University of Jijel

Faculty of Natural Sciences and Life

Department of Cellular and Molecular Biology

Scientific/Academic English in Molecular Biology

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- Target audience: **3rd year Students of Molecular Biology**
- Objectives: **are initiating students into the lexical, grammar peculiarities of professional English in the sphere of Molecular Biology through reading comprehension exercises, vocabulary exercises and also listening and speaking exercises. Moreover, the aim is to form students communicative competence, abilities to participate in communication on professional topics.**

Content

Unit 1: Cell Biology

Unit 2: Biomolecules

Unit 3: Structure/Passive voice

Unit 4: Pollution/Punctuations

Unit 5: Cloning/Paragraphs

Unit 6: Scientific writing

Unit 7: (IMRAD) Introduction

Unit 8: (IMRAD) Methods

Unit 9: (IMRAD) Results and Discussion

Unit 10: Abstract and Title

Unit 1: CELL BIOLOGY

Vocabulary notes:

Keep in mind these notes in order to use them to build up the discussion section.

- ✓ Cell Membrane
- ✓ Cytoplasm
- ✓ Nucleus
- ✓ Mitochondria
- ✓ Ribosomes
- ✓ Endoplasmic Reticulum
- ✓ Golgi Apparatus
- ✓ Lysosome
- ✓ Cell Cycle
- ✓ DNA Replication
- ✓ Gene Expression
- ✓ Mitosis
- ✓ Meiosis
- ✓ Cell Differentiation
- ✓ Apoptosis

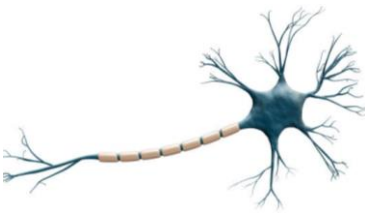
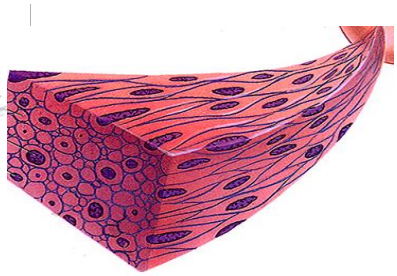
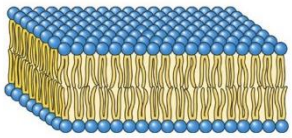
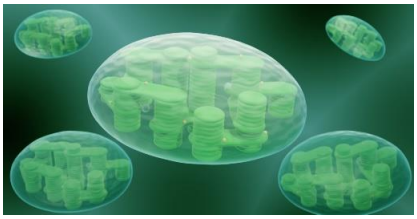
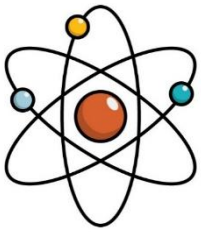
Discussion

1. What is Cell? What is the role of cell?

2. What do you know about types of cell?

Now look at these images and try to complete the specific scientific title for each picture:



Read this passage:

The basic structural and functional unit of cellular organization is the cell. Within a selective and relative semi permeable membrane, it contains a complete set of different kinds of units necessary to permit its own growth and reproduction from simple nutrients. All organisms, more complex than viruses, consist of cells, yet they consist of a strand of nucleic acid, either DNA or RNA, surrounded by a protective protein coat (the capsid). On the basis of internal organization and architecture, all cells can be subdivided into two major classes, prokaryotic cells and eukaryotic cells. Cells which have the unit membrane bound nuclei are called eukaryotic, whereas cells that lack a membrane bound nucleus are prokaryotic. Besides the nucleus, the eukaryotic cells have other membrane bound organelles (small organs) like the Endoplasmic reticulum, Golgi complex, Lysosomes, Mitochondria, Microbodies and Vacuoles. The prokaryotic cells lack such unit membrane bound organelles.

Answer the following questions:

- **What are the defining characteristics that distinguish prokaryotic cells from eukaryotic cells in terms of their internal organization and architecture?**
- **How does the presence or absence of membrane-bound organelles impact the functionality and complexity of prokaryotic and eukaryotic cells?**

Unit 2: BIOMOLECULES

Vocabulary notes:

Keep in mind these notes in order to use them to build up the discussion section.

- ✓ Organic compounds
- ✓ Carbohydrate
- ✓ Lipid
- ✓ Protein
- ✓ Nucleic Acid
- ✓ Polysaccharide
- ✓ DNA (Deoxyribonucleic Acid)
- ✓ RNA (Ribonucleic Acid)
- ✓ Phospholipid
- ✓ Glycoprotein
- ✓ Denaturation
- ✓ Hydrolysis
- ✓ Antibody
- ✓ Nucleotide

Discussion

1. What are biomolecules? What is its function?

2. What are the 4 main classes of biomolecules?

Read this passage:

Biomolecules are the intricate building blocks of life, a captivating orchestra of molecular structures that underpin the complexities of all living organisms. These tiny, yet mighty entities encompass a diverse array of molecules, including proteins, nucleic acids, lipids, carbohydrates, and more. Their unique compositions and intricate arrangements dictate life's fundamental processes, from genetic information storage in DNA to the catalytic prowess of enzymes that drive biochemical reactions. Biomolecules are the architects of cellular structures and the messengers of genetic information, orchestrating the symphony of life itself. Their roles extend to energy storage, membrane integrity, signaling pathways, and countless other vital functions, making them the very essence of life's exquisite tapestry.

Find words or phrases from the passage which tell you the following:

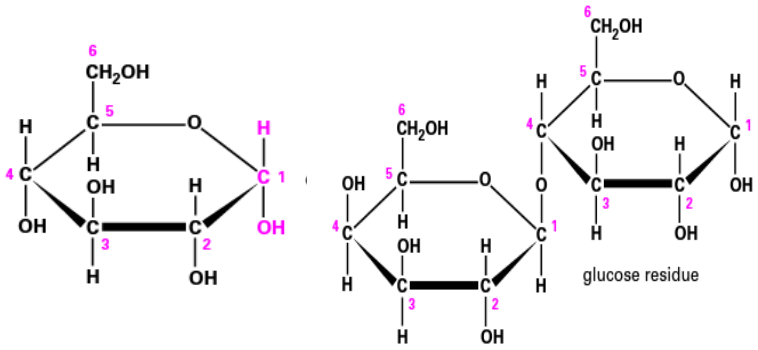
a) Biomolecules play a crucial role in various biological processes.

b) The biomolecules maintain their structure like the harmonious melodies in a piece of music.

c) Organic compounds are complex foundational components.

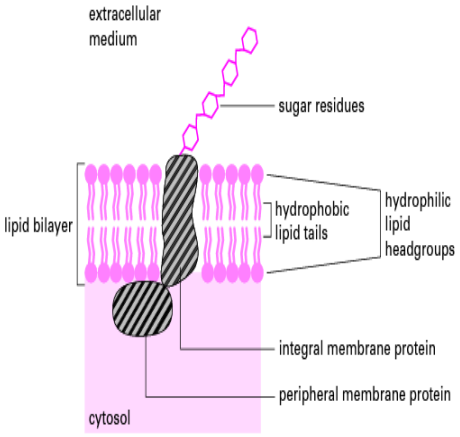
Development

Look and complete the description:



All carbohydrates are formed from the _____ sugars called _____. Figure on the to shows the monosaccharide called _____. _____ can be easily _____ by _____ bonds in which the _____ backbones are linked through _____ and a _____ is lost. For example, Figure on the bottom shows _____, a sugar found in _____ that is formed when _____ and glucose are _____ by a _____bond. Sugars formed from two monosaccharide monomers are called _____.

Look to the image below and indicate which of the following statements is incorrect?



1. The lipid layer of the cell membrane primarily comprises phospholipids, not triglycerides.

2. Lipids in the cell membrane are evenly distributed, without any segregation based on their properties, which is not true.

3. The lipid layer of the cell membrane is composed entirely of triglycerides, which is not accurate.

4. Lipids in the cell membrane exhibit lateral mobility, allowing for membrane fluidity and flexibility.

Unit 3: STRUCTURE

Vocabulary notes:

Keep in mind these notes in order to use them to build up the discussion section.

- ✓ Oncology
- ✓ Carcinogen
- ✓ Metastasis
- ✓ Tumor
- ✓ Malignant
- ✓ Benign
- ✓ Chemotherapy
- ✓ Radiation Therapy
- ✓ Immunotherapy
- ✓ Remission
- ✓ Biopsy
- ✓ Oncogene
- ✓ Neoplasm
- ✓ Angiogenesis
- ✓ Palliative Care
- ✓ Adjuvant Therapy
- ✓ Heterogeneity

Discussion

1. Is cancer a genetic disease?
2. What are the factors leading to cells becoming cancerous?

Should scientific writing use active or passive voice?

Using passive voice is common and can help convey information objectively and emphasize the results and findings rather than the individuals performing the actions.

Uses of passive voice in Scientific writing

1) When the agent of the action is unimportant, unknown, or obvious to readers

E.g. Over 20,000 patients **are diagnosed** with diabetes each year (by doctors) in the United States.

2) When the object or action itself is more important than the agent performing the action.

E.g. Frozen embryos **were stored** in a cryogenic tank for two weeks.

3) When the recipient of the action is the topic of your sentence.

E.g. Slime molds **were** once **classified** as fungi but **are** no longer **considered** to be part of that particular kingdom.

4) Privileging One Element Over Another in a Sentence

E.g. Malignant tumors are grown rapidly and **invaded** other parts of the body by generating coalescent mutations in the cancer cell.

- ✓ **Combining active and passive voice in Scientific writing**

  E.g. (1) The present work concerns the face/object (AI) effect on cancer assessment. **(2)** This effect can be explained by appeal to either X-ray images or data analysis. **(3)** However, this effect can be also be influenced by another factor, the baseline level, which is the focus of the present study.

Using your understanding, transform these sentences into the scientific passive voice.

Researchers are studying the genetic mutations that cause cancer.

Doctors are treating patients with chemotherapy to target cancer cells.

Researchers analyzed the tumor samples and identified specific mutations in the patient's DNA.

Unit 4: POLLUTION

Vocabulary notes:

Keep in mind these notes in order to use them to build up the discussion section.

- ✓ Water pollution
- ✓ Bioremediation
- ✓ Toxic compounds
- ✓ Soil pollution
- ✓ Deterioration
- ✓ Renewable energy
- ✓ Gas emission
- ✓ Hazardous material
- ✓ Environmental contaminant
- ✓ Air pollution
- ✓ Discharge
- ✓ Bioaccumulation
- ✓ Greenhouse Gas Emissions
- ✓ Plastic pollution
- ✓ Heavy metals
- ✓ Eutrophication

Discussion

How we can stop pollution?

What are 4 types of pollution?

What are the most recent advancements in pollution management?

Is punctuation important?

Punctuation is crucial in scientific writing as it helps to convey the writer's intended meaning and tone. Incorrect punctuation can lead to ambiguity, which can be detrimental to the clarity and credibility of the text. Scientific writing often involves the use of complex sentence structures and technical terms, so it is essential to use punctuation correctly to ensure readers can fully understand the text. In addition, proper use of punctuation can enhance the overall readability of the writing.

✓ **Period (.)**:

- Use periods to end sentences.
- Use a single space after a period.

E.g. Pollution not only affects the environment but also introduces diseases that could kill all living organisms.

✓ **Comma (,)**:

• Use commas to separate items in a list, such as variables or parameters in a study.

- **E.g.** In our investigation of air pollution, we considered several key parameters, including temperature, humidity, wind speed, pollutant concentration, and air quality index.

• Use commas to set off non-essential clauses or phrases within a sentence.

- **E.g.** The air quality in urban areas, especially during rush hours, is a significant concern for public health.

• Use commas to separate multiple adjectives modifying a noun (e.g., "The large, green leaf").

- **E.g.** The city implemented a comprehensive, long-term strategy to combat air pollution.

• Use a comma before a coordinating conjunction (and, but, or, nor, for, so, yet) to join independent clauses.

- **E.g.** The air quality index in the city reached a hazardous level, and local authorities issued public health advisories.

✓ **Semicolon (;):**

- Use semicolons to separate closely related but independent clauses within a sentence.
- Use semicolons to separate items in a list if those items contain internal commas.
- Additional: use with **moreover** and **nevertheless** is they came in the middle of a sentence**.**

✓ **Colon (:):**

- Use colons to introduce lists, explanations, or examples.
- Use a colon before a block quotation or an indented quote.

✓ **Hyphen (-):**

- Use hyphens to link compound words (e.g., "well-defined").
- Use hyphens in compound adjectives (e.g., "data-driven analysis").
- Use hyphens to avoid ambiguity, such as in "re-cover" (to cover again) vs. "recover" (to regain).

✓ **Forward Slash (/):**

- Use a forward slash sparingly to indicate alternatives (e.g., "and/or").

Read these sentences and complete the correct punctuations:

Toxic compounds including carcinogens mutagens and neurotoxins can have severe health implications

The causes of water pollution, are multifaceted and include several factors industrial discharges agricultural runoff sewage contamination and natural processes.

Toxic contaminants, often infiltrate aquatic environments, impacting aquatic life, this has devastating implications for both: local and global biodiversity. Addressing these issues requires a multifaceted approach; reducing emissions, improving waste management, and implementing cleaner technologies.

Unit 5: CLONING

Read this passage carefully

Cloning is a scientific technique that allows the creation of genetically identical copies of an organism, cell, or DNA sequence. In reproductive cloning, an entire organism is duplicated, typically through somatic cell nuclear transfer, where the nucleus of a somatic cell is transferred into an enucleated egg cell. This process has been used in animals, including the famous case of "Dolly the sheep," although it remains ethically and technically challenging in humans.

Cloning offers both opportunities and challenges. On the other hand, ethical and safety concerns, as well as the potential for misuse, necessitate careful regulation and thoughtful consideration of the ethical, legal, and social implications surrounding cloning technologies. Balancing these aspects is critical as science continues to advance in this field.

Cloning has applications in molecular biology, where specific DNA sequences, genes, or fragments can be cloned and amplified for research purposes. These techniques have revolutionized genetic engineering and the production of important proteins, such as insulin for diabetes treatment.

Why are paragraphs important?

All academic essays require paragraphs. They are important because they fulfil the following functions:

- **Organization**: Structure and outline your ideas.
- **Focus**: Keeps the writer on track and on topic.
- **Coherence**: Assists readers in following a piece of writing.

An academic paragraph needs to contain:

- **A topic sentence –** what is the overall point that the paragraph is making?
- **Evidence that** supports your point – this is usually your cited material.
- **Explanation** of why the point is important and how it helps with your overall argument.

- **A link (if necessary)** to the next paragraph (or to the previous one if coming at the beginning of the paragraph) or back to the essay question.
- It is important to remember that a paragraph in an academic essay is generally 5 – 10 sentences, but this can vary. These sentences need to build off one another to develop the main point or focus of the paragraph.

Take in mind

- When writing scientific essays, paragraph structure can also be considered in terms of claims, evidence and analysis or:
    - Point
    - Quotation
    - Explanation
- This is another way of achieving a fluid and coherent paragraph structure. Explain the relevance of the quoted evidence to your point and how it proves your thesis or argument.
- Simply put: Make a point. Support it with a quote. Explain how that quote proves your point.

Unit 6: SCIENTIFIC WRITING

What is scientific writing?

Scientific writing is a technical form of writing that is designed to communicate scientific information to other scientists. Depending on the specific scientific genre—a journal article, a scientific poster, or a research proposal, for example—some aspects of the writing may change, such as its purpose, audience, or organization. Many aspects of scientific writing, however, vary little across these writing genres. Important hallmarks of all scientific writing are summarized below.

What is the key characteristics of scientific writing?

- ✓ **Clarity:** which is effectively communicating the ideas in the fewest short words possible.
- ✓ **Organized:** use standards formats like journal instructions to author or guideline application.
- ✓ **Concise:** much information in fewest words possible to keep the attention of your reader

Types of scientific writing

- ✓ **Research paper:** the first written and published reports describing the original research results i.e, primary publication.
- ✓ **Review paper:** is formed of a secondary publication, which summarizes the recent primary publication on a topic.
- ✓ **Literature reviews:** provides a critical analysis of the published works related to a specific research question or topic.
- ✓ **Meta-analysis:** statistical method that combines data from multiple, independent studies to create a summarized, overall conclusion.
- ✓ **Editorials:** a written piece that presents a viewpoint, argument, or critique on a current issue or event.
- ✓ **Grants proposal:** is a public speech in which a speaker presents his or her views on a topic based on reading or research.
- ✓ **Science writing:** writing about science related topic for the general public to understand like edits scientific news articles.
- ✓ **Short communication.**
- ✓ **Chapters in Books.**

- ✓ **Speeches and interviews.**
- ✓ **Oral and poster presentation.**

Types of scientific publisher:

Elsevier, Springer, Wiley, Taylor & Francis, Nature Publishing Group, American Chemical Society (ACS), IEEE (Institute of Electrical and Electronics Engineers), Oxford University Press, Cambridge University Press, Public Library of Science (PLOS).

Impact factor (IF)

Used for measure the impact of scientific Journals court in its field. The indexed in the journal citation reports began since 1975.

What is a good impact factor for a scientific journal?

Impact Factors are used to measure the importance of a journal by calculating the number of times selected articles are cited within a particular year. Hence, the higher the number of citations or articles coming from a particular journal, or impact factor, the higher it is ranked. IF is also a powerful tool if you want to compare journals in the subject category.

Measuring a Journal Impact Factor:

$$\mathrm{IF}_y = \frac{\mathrm{Citations}_y}{\mathrm{Publications}_{y-1} + \mathrm{Publications}_{y-2}}$$

Google citation:

Google Scholar Citations lets authors set up a profile page that lists their publications and citation metrics.

The citation metrics are updated automatically, and you can choose to have your list of publications updated automatically or update them yourself.

You can make your profile public, so that it appears in Google Scholar results when people search for your name.

The *h*-index is the largest number *h* such that *h* articles have at least *h* citations each. For example, if an author has five publications, with 9, 7, 6, 2, and 1 citations (ordered from greatest to least), then the author's *h*-index is 3, because the author has three publications with 3 or more citations.

The i10-Index is the number of publications with at least 10 citations. This very simple measure is only used by Google Scholar.

Unit 7: INTRODUCTION

The introduction is an important and challenging part of any research paper as it establishes your writing style, the quality of your research, and your credibility as a scholar. It is your first chance to make a good impression on your reader. The introduction gives the reader background and context to convey the importance of your research. It should begin by broadly introducing your topic, then narrowing to your focused research question or hypothesis.

What is the Purpose of an Introduction Section?

The introduction should answer three important questions:

1. What am I writing about?

2. Why is it important?

3. What do I want the reader to know about it?

An introduction should establish the topic with a strong opening that grabs the reader's attention before giving an overview of recent research on your chosen topic. Avoid going too in-depth in the introduction; deep dives into your topic should be saved for the body of the paper. Background and historical context help explain to the reader why your research is important. The type of information you share will vary by discipline. As you reach the end of the introduction, you should begin to establish what you want the reader to know about your topic and research. This may include your focus and scope, the problem statement, and your specific research question(s), hypotheses, or objectives. Again, the information you choose to share here will vary depending on your discipline. It is always a good idea to check major academic journals within your field for examples of current best practices.

How Does an Introduction Differ from a Literature Review?

While the introduction often includes a brief overview of the important research on your topic, it should not be overly specific when discussing the literature. Instead, it also introduces your research question(s), purpose, objectives, or hypotheses. The literature review, however, critically evaluates the existing research in greater detail, summarizing and synthesizing important articles. The literature review is thorough in discussing subtopics that may be organized chronologically, thematically, or methodologically. The literature review often

comes immediately after the introduction. Depending on the academic journal, the two can sometimes be combined.

How Is the Introduction Section Structured?

- ✓ **Big picture**

  Introduces the general context and relevance of the research area.

  Provides an overview of why this topic or issue is important for population or a public health.

  Provides an understanding of the study outcome or explanatory variable from a public health perspective.

- ✓ **What is known?**

  Outlines the existing knowledge of the research area.

  Summary of the evidence (**E.g.** Landmark studies, reviews, recent studies).

  Should cite the most current and comprehensive knowledge on the subject.

  Focus on the particular exposure or disease of interest.

- ✓ **What is unknown?**

  Synthesis of big picture, what is known, and what is unknown to convince the audience.

  Persuades readers why this study was needed (i.e, the rational for the study)

  Highlights who would likely benefit from the study.

- ✓ **Research question**

  Outlines the specific aim/ purpose of the study.

  Should includes study objective/hypothesis that will address the identified gap in the current knowledge.

- ✓ **Study design and methods**

  Briefly introduces the approach used to answer the question.

Important points which one should take heed of:

1. Abbreviations should be given following their explanations in the ‘Introduction’ section (their explanations in the summary does not count)
2. Simple present tense should be used.
3. References should be selected from updated publication with a higher impact factor, and prestigous source books.
4. Avoid mysterious, and confounding expressions, construct clear sentences aiming at problematic issues, and their solutions.
5. The sentences should be attractive, tempting, and comprehensible.
6. Firstly general, then subject-specific information should be given. Finally our aim should be clearly explained.

Unit 8: METHODS

The method section is the most important aspect of a research paper because it provides the information by which the validity of a study is ultimately judged. Therefore, the author must provide a clear and precise description of how an experiment was done, and the rationale for the specific experimental procedures chosen. It must be written with enough information so that: (1) the experiment could be repeated by others to evaluate whether the results are reproducible, and (2) the audience can judge whether the results and conclusions are valid.

General Methods Section Structure: What Is Your Story?

You might have conducted a number of experiments, maybe also a pilot before the main study to determine some specific factors or a follow-up experiment to clarify unclear details later in the process. Throwing all of these into your methods section, however, might not help the reader understand how everything is connected and how useful and appropriate your methodological approach is to investigate your specific research question. You therefore need to first come up with a clear outline and decide what to report and how to present that to the reader.

The first (and very important) decision to make is whether you present your experiments chronologically (e.g., *Experiment 1, Experiment 2, Experiment 3…*), and guide the reader through every step of the process, or if you organize everything according to subtopics (e.g., *Behavioral measures, Structural imaging markers, Functional imaging markers…*). In both cases, you need to use clear subheaders for the different subsections of your methods, and, very importantly, follow the same structure or focus on the same topics/measures in the results section so that the reader can easily follow along (see the two examples below).

If you are in doubt which way of organizing your experiments is better for your study, just ask yourself the following questions:

- ✓ Does the reader need to know the timeline of your study?
- ✓ Is it relevant that one experiment was conducted first, because the outcome of this experiment determined the stimuli or factors that went into the next?
- ✓ Did the results of your first experiment leave important questions open that you addressed in an additional experiment (that was maybe not planned initially)?
- ✓ Is the answer to all of these questions “no”? Then organizing your methods section according to topics of interest might be the more logical choice.

- ✓ If you think your timeline, protocol, or setup might be confusing or difficult for the reader to grasp, consider adding a graphic, flow diagram, decision tree, or table as a visual aid.

What Methods Should You Report (and Leave Out)?

The answer to this question is quite simple–you need to report everything that another researcher needs to know to be able to replicate your study. Just imagine yourself reading your methods section in the future and trying to set up the same experiments again without prior knowledge.

Also, make sure your subheadings are as clear as possible, suit the structure you chose for your methods section, and are in line with the target journal guidelines. If you studied a disease intervention in human participants, then your methods section could look similar to this:

Material and Methods

1. Patients

Recruitment
Screening, inclusion and exclusion criteria
Baseline evaluation

2. Study design

Location (single-center vs multi-center) and timeline
Assessments
Interventions
Outcome variables
Adverse events and drop-out criteria

3. Statistical analysis

Sample size and power estimation
Tests, hypotheses, significance levels

Details Commonly Missing from the Methods Section

- ✓ Manufacturer information.
- ✓ Sample size.

- ✓ Ethical guidelines and approval.

Tips

- ✓ Do not include an excessive unnecessary details.
- ✓ Discuss enough details to enable reproducibility.
- ✓ Include statements on the ethics approval or other ethical considerations.
- ✓ Include a citation for a new or unknown statistical test or method.

Unit 9: RESULTS AND DISCUSSION

Results

The results (or findings) section is one of the most important parts of a research paper, in which an author reports the findings of their study in connection to their research question(s). The results section should not attempt to interpret or analyze the findings, only state the facts.

What is the Purpose of a Results Section?

The results section summarizes and presents the findings of the study to put them in context with your research question(s). The study's data should be presented in a logical sequence without bias or interpretation. Findings may be reported in written text, tables, graphs, and other illustrations. It is important to include a contextual analysis of the data by tying it back to the research question(s). Only share relevant data and findings that connect with the goal of the study; too much data may overwhelm a reader. An effective results section will present the findings of a study without attempting to analyze or interpret them.

How Does a Results Section Differ from a Discussion Section?

The results section of a research paper tells the reader what you found, while the discussion section tells the reader what your findings mean. The results section should present the facts in an academic and unbiased manner, avoiding any attempt at analyzing or interpreting the data. Think of the results section as setting the stage for the discussion section by making all the necessary information known to the reader.

How Is a Results/Findings Section Structured?

1. Study sample characteristics and descriptive statistics
2. Finding of the primary analysis
3. Finding of the secondary analyses

Key characteristics and organization of a results section

1. Begin with an introduction to connect the results with the research question(s). This brings the readers' focus back to the purpose of the study after reading the literature review and methods sections of your paper.
2. Present your findings in a structured way (such as thematically or chronologically), bringing the readers' attention to any important, interesting, or significant findings. Be

sure to include a combination of text and visuals. Data illustrations should not be used to substitute or replace text, but to enhance the narrative of your findings. Take a look at the example below.

3. The results section should include a closing paragraph that clearly summarizes the key findings of the study. This paves the way for the discussion section of the research paper, wherein the results are interpreted and put in conversation with existing literature.

Discussion

The discussion section is one of the final parts of a research paper, in which an author describes, analyzes, and interprets their findings. They explain the significance of those results and tie everything back to the research question(s). In this handout, you will find a description of what a discussion section does, explanations of how to create one, sample discussion sections, and a culminating activity to practice identifying the parts of the discussion section.

What is the Purpose of a Discussion Section?

The discussion reviews the findings and puts them into the context of the overall research. It brings together all the sections that came before it and allows a reader to see the connections between each part of the research paper. In a discussion section, the author engages in three necessary steps: interpretation, analysis, and explanation. An effective discussion section will tell a reader why the research results are important and where they fit in the current literature, while also being self-critical and candid about the shortcomings of the study.

How Does a Discussion Section Differ from a Conclusion?

A conclusion summarizes parts of the paper. A discussion, however, is a much more thorough and rigorous examination of the results. It requires the author to interpret those results by looking at how or why they are the way they are. Additionally, the discussion section is the space where the author acknowledges the limits of the research and identifies gaps for future research. Finally, this section investigates the implications of the research based on the findings and results, and it draws meaningful conclusions from those implications. So, where a

conclusion is brief and touches on the main points of the paper, the discussion is much longer and more detailed.

How Is a Discussion Section Structured?

Each discussion section will vary based on the discipline and the subject of the paper.

1. Summarize the key findings from the research and link them to the initial research question. Seek to answer this question: What should readers take away from this paper?
2. Place the findings in context. This step will involve going back to the literature review section and analyzing how the results fit in with previous research.
3. Mention and discuss any unexpected results. Describe the results and provide a reasonable interpretation of why they may have appeared. Additionally, if an unexpected result is significant to the research question, be sure to explain that connection.
4. Address limitations or weaknesses in the research. Addressing limitations helps build your credibility as a writer, because the reader sees that you have thought critically about what your study does and does not cover.
5. Provide a brief look at potential follow-up research studies. Recommend a few areas where further investigation may be crucial. However, don't go overboard with the suggestions, as they can leave a reader thinking more about the gaps in the paper rather than the actual findings.
6. Conclude with are statement of the most significant findings and their implications. Explain why the research is important and remind readers of the connections it has to outside material, such as existing literature or an aspect of the field that is affected by the study.

What Should Be Avoided in a Discussion Section?

A discussion section has a few possible pitfalls, but these issues can be navigated easily by remaining aware of what not to do.

- ✓ Don't rewrite the results section: A discussion section does go over the most significant results, but it also must provide interpretation and analysis instead of a simple summary of the findings.

- ✓ Don’t draw conclusions from the findings without support: All the explanations of the key results should be firmly backed up by evidence found in the paper’s data or references. Remember to stay within the bounds of the study; don’t speculate and wander into another discipline without support.
- ✓ Don’t bring up new information: The discussion is about examining the information already presented earlier in the paper. Adding new information in this section will confuse a reader and derail the flow of ideas. If new information does come up, put it in the results section.
- ✓ Don’t cherry-pick the results to analyze: Some results and findings won’t answer the research question, won’t answer it the way they were expected to, or will be simply unexpected. That’s perfectly fine—a discussion section is simply the place to write about why or how this may have happened. Avoid ignoring those results in favor of only the ones that support your research question(s).

Unit 10: ABSTRACT AND TITLE

Abstract

Abstracts provide a summary and preview of an academic work, such an article, research proposal, or conference presentation. Abstracts are the first part of an article that readers will see: They set expectations and help readers understand what will come next. All abstracts used in this handout are from published articles from biology, business, linguistics, nursing, and neuroscience.

Why are abstracts important?

Abstracts are used in a variety of academic contexts. First, readers use them to decide if an article belongs in their research and warrants being read completely. Second, many professional and research conferences require presenters to submit an abstract before being accepted. Third, writers use abstracts in their research papers and often in applications for funding opportunities.

What is the basic structure of abstracts?

Abstracts vary some by discipline, but within a discipline, they often follow predictable patterns. Some general observations can be made. Abstracts are usually 100 to 300 words long. They use cited references sparingly. They are meant to standalone and be understood without the larger work. Each sentence has a particular job or function.

Example

[Introduction] In many forest ecosystems, green leaf deposition (greenfall) constitutes an enrichment over background levels of litterfall nutrients and may therefore influence key ecosystem processes. [Purpose] This study examined the litter quality and decomposition rates of green leaves compared to senescent litterfall for four dominant tree species (*Dacryodes excelsa, Manilkara bidentata, Guarea guidonia,* and *Cecropia schreberiana*) in a lower montane rain forest at El Verde Field Station, Luquillo Experimental Forest, Puerto Rico. [Method] Green leaves from the canopy and freshly senesced leaves from the forest floor were analyzed for carbon, nitrogen, and fiber and placed in litterbags in the field for up to 16 weeks. [Result] Green leaves displayed significantly higher rates of decompositions than did senescent litter among all four species. [Result] Green leaves also had significantly higher nitrogen concentrations and lower lignin to nitrogen ratios compared to senescent leaves. [Conclusion]

These results suggest that greenfall may have a major influence on decay processes and nutrient cycling in forests that experience large-scale green foliage removal.

Title

Even before the abstract, the title is the first thing readers look at, hence it is a very important element of a scientific article. Though the title shouldn't be "click-bait," it should still pique the interest of the readers.

Types of the titles in scientific writing

- ✓ **Descriptive titles** are used most often, and usually describe the main topic or association that is under investigation.
- ✓ **Informative or "assertive sentence" titles** are not always preferred by all readers since they may be perceived as being too conclusive without supporting arguments or explanations, but they are catchy and summarize the key message of the study.
- ✓ **Inquisitive titles** actually present the main scientific question that is addressed in the research paper.