicians) who are seeking the information contained in articles or program reports produced by the researcher. However, most people are also consummatory readers and writing for this audience may be an important component of the dissemination of research results.

All members of society have a right to be informed of the results of publicly funded research and for this reason writing for a wider audience should not be considered less important than preparing papers for specialist journals. Consummatory readers may also include extension agents and farmers. These groups could benefit from knowing about your research, but they have many other priorities and demands on their time. Their attention needs to be drawn to what you have found. Their 'need to know' must be created, to make them into instrumental readers

15.3.3 Deciding what to write

When writing a popular article for non-technical, consummatory readers it is important to establish what is important, interesting, and relevant.

- Is the information new, or are the events recent enough to be interesting?
- Is the information close enough (geographically or to people's lives and experience) to be interesting?
- Will the information affect peoples' lives, and therefore appeal to their self-interest?

Agricultural researchers work in a field that is of wide interest since everyone has to eat, and everyone is affected by their physical environment. It is for the researcher to use one's imagination to identify what will bring about changes in people's lives and is likely to be of interest to journalists and the wider public.

15.3.4 Writing techniques

The same basic rules apply to popular non-technical writing as to writing research articles. These include:

- Avoid technical terms, which is often difficult for researchers who are not used to interacting with non-technical people.
- Use short words.
- Write short sentences; short 'active' sentences are easy to understand.

Readability can be quantified. A popular English-language magazine may have 12–15 words per sentence and an average of 1.6 syllables per word. But, on the other hand, a research paper may have as many as 25 words per sentence and 1.9 syllables per word. So, when writing for a non-technical audience, change your writing style.

15.3.5 Order of presentation

In popular writing, the most important information usually comes first. After reading the first few sentences, the reader decides whether the rest of the article is worth reading. The end of the article could easily be cut by the editor without losing much of the information. The presentation of a technical paper, however, is completely different with an introduction at the beginning that often gives information that is already familiar to some of the readers, and the most important conclusions at the end of the paper. So, when writing for a general audience you don't only change your style but also the order of presentation.

15.4 Ethical issues in scientific writing

15.4.1 Double publishing and multiple submissions

Double publishing is when the same data is used to produce two papers that are published in two different journals. This is strictly prohibited in scientific publishing circles. In addition, you should never submit the same article to several journals at the same time. If and when you are found out it will like be very embarrassing for you, and might even cost you your scientific reputation for many years.

Many international journals are becoming ruthless in their treatment of what they consider to be dishonest authors. Double publishing and multiple submissions are regarded as cheating. Most journals make it a condition when they accept a paper for consideration that it is not being considered for publication anywhere else. The rules call for you to submit one paper to one journal at a time, and never try to make two different papers out of the same data set. The exception to this rule is writing for a general audience in a popular publication. After your research paper has been published in a scientific journal, you may rewrite the material for a lay audience and publish it in the popular media. Not only is the quite ethical, but it is also encouraged, as opening an avenue for the population to know what its scientists are doing.

15.4.2 Publishing in different languages

If an article has already been published in your own language, you should not expect to translate it and then send it off to a journal that publishes in another language, and publish it there also. The only way this can be ethical is if you explain in advance to the editor of the second publication what you have done—i.e., published the paper in another language already. If the second editor is agreeable to this arrangement, you will still need to get permission from the journal in which you first published.

15.4.3 Publishing conference papers

If you give a paper at a conference you need to choose whether you want to publish the paper in a refereed journal or you will give the paper for publishing in the conference proceedings. If you wish to publish a reworked version of a conference proceedings paper, perhaps with additional information, some time later, remember to obtain permission from the conference organizers first.

15.4.4 Authorship

There are many ethical issues associated with authorship. When considering the submission of a paper for publication, you need to consider, and answer the following questions:

- Who holds the rights to the data?
- Who did the research?
- Are you entitled to write up and publish under your name?
- Whose names should be on the paper?

If you intend to name other people as co-authors you must check with them to ensure that they have no objections. The names at the top of the paper should be those of the researchers who did the research and nobody else. Journals do not want directors' names first or anywhere at all if they did nothing in the experiment or did not help with writing the paper. You should avoid loading your paper with a long string of names Authorship is a dangerous area. Journal managers are just as sensitive about disputed authorship and allegations of stolen results as they are about double publishing. So be very careful that

every author you mention fully agrees with the publication of the paper in the form that you present it.

The following guidelines for authorship are recommended:

- The first author should be the one who did most of the work and wrote most of the paper.
- Second should come the person who either supervised the activity of the first, as well as planned the study and helped write the paper, or, alternatively, the person who did the second-most amount of work.
- Next should come any researchers who contributed, in decreasing order of their inputs.

15.4.5 Copyright

People who write anything in most countries automatically possess certain rights to their work. You wrote it, so you should be able to choose and control where and how it is published. This is known as copyright. You 'hold the copyright' for your own work. If a written work is to be published, the authors will transfer some or all of their rights, by formal agreement, to the publisher. These rights include the right to make copies of the work and the right to distribute these copies. In international practice, most journals will publish a copyright notice when they claim the copyright. This may involve the copyright symbol ©, or sometimes the phrase 'all rights reserved'.

15.4.6 Permission to reproduce material

If you want to include in your publication a figure or table or other material that is from a published work under copyright, you must get permission from the copyright holder. It is your responsibility as an author to do this. It is not difficult, but can take time. You write to the publisher giving exact details of what you want to reproduce and where you want to print it. Most presses will grant all reasonable requests at no charge, subject to the agreement of the author. So at the same time, you should write to the author to seek permission. When you receive both permissions, send copies of both with your article to the publisher or journal editor you selected. When you reproduce such material, remember to credit it in the text. Here is an example of what you might say: 'Reproduced with permission from CSIRO Australia, Jones AB, Aust J Bot 1985, 53: 121-5'.

15.4.7 Guarantee of material

In signing a publication contract or submitting a paper to a journal, authors guarantee that:

- The work is original
- The author(s) owns it
- No part has previously been published
- No other agreement to publish all or part of it is outstanding.

As noted, if you have published a significant part of the material elsewhere, you must obtain written permission to reprint the material from the copyright holder and send a copy of the permission to the publisher. You must also mention this matter of copyright in your paper. The issue of copyright and intellectual property is complicated. Publishers are strict and getting stricter. Be careful, and take advice from senior, experienced, and trusted colleagues, who have published widely. If in doubt, always check with the editor of the journal in which you hope to publish. It is always better to check than to make assumptions that can later give you grief.

Trainer's guide

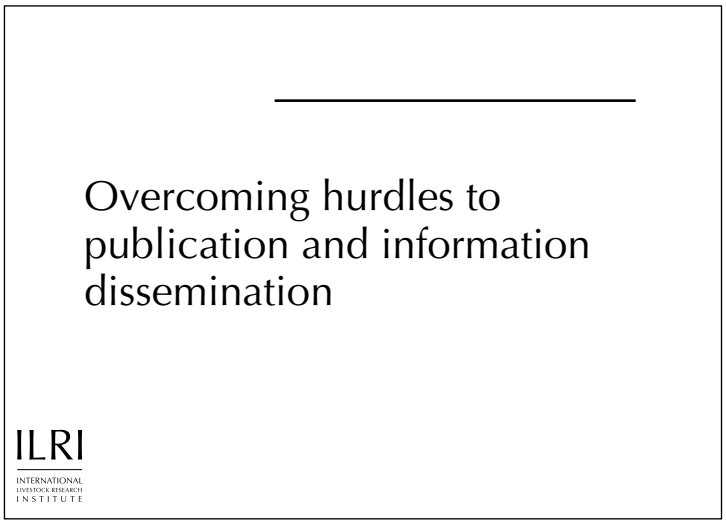
Session 16: Overcoming hurdles to publication and information dissemination

Session objectives	By the end of this session participants will: • Appreciate the factors that make it hard for people to publish or disseminate their research findings • Write easily and simply • Identify appropriate ways of overcoming the factors that constrain researchers to publish their findings • Apply the different considerations for effective communication
Training materials	• Assorted markers • Felt pens • Flip charts
Time needed	50 min
Method of facilitation	

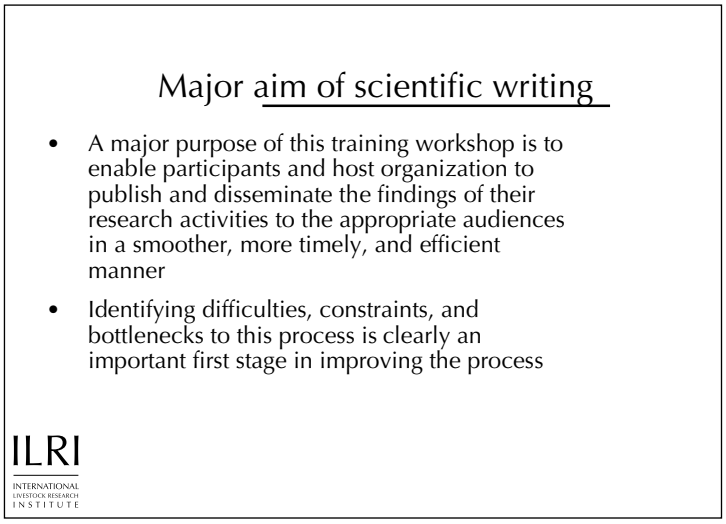
Activities	Contents	Time
Plenary discussion	Ask participants for some of the reasons why publishing and disseminating research results are limited in Africa	5 min
Plenary presentation	Overcoming hurdles to publications and information dissemination	35 min
Participants interaction	Participants are organized into a group to discuss the questions and answers to the exercise on project management, monitoring and evaluation.	5 min
Plenary presentation	Participants share in subgroups what best practice and challenges they have experienced. Write on cards—green for best practices, red for challenges.	5 min
Summary	Trainer summarizes the salient features of the session	
Individual exercise	Workshop evaluation	
Handouts and reference materials	PPT: Overcoming hurdles to publication and information dissemination Reading notes on overcoming hurdles to publication and information dissemination	

Session 16: Summary of presentations: Overcoming hurdles to publication and information dissemination

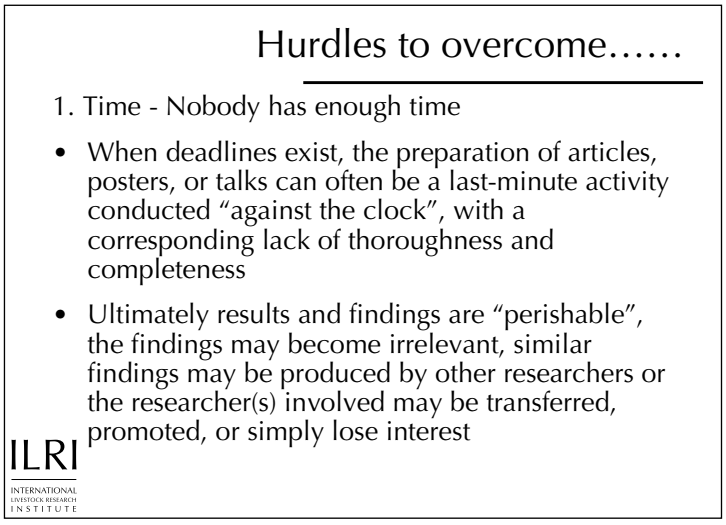
16.1



16.2



16.3



Slide 4

Hurdles to overcome (cont'd…)

2. Communication and coordination between researchers

- Problems of time are amplified when more than one author or contributor is involved
- Each partner may have difficulty preparing or reviewing their own contribution or that of their colleague
- If the main contributor is junior to more senior collaborators it may be difficult and frustrating to maintain momentum during the preparation process
- Existing differences between potential collaborators as to the nature and meaning of the material
- Collaborators in different institutes or countries

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Slide 5

Hurdles to overcome (cont'd…)

3. Access to information

- Most researchers outside of a few well-funded universities or institutes do not have access to the full range of journals and specialist background literature in their subject
- Researchers without access to abstracting services or the Internet may even find it difficult to maintain awareness of what work other researchers in their subject are doing
- Obtaining copies of other researchers' work can be a lengthy and expensive process and the institute or project budget may not be able to afford them
- This 'isolation' from the broader community of researchers may hinder and delay the process of writing, either by reducing confidence in the validity and originality of what has been done or simply through the delays in waiting for thorough background information

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Slide 6

Hurdles to overcome (cont'd…)

4. Choice of journal

- Ensuring that a completed research article is in fact submitted to an appropriate journal, one that publishes articles on the particular subject, is an obvious step
- Some journals are published by societies and only members of the society may publish in it
- Some journals have page charges, where authors contribute to the cost of publication - Who will pay these, is there a budget in the project or the institute to cover any such charges?

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16.7

Hurdles to overcome (cont'd…)

5. Publishing process

- Journals themselves may only publish 2 or 3 or 4 times a year
- Referees and editors are themselves short of time, called to other tasks and delayed by poor or late communication
- Unnecessary difficulties and delays often result from the fact that the authors did not follow the instructions to authors as specified for the journal to which they submitted their paper
  - preparation of tables and graphs
  - the length of the abstract
  - lack of a clear distinction between the results and discussion sections of the paper
  - or an incomplete list of references

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16.8

Hurdles to overcome (cont'd…)

5. Publishing process

- Language is another issue that can lead to considerable difficulties
- many poorly-written papers are submitted
- most reviewers become irritated by impenetrable and wrong use of the language and will quickly conclude that the paper is not suitable for publication
- The refereeing process is time consuming
  - Referees are also dealing with many tasks and responsibilities
  - They may be in different countries
  - Manuscripts are still often distributed, and comments added, on paper copies distributed by post
  - changing the number of issues per year, may delay the whole publishing process

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16.9

In conclusion…

- Many factors may delay dissemination of a researcher's work
- Many of these may appear beyond the control of the researcher and be a cause of intense frustration
- With thought and planning, and the skills, these can be minimized and the whole process of bringing important and necessary information to those who will benefit from it, be made easier

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Session 16: Notes to participants: Overcoming hurdles to publication and information dissemination

16.1 Introduction

A major purpose of this training workshop is to enable participants and their host organizations to publish and disseminate the findings of their activities to the appropriate audiences in a smoother, more timely, and efficient manner. Identifying difficulties, constraints, and bottlenecks to this process is clearly an important first stage in improving the process.

16.2 Time

Nobody has enough time. Preparing an article is not (in the short or medium term) 'perishable' and (again in the short or medium term) results do not decay. Frequently and inevitably, other activities with time constraints, e.g. completing a survey before the rainy season, overseeing the harvesting of field trials, giving lectures at the local university for which the dates have been set, can all take priority. For most researchers writing becomes something done in the evenings, or at weekends.

Often the only mechanism to ensure that preparation of articles and talks becomes a priority is the establishing of a deadline by an outside authority. When deadlines exist, the preparation of articles, posters, or talks can often be a last-minute activity conducted 'against the clock', with a corresponding lack of thoroughness and completeness. With deadlines missed, the urgency to complete may again be lost and once more the preparation of an article or report can take second place to more urgent activities. Ultimately results and findings are 'perishable', the findings may become irrelevant, similar findings may be produced by other researchers or the researcher(s) involved may be transferred, promoted, or simply lose interest.

16.3 Communication and coordination between researchers

The problems of time are amplified when more than one author or contributor is involved. Each partner may have difficulty preparing or reviewing their own contribution or that of their colleagues. If the main contributor is junior to more senior collaborators (for example, the need to await the corrections and approval of the Institute Director), it may be difficult and frustrating to maintain momentum during the preparation process. It may even be the case that differences exist between potential collaborators as to the nature and meaning of the material to be presented, which may necessitate protracted negotiation before agreement is reached. If the collaborators are in different institutes, or in different countries, the problems are correspondingly greater.

16.4 Access to information

Most researchers outside of a few well-funded universities or institutes do not have access to the full range of journals and specialist background literature in their subject. This of course includes most researchers involved in agricultural development. Researchers without access to abstracting services or the internet may even find it difficult to maintain awareness of what work other researchers in their subject are doing. Even if researchers are aware of, and wish to read, what other workers are doing, obtaining copies of other researchers' work can be a lengthy and expensive process and the institute or project budget may not be able to afford them. This 'isolation' from the broader community of

researchers may hinder and delay the process of writing, either by reducing confidence in the validity and originality of what has been done or simply through the delays in waiting for thorough background information.

16.5 Choice of Journal

Ensuring that a completed research article is in fact submitted to an appropriate journal, one that publishes articles on the particular subject, is an obvious step. Some journals are published by societies and only members of the society may publish in it. Is at least one of the authors a member of the society in question? Is the article the right length for the journal—is it short enough or long enough for the journal?

Some journals have page charges, where authors contribute to the cost of publication. (Some journals offer free publication, but faster publication if page charges are paid). Who will pay these, or is there a budget in the project or the institute to cover any such charges? Can the journal reproduce any figure or plate that the article may contain? Will the cost of these be charged to the authors or their institutes?

16.6 The publishing process

Journals themselves may only publish 2 or 3 or 4 times a year. Referees and editors are themselves short of time, called to other tasks and delayed by poor or late communication. For this reason, minimizing difficulties that are within the researcher's control (the subject of this workshop) are clearly of importance. Unnecessary difficulties and delays often result from the fact that the authors did not follow the instructions to authors as specified for the journal to which they submitted their paper. Examples include the preparation of tables and graphs, the length of the abstract, lack of a clear distinction between the results and discussion sections of the paper, or an incomplete list of references. All of these are specified in the instructions to authors while good examples are readily available in recent issues of the journal. Language is another issue that can lead to considerable difficulties. Many authors who write English-language journal articles do not have English as their mother tongue.

Journal editors cannot be expected to edit the language of the submitted papers other than to spot and correct the odd typing or grammatical error. Still, many poorly-written papers are submitted. Not surprisingly, most reviewers become irritated by impenetrable and wrong use of the language and will quickly conclude that the paper is not suitable for publication rather than spend time to search for the gem that may make the paper worthwhile. Here the obvious solution lies in asking someone with greater language skills to read the paper critically before submission, and to do the editing for you or refer you to a professional editor if necessary.

The refereeing process is time consuming. Trying to ensure that referees deal promptly with manuscripts they are sent to review is one of the major tasks of a journal editor. Referees themselves are also dealing with many tasks and responsibilities (often including their own research). They may be in different countries. Manuscripts are still often distributed, and comments added, on paper copies distributed by post. Journals themselves are often part of commercial organizations and on occasion business decisions, such as changing the number of issues per year, may delay the whole publishing process.

16.7 Summary

As is clear from this brief overview many factors may delay dissemination of a researcher's work. Many of these may appear beyond the control of the researcher and be a cause of intense frustration. However, with thought and planning, and the skills to be taught in this module, these can be minimized and the whole process of bringing important and necessary information to those who will benefit from it, be made easier.

Annex 9: ILRI style guide for editors and writers

Introduction

This style guide contains the house style to be followed when preparing documents for the International Livestock Research Institute. Consistent use of the house style will ensure that all material published maintains the institute's corporate identity.

The Publishing Unit can assist with identifying professional editors/proofreaders for your manuscript. A copy of this document should be made available to all external editors. The document is also available on ilrinet, ILRI's intranet: http://ilrinet.ilri.cgiar.org/defaultframe.asp

Spelling and terminology

ILRI follows British English spellings and usage. Primary references for these are *The Concise Oxford Dictionary* for spelling and hyphenation, *Collins Gem Dictionary of Spelling and Word Division* for word division and *Fowler's Modern English Usage* for usage.

Use the first spelling listed in the *Concise Oxford Dictionary*, which includes using 'ize' rather than 'ise' spellings in such words as hybridize, organize, realize, recognize and sympathize. Note, however, a few exceptions in British 'ize' usage: analyse, dialyse, catalyse etc. Also note that some ILRI terminology differs from this standard (see Appendix 2)

Compile a custom dictionary on your computer for commonly used words. Ensure that the default language for your document is set to English (UK) by selecting Language from the Tools menu.

Compound words

In general, follow the *Oxford Concise*, but regardless of particular compound lists, cut down on hyphens and compounds words.

- The tendency for English spelling is not to hyphenate where the sense is clear, e.g. subeditor, subregion, overuse, database, germplasm, ongoing, proofreader, worldwide etc.
- Do not hyphenate adverbial clauses, e.g. environmentally sound development.
- Hyphenate compound adjectives when they preceded the noun they modify, e.g. short-term objective (but 'an objective that is short term').
- Do not hyphenate compound adjectives denoting regions, e.g. southeast, southwest, northeast, northwest.

Emphasis

Because there are so many scientific names in ILRI publications in italics, use single quotation marks for words that need emphasis. Put local names of plants and similar terms in single quotes (regular typeface) the first time they are used.

Jargon

Avoid jargon and buzz words of the moment: e.g. *not* backstop *but* back up, support, reinforce.

Non-biased language

- As far as possible, avoid biases in the language: e.g. *not* 'the farmer tilling his fields…' *but* the farmers tilling their fields…'.
- Avoid sexist language. Correct: people, chairperson, humanity, spokesperson, handmade, trader, worker etc. Incorrect: man, chairman, mankind, spokesman, man-made, middleman, workman.

Scientific and technical names

- Use italics for Latin genus and species names. Note: abbreviations such as ssp, var, cv in a scientific name are not italicized.
- Latin names for family, order, class etc. start with a capital letter but are neither underlined nor put in italics.
- Use full stops when abbreviating genus and species names (*T. b. brucei*, not *T b brucei)*.
- Insert a space between abbreviations of genus and species names (*T. b. brucei*, not *T.b. brucei),*
- When names of species occur in titles or heads, the style of which is to capitalize the first letter of every main word, do not capitalize the species names for the sake of stylistic consistency (The Importance of *Trypanosoma brucei* in Africa, not The Importance of *Trypanosoma Brucei* in Africa),
- English names are not capitalized unless they contain a proper noun, such as someone's name or other proper name (ascochyta blight, but East Coast fever).
- Sometimes the Latin name and the English name are the same; make clear whether the scientific name or the common equivalent is intended (*Leucaena*, leucaena; *Acacia*, acacia).
- Refer to crops by their English names; weeds, insects, and pathogens by Latin names (without authorities unless especially required, such as in a taxonomic paper), except for the most common pests and for diseases for which English names are widely accepted and unambiguous.
- Common (generic) names start with a lowercase letter, trade names with a capital.
- Variety names of crops start with a capital letter, e.g. Katumani, Sissay, Enkoy.
- Soil types start with a capital letter, e.g. Vertisol.

Acronyms and abbreviations

- Do not abbreviate figure, table or litre.
- Do not use an acronym or abbreviation if the term it stands for appears only once in a document. If a term appears more than once, spell it out on its first use and put the abbreviation or acronym in parentheses immediately after. Thereafter use the acronym only without full stops or spaces.
  - dry matter (DM)
  - tonnes (t)
  - Consultative Group on International Agricultural Research (CGIAR)
  - Food and Agriculture Organization of the United Nations (FAO)
- In tables, use footnotes to define all abbreviations, acronyms and symbols used.
- In figures, define abbreviations and acronyms in the caption; symbols will generally be defined in the key/legend.
- Do not spell out SI or statistical symbols.
- Keep a separate list of all acronyms you use and their full names. A list of acronyms is useful if several are used in the paper.

Capitalization

- In book titles, headings, subheadings and captions, use capitals only for the initial letter.
- In text, capitalize table, figure, annex, appendix, section etc. when referring to a specific table etc. in the document.
- Capitalize regions used as proper nouns.
- South Africa, Southeast Asia
- If a name consists of more than one word, capitalize the first letter of each word except articles, conjunctions and prepositions such as *of*.
    - Association for Strengthening Agricultural Research in Eastern and Central Africa
    - Kenya Ministry of Agriculture
- Where a multiple-word name is subsequently shortened to part of the name, do not capitalize the short name.
    - Coast Province . . . the province
    - International Livestock Research Institute . . . the institute
    - Addis Ababa University . . . the university
    - The Ethiopian Government . . . the government
- Such terms should also not be capitalized if used in a general sense.
    - A university, a province, a centre, government policies
- Do not capitalize the common names of plant and animal species and various groupings of species, but capitalize names of breeds.
    - N'Dama, West African Dwarf goats, East African Zebu cattle, zebu cattle, hair sheep, taurine cattle

Lists

- For very short lists, initial word is lower case and there is no end punctuation.
- For longer lists, initial word lower case and end list with full stop.
- For complete sentences, initial word of each capital and end each with full stop.

Punctuation

Full stops

- Leave only one letter space after a full stop at the end of a sentence.
- Use full stops in i.e., e.g., etc., et al., p. and pp.
    - Otherwise, do not use a full stop in abbreviations unless the abbreviation might be confused with a word.
    - no. for number (not 'no')
    - temp
    - Do not punctuate degrees, titles etc.
    - BSc MSc PhD FRCVS The Right Hon Mr Mrs Ms Dr Prof
    - Do not use full stops after sp, spp var and cv.

Commas

Minimize the use of commas. Use commas to separate clauses within complex sentences to prevent possible misreading.

- Do not use commas after i.e. and e.g.
- Do not use commas before 'and' or 'or' in a list and before 'etc.'.

Colons and semicolons

- Use a colon when the second part of the sentence directly results from the first part, e.g. The farmer had five children: one is working at the farm, three are working in the city but the youngest is still looking for a job.
- Use a semicolon to join two parts of a sentence that belong together but contain different statements. In most cases the semicolon can be replaced by 'and', 'but' or 'because'. Both parts must be a complete sentence, with a subject and verb. For example: It is a pity that the farmers in our trial are illiterate; this is hampering the experiment.

Brackets

- (When a complete sentence is enclosed in brackets, its punctuation is enclosed.)
- When only part of a sentence is enclosed in brackets, punctuation is placed outside (as in this example).

Quotation marks

- Use single quotation marks (' ') to enclose quoted material that is run into text.
- Use double quotation marks (" ") to enclose a quotation within a quotation.
- If the quotation is not a full sentence, place punctuation marks such as commas, colons and full stops outside the quotation marks. If the quotation is one or more full sentences, place the quotation marks outside the associated punctuation.
- Where the quoted text is set off from the text, no quotation marks are needed.

Numbers, units and dates

Numbers

Write out numbers below 10 except:

- When they are part of a series with some numbers below 10 and some of 10 or more.
- The average farm livestock holding consists of 2 cows, 7 sheep and 11 goats.
- When used in conjunction with a standard (abbreviated) unit of measure.
  - 3 kg, 5 TLU, 2 t/ha, 5%
- A number implying an arithmetical manipulation.
  - a factor of 2
- When a number begins a sentence it is always written out.
  - Fifteen sheep were infected.
- In numbers consisting of two to four digits, run the numerals together.
  - 1500, 2570, 9999.
- In numbers consisting of more than four digits, separate groups of three with a comma.
  - 10,000 100,000 1,273,000
- Avoid writing numbers ending in several zeros; either substitute a word for part of the number or add a prefix to a basic unit of measurement.
  - 1.25 million, rather than 1,250,000
  - 9 mg, rather than 0.009 g
- Numbers smaller than 1.0 should be written with a zero in front of the decimal point.
  - 0.05, not .05

Units

- Use the metric system (tonnes, hectares etc.).
- Use the symbols for per cent (%) and degree (°) with numerals; leave no space between the numeral and the symbol.
  - 15°C 25%
- Insert a space before a figure and a unit of measurement.
  - 33 cm (*not* 33cm)
- In an expression of range, omit the symbol after the first number.
  - 15–25% 20–27°C
- Do not use full stops or spaces after measurements, e.g. cm, mm, g, ha.
- Write out if the unit is used without numerals, e.g. the level of N applied in kilograms per hectare.

Expression of division, rate and concentration

- Use a slant line as a sign for division and to show rates or concentrations. Do not use the negative powers system.
  - One-quarter = 1/4
  - kg/ha
  - mol/litre
- Do not use more than one slant line in an expression.
  - kg/ha/year should be written as kg/ha per year

Dates

- Report dates in the sequence day, month, year, with no punctuation.
  - 12 June 1993 (not 12/6/93, since this could mean either 12 June or 6 December 1993, depending on the convention used)
- Do not use apostrophes in decades: e.g. 1990s.
- Do not abbreviate years, i.e. use 1990 not ’90.
- Indicate a range of dates as 1998–99 or from 1998 to 1999.

Time

- Report times using the 24-hour time system; the time is indicated by four digits, the first two for the hour, the last two for minutes, with no punctuation between the two sets.
  - 0830 hours 1200 hours 1905 hours

Currency

- Prices etc. will normally be expressed in local currency, but the exchange rate to the US dollar should be given at first mention.
- The name of the local currency should be spelled out at the first mention, and an ISO-approved abbreviation, using the alphabet rather than symbols, used thereafter (e.g. : United States dollar, USD; British pound sterling, UKP; Euro, EUR; Ethiopian birr, ETB; Kenya shilling, KES; Tanzania shilling, TZS; Uganda shilling, UGS; for a full list of such approved currency abbreviations, see: http://www.xe.com/iso4217.htm)
- When the unit of currency is written out in full, it comes after the number; when abbreviated, it comes before the number.
  - . . . a price of 20 Ethiopian birr (ETB) per kilogram (ETB 8.8 = USD 1.00 at 18 March 2006).
  - then . . . EB 15/kg

Tables and figures

Tables are used for reporting extensive numerical data in an organized manner. They show classifications, facilitate comparison, reveal relationships and save space. They should be self-explanatory. It is seldom necessary to use a table for fewer than 8 items of data; instead, present the information in the text.

Figures present comparisons and contrasts quickly and visually. They catch the reader's attention and are vivid in the message they convey. But by their nature, they do not give the detail of data that can be carried in a table.

You must decide whether a table or figure is better for conveying a particular message. Data presented in tables should not be duplicated in figures. Neither tables nor figures should be discussed extensively in the text, as if they were not there for the reader to see. However, important points can be brought out and reinforced in the text. Every table and every figure should be cited in the text. Tables and figures both should be numbered consecutively in the order they are referred to in the main text. Each should have its own number: not Table 2a, Table 2b but Table 2, Table 3; not Figure 3a, Figure 3b, Figure 3c but Figure 3, Figure 4, Figure 5.

Both tables and figures should be self-explanatory; that is, they should stand on their own, in that the reader does not have to refer to the text to understand the material being presented. Abbreviations in a table should be spelled out in the table footnotes. Axes in a figure should be clearly labelled and symbols used explained in a key.

Note: A table should be an analysis, not merely a listing of all the raw data collected.

Show the units for all measurements. Use no more digits than the accuracy of the method justifies. Do not include columns of data that can be calculated easily from other columns.

Table titles should be brief but sufficiently explanatory of the data included. They should not include the units of measurement. Table titles go above the table. The title is not a complete sentence and should not end with a full stop. It should be flush at the left, not centred.

Figure captions go below the figures. The caption is often a complete sentence; even if it is not, it should end with a full stop. Submit your data figures with your figure, whether it is drawn by hand or on the computer, so that if it needs to be redrawn, that can be done accurately and efficiently.

References

Every reference cited in the text of an article or as a source of a table or figure must be included in the reference list with full bibliographic details. The details must be complete, so that an interested reader can locate the reference. Also, any work listed in the reference list must be cited in the text.

Citations in the text

- Use the name-year system, with no comma between the author and the year (O'Connor 1992).
- When an author has written more than one work in the same year, use a, b etc. to differentiate, e.g. 1999a, 1999b.
- Where there are more than two authors for a publication, use the first author's name and et al. in the text; give all the names in the reference list (Smith et al. 2003).

- When there is more than one reference for a certain issue, separate the citations with a semicolon; place the citations in chronological order with the earliest citation first (O'Connor 1992; Smith et al. 2003; FAO 2004).

Styling the reference list

- All lists of literature cited should be in alphabetical order by surname (or main name) of the first author, followed by initials; if there are listings of different authors with the same surnames and initials, then alphabetize by date.
- All works by a single author precede works by that author jointly with others.
- Works written by an author precede those edited by the same author.
- Works published in the same year are alphabetized by title.
- Multi-authored works are alphabetized by surname of the first author, then of the second etc.
- Italicize titles of books and journals; do not italicize titles of articles and chapters.

Components of a publication

Major components for a journal article

- **author.year.**
- **title of article.** Not italicized or enclosed in quotation marks. Capitalization is 'sentence style', that is, capitalize only the first word and proper nouns, as you would in a sentence. Followed by a full stop.
- **name of journal.** In italics; do not abbreviate the journal title.
- **volume, inclusive pages.**

Major components for a book

- **author.year.**
- **title of book.** Italicized followed by a full stop.
- **publisher:** Give the name of the publisher followed by a comma.
- **city of publication**: Give the city where the book was published, followed by a comma.
- **country of publication:** Give the country where the book was published followed by a full stop.
- Note: if the publisher has multiple offices around the world, omit the city and country.

Major components for a chapter in a book or a paper in a proceedings

- **author.year.**
- **title of chapter or paper.**
- **in:** Give editors' names and initials followed by (eds) and a comma.
- **title of book or proceedings.** Italicized followed by a full stop.
- **publisher:** Give the name of the publisher followed by a comma.
- **city of publication:** Give the city where the book was published, followed by a comma.
- **country of publication:** Give the country where the book was published followed by a full stop.
- Note: if the publisher has multiple offices around the world, omit the city and country.
- **page numbers**

ILRI and corporate authors

- If the author is a corporate author, for example ILRI, which would be cited in the text as (ILRI 2005), list the acronym or abbreviation of the corporate entity as the author, followed by the name spelled out in full in brackets.

- ILRI (International Livestock Research Institute). 2005. *Annual report 2004*. ILRI, Nairobi, Kenya.

Examples of references

Journal article

- Thorpe W, Cruickshank DKR and Thompson R. 1981. Genetic and environmental influences on beef cattle production in Zambia. 4. Weaner production from purebred and reciprocally crossbred dams. *Animal Production* 33:165–177.
  - Note: If there is a journal number, insert it in brackets after the volume: 33(2):130–135.

Paper in workshop proceedings

- Bunderson WT and Cook RH. 1985. Feeding conserved forages to traditional cattle in the Nuba Mountains, Sudan. In: Nordblom TL, Ahmed AKH and Potts GR (eds), *Research methodology for livestock on-farm trials*. Proceedings of a workshop held at Aleppo, Syria, 25–28 March 1985. IDRC (International Development Research Centre), Ottawa, Canada. pp. 41–63.

Chapter in book

- McKay MN, Nelson OP and Peterson RS. 1988. Sheep and goat farming in Ethiopia. In: Adams AB, Smith ST and Jones FG (eds), *Improved production of livestock in Africa*. 2nd edition. Oxford University Press, London, UK. pp. 275–301.

Whole book

- Esslemont RJ, Bailie JH and Cooper MJ. 1985. *Fertility management in dairy cattle*. Collins, London, UK. 143 pp.
- If the book has named editors, rather than authors, the style is exactly the same, except that the abbreviation 'ed' or 'eds' is added after the name(s). For example:
  - Hafez ESE. (ed). 1980. *Reproduction in farm animals*. Lea and Febiger, Philadelphia, USA. 627 pp.

Institutionally published documents, government reports etc.

- If they have named authors or editors, documents published by institutions, government agencies etc. should be treated in the same way as published articles, books etc. For example:
  - Goldson JR. 1977. *Calf and dairy heifer rearing at Kitale with special reference to smallholder practice*. National Agricultural Research Station Technical Report 15. National Agricultural Research Station, Ministry of Agriculture, Nairobi, Kenya. 15 pp.
  - Okike, Iheanacho. 2004. *Impact of livestock pricing policies on meat and milk output in selected sub-Saharan African countries*. ILRI Technical Report 20. ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia. 79 pp.
  - Al-Najim MN. 1991. *Changes in the species composition of pastoral herds in Bay Region, Somalia*. Pastoral Development Network Paper 31b. ODA (Overseas Development Institute), London, UK. 14 pp.
- If the documents do not have a named author, show the issuing institution or government as the author.
  - AMLC (Australian Meat & Livestock Corporation). 1991. *Statistical review, July 90–June 91*. AMLC, Sydney, Australia. 52 pp.

    - FAO (Food and Agriculture Organization of the United Nations). 1970. *Improvement of livestock and dairy industry, Malawi. Pasture and range conditions.* FAO Technical Report 3. FAO, Rome, Italy. 15 pp.
- If the documents have multiple institutional authors and one is the major publisher, show the main publisher as follows:
    - ILRI (International Livestock Research Institute) in collaboration with the Kenya Bureau of Statistics. 2003. *Kenya Poverty Mapping.* ILRI, Nairobi, Kenya. 250 pp.

Unpublished reports

- Huxley PA. 1986. Rationalising research on hedgerow intercropping: An overview. ICRAF Working Paper 40. ICRAF (International Centre for Research in Agroforestry), Nairobi, Kenya.

Electronic publications (reference to Internet documents)

- The basic rules of citing do not differ markedly between Internet and printed publications. There is always an author or organization with responsibility for the publication, a date of publication, a title, a place of 'publication ' and a publisher. It is true, however, that some elements are harder to locate when citing Internet publications. When certain elements are missing, square brackets can be used to indicate missing data or for clarification by the person doing the citing, e.g. [no date]. For publications available on the Internet, give the full reference and add the website address in brackets and the date the website was accessed.
    - FAO (Food and Agriculture Organization of the United Nations). 2005. Training HIV/AIDS orphans in sub-Saharan Africa. FAO Newsroom. FAO, Rome, Italy. (Available from http://www.fao.org/newsroom/en/news/2005/102183/index.html) (Accessed on 16 May 2005)

CD-ROM

- The format for citing CD-ROM publications is similar to that for print media.
    - OUP (Oxford University Press). 1996.*Oxford English Dictionary on CD-ROM* [monograph on CD-ROM]. OUP, Oxford, England.

Appendix 1. SI units

In general, ILRI uses SI (Systeme Internationale) units. The SI base units are:

Physical quantity	Name of unit	Unit symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
luminous intensity	candela	cd
amount of substance	mole	mol

Acceptable SI-derived units include:

Unit name	Symbol	Physical quantity
degree Celsius	oC	Celsius temperature
joule	J	energy, work or quantity of heat
Newton	N	force
ohm	[omega]	electric resistance
Pascal	Pa	pressure
volt	V	and electromotive force and electromotive force
watt	W	power

Non-SI units accepted for general use:

Physical quantity	Name of unit	Unit symbol
volume	litre	litre
mass	tonne	t
time	minute	min
time	hour	h
time	day	day
plane angle	degree	o
plane angle	minute	‘
plane angle	second	“

Annex 10: Preferred usage

For a full list of variants in British and American spellings, check web resources such as: http://www.spelling.org/Freebies/british_vs_american_spelling.htm

acknowledgement	not acknowledgment
ageing	Sot aging
agro-ecology	not agroecology
aluminium	not aluminum
antigen-trapping ELISA	not antigen ELISA
artefact	not artifact
B cell (noun)	not B-cell
B-cell (adjective)	Not B cell
behaviour	not behavior
Blue Sepharose	not blue sepharose
B lymphocyte (noun)	not B-lymphocyte
B-lymphocyte (adjective)	not B lymphocyte
cancelled, cancelling	not canceled, canceling
centimetre	not centimeter
centre	not center
Chad	not Tchad
Chagas' disease	not Chagas disease
channelled, channelling	not channeled, channeling
cheque	not check
co-localized	not colocalized
colour	not color
Coomassie	not coomassie
Côte d'Ivoire	not Ivory Coast
cross-react	not cross react
cross-resistance	not cross resistance
C-terminus (carboxyl end, carboxyl terminus)	not C terminus
Dar es Salaam	not Dar-es-Salaam
database	not data base
decision-maker	not decisionmaker or decision maker
decision-making	not decisionmaking or decision making
defence	not defense
dialogue	not dialog
disulphide	not disulfide
draught, draughtsman	not draft, draftsman
Eagle's medium	not Eagles medium
endeavour	not endeavor
endocytic	not endocytotic
enquire	not inquire
enrol, enrols, enrolled, enrolling immunosorbent assay	not enroll, enrolls, enrolled, enrolling
immunosorbent assay	not enzyme linked
equalling	not equaling
favour	not favor
feeder layer	not feeder-layer (except as adj)
fibre	not fiber
fluorescence-activated cell sorter	not fluorescence activated cell
sorter	not focusses
focuses	not focusses
fold: twofold, ninefold etc. (but 70-fold)	not two-fold, nine-fold etc.
Freund's adjuvant	not Freunds adjuvant
fulfil, fulfilment	not fulfill, fulfillment

gastro-intestinal	not gastrointestinal
goal	not jail
grey	not gray
high-performance liquid chromatography chromatography	not high performance liquid
immunogold	not immuno-gold
infection and treatment (except as adj)	not infection-and-treatment
infection-and-treatment immunization immunization	not infection and treatment
infra-red	not infrared
internet	not Internet
judgement	not judgment
kDA (for kilodalton)	not kD
kerb	not curb
kilometre	not kilometer
labelled	not labeled
labour	not labor
leukaemia	not leukemia
levelled	not leveled
licence (n.)	not license (n. & v.)
license (v.)	—
life cycle as adj)	not lifecycle or life-cycle (except
litre	not liter
liveable	not livable
live weight adj)	not liveweight (except as
MAb (monoclonal antibody)	not mAb
metre (unit of measure)	not meter
modelling	not modeling
Mozambique	Not Moçambique
neighbour	not neighbor
net	not Net
neurone	not neuron
N'Dama	not ndama, D'dama, NDama
northeast, northeastern	Not north-east, north-eastern
northwest, northwestern	not north-west, northwestern
N-terminus (amino end, amino terminus)	not N terminus
oedema	not edema
palaeontology	not paleontology
pelleted	not pelletted
per cent	not percent
plough	
policymaker	not policy-maker or policy maker
policymaking	not policy-making or policymaking
postcode	not zip code
practice (n.)	—
practise (v.)	not practice (v.)
program	not programme
quantification	not quantitation
radiolabelled	not radiolabeled
rigour	not rigor
Sanga	not sanga
savannah	not savanna
sceptic	

semi-arid	not semiarid
sheikh	
skilful, skilfully	not skillful, skillfully
socio-economics	not socioeconomics
southeast, southeastern	not south-east, south-eastern
Southeast Asia	
southwest, southwestern	not south-west, south-western
Southern blot	not southern blot
speciality	not specialty
spiralled	not spiraled
subhumid, subunit, subpopulation, subclinical etc.	not sub-humid, sub-unit etc.
sulpha	not sulfa
Superose	not superose
targeted	not targetted
T cell (noun)	not T-cell
T-cell (adjective)	not T cell
theatre	
the Gambia	not The Gambia
the Netherlands	not The Netherlands
the Philippines	
T lymphocyte (noun)	not T-lymphocyte
T-lymphocyte (adjective)	not T lymphocyte
totalling	not totaling
towards	not toward
transferral	not transferal
trans Golgi	not trans-Golgi or trans Golgi
travelling	not traveling
trypano-resistant	not trypanoresistant
trypano-sensitive	not trypanosensitive
trypanotolerant	not trypano-tolerant
tumour	not tumor
tyre	not tire
UK	not U.K.
under way	not underway
USA	not U.S.A.
web	not Web
web page	not Webpage, Webpage or webpage
website	not Website, Website or web site
webmaster	not Webmaster or web master
Western blot	not western blot
yoghurt	Not yogurt
zebu	not Zebu (except in proper name such as East African Zebu

ISBN 92–9146–240–3