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DEPARTMENT OF BASIC STUDIES

Handout of

Work Methodology and Terminology

(2)

Work Methodology and Terminology 2

WM&T2 For Nature and Life Sciences

Intended for Undergraduate Students

Level: 1st year of Bachelor's degree

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Foreword

Foreword

A solid foundation in work methodology and terminology gives first-year Bachelor of Science students the knowledge and skills to explore key aspects of scientific research, paving the way for a thriving career in biology. This module provides a comprehensive set of tools to help students deepen the essential knowledge that will prepare them to excel in the field of scientific research. Students will begin to understand the language of science through terminology. They will then learn how writing a scientific report is also the most common scientific communication. Mastering this essential skill leads to better collaboration and easier access to interdisciplinary knowledge. Although a scientific report provides a formal version of the results of a scientific experiment or project. It is basically a method to communicate and transfer knowledge with other people in the same field. Subsequently, students will learn to read, analyse and understand scientific articles in a critical manner. They will be ready to actively participate in scientific discussions and effectively communicate your research results to the scientific community. The skill targeted by this module, as a whole, is “helping students to design research methods and synthesis of work according to scientific rules”, besides, to acquire the skills necessary to rigorously evaluate the scientific quality of different types of scientific documents (reports and articles). It is a complex performance, which they will gradually build by mastering knowledge, implementing skills, and doing it with interpersonal skills.

Chapter I

1. Terminology

1.1. Introduction to biological terminology

1. 1.1. Definition

It is a specialized language used within the field of biology to describe, identify and communicate complex concepts, processes, structures, and classifications. It serves as the backbone of scientific communication, allowing researchers to convey information with clarity and accuracy, ranging from microscopic cellular processes to the broader interactions within ecosystems. Most word roots are derived from Greek or Latin language. Thus, two different roots may have the same meaning.

Table 1: Comparison of Greek and Latin roots

Greek word	Latin word	Refer to
dermatos	cutane	skin
describe a disease, condition, treatment, or diagnosis	describe an anatomical structure	

1.1.2. The importance of biological terminology

Precision in biological terminology is the cornerstone of scientific integrity. It ensures clarity in research by eliminating ambiguity, allowing complex findings to be communicated with absolute accuracy. Because these terms are standardized, they facilitate global communication, acting as a universal language that transcends borders and allows scientists from different cultures to collaborate seamlessly.

Furthermore, this precise vocabulary promotes efficient communication, accelerating the exchange of ideas and driving faster advancements in the field. While the sheer volume of biological terms can be daunting, the secret to mastering them lies in structural analysis.

Rather than memorizing thousands of individual words, learning to break terms down into their Greek and Latin roots, prefixes, and suffixes allows you to decode and understand almost any scientific term you encounter.

There are an immense variety of biological terms. So, how do I remember them all?

1.1.3. Basic rules

For constructing and understanding biological terms, it is crucial to recognise:

a. Word Structure

The architecture of biological terminology is built upon four essential components: the word root, the combining form, the suffix, and the prefix. The word root serves as the core foundation, carrying the primary meaning, while the combining form (a root plus a vowel, usually "o") acts as a bridge to make the term pronounceable.

Prefixes are added to the beginning to modify the term's direction or intensity, and suffixes are attached to the end to indicate a specific condition, disease, or procedure.

The precise arrangement of these components conveys distinct meanings; as shown in **Figure 1**, the most effective way to decode a complex term is to start with the suffix and then read backwards to the root to uncover the correct definition.

- word root (core part),
- combining form,
- suffix and prefix (beginning or end part).

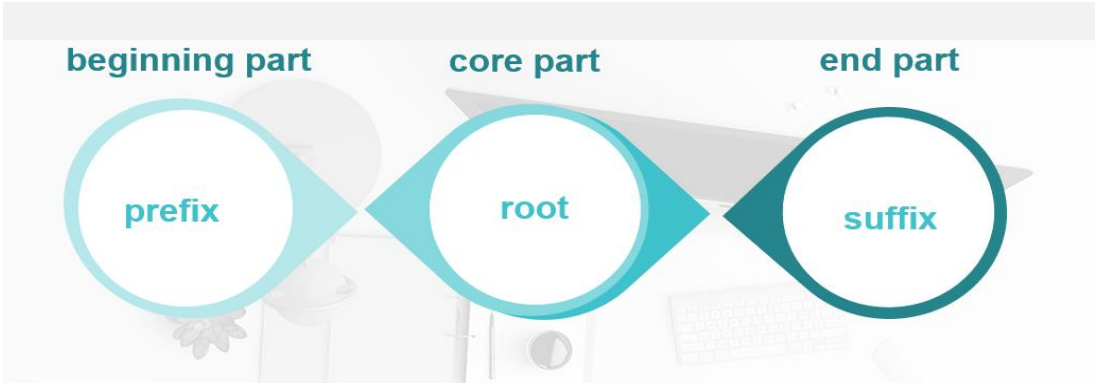

Figure 1: Read from the suffix backwards to the root word for the correct meaning

b. Components

Biological terms consist of four basic elements.

b.1. Word roots

The word root serves as the fundamental foundation of any biological or medical term. Every scientific word contains at least one root, which acts as the core building block carrying a specific, unchanging meaning. These roots function as the primary anchor of a term; when they are combined with other roots or elements, they form complex words that precisely describe anatomical structures, physiological processes, or clinical conditions. To summarize their role, remember these three key principles

- All words have at least one word root.
- Each root has a specific meaning.
- They combine together to form words.

Tables (2, 3) demonstrates how biological terms are built by combining multiple word roots to create a specific definition.

In the example of an erythrocyte, the term is formed by joining *erythr* (red) with *cyte* (cell). By analyzing these individual building blocks, the complex term is easily decoded to mean "red blood cell." This structural approach is a fundamental skill in mastering scientific language, as it allows for the interpretation of unfamiliar terms based on their component parts.

Table 2: Decomposition of the term "erythrocyte" into word roots

Word	Word Roots	Meaning
Erythrocyte		
	Erythr	Red
	cyte	cell

By breaking the word Leukocyte into its two constituent parts, the literal meaning becomes immediately clear: the root "leuk" originates from the Greek word for white, while "cyte" refers to a cell. When joined together, they form the precise scientific name for a white blood cell. This process demonstrates that once you learn the individual building blocks, you can "read" the definition of a complex term without needing to look it up.

Table 3: Decomposition of the Biological Term "Leukocyte"

Word	Word Roots	Meaning
Leukocyte		
	Leuk	White
	cyte	cell

b.2. Prefix

A prefix is a descriptive element placed at the very beginning of a word to modify or refine the meaning of the word root. It acts as a qualifier, providing essential context that specifies "where," "when," or "how many." While the root provides the core subject, the prefix adds a layer of precision that can completely change the term's orientation. It is important to note that while every biological term requires a root, a prefix is optional and is only used when additional detail is necessary. When identifying prefixes, keep these three characteristics in mind:

- Word beginning.
- Usually indicates location, time, or a number.
- Not all biological words have prefixes.

Table 4: Structural analysis of biological terms using roots and prefixes.

Word	Prefix	Word Root	Meaning
Postnatal	Post	natal	relating to the period after child-birth
Intramuscular	Intra	muscular	situated or taking place within, or administered into, a muscle.
Diptera	Di	ptera	a large order of insects that comprises the two-wings

b.3. Suffix

The suffix is a functional element placed at the end of a word to modify its primary meaning and provide essential context. In biological setting, suffixes are most commonly used to indicate a specific procedure, condition, disorder, or disease. Furthermore, they perform a grammatical function by determining the word's part of speech, allowing a root to act as either a noun or an adjective within a sentence. Key characteristics of suffixes include:

- Word ending.
- Usually indicates a procedure, condition, disorder or disease.
- Suffixes can be nouns or adjectives.

The practical application of suffixes when joined with specific word roots to create precise clinical meanings is illustrated in **Table 5**. By observing terms such as Nephritis, Pharmacology, and Cardiopathy, it becomes clear how the suffix defines the nature of the word whether it indicates an inflammatory condition (-itis), a specialized field of study (-logy), or a state of disease (-pathy). Mastering these combinations allows you to quickly decode the relationship between an anatomical structure and its current biological or medical status.

Table 5: Structural analysis of biological terms using roots and suffixes

Word	Word Root	Suffix	Meaning
Nephritis	Nephr	-itis	Inflammation of the kidneys
Pharmacology	Pharmaco	-logy	Study of drugs
Cardiopathy	Cardio	-pathy	Heart disease
Ecology	Eco	-logy	Study of the home the household of nature
Biotechnology	Biotechn	-logy	The application of science/engineering to living systems
Entomology	Entomo	logy	Study of the insects

1.1.4. Combining form

The combining form is a critical structural element that ensures words are easy to pronounce. It is created by taking a word root and adding a combining

a. Combining vowel:

A vowel (usually the letter "o," though "i" is occasionally used). This vowel acts as a linguistic "glue" that has no meaning of its own; its sole purpose is to connect different word parts smoothly. As shown in this example, the formula for creating this form is straightforward:

Example:

root word	**+**	**a combining vowel**	**=**	**Combining form**
Cardi	+	o	=	Cardio
Gastr	+	o	=	Gastro

b. Rules for using combining vowels

1. A prefix does not require a combining vowel.
   e.g. epi/gastr/ic
2. Do not use a combining vowel when:
   - ✓ the ending of the root word is a consonant,
   - ✓ and the beginning of the suffix is a vowel.

   e.g. gastr/itis
3. It is used when:
   - ✓ two root words are joined.

     e.g. cardi/o/thorac/ic
   - ✓ the ending of the root word and the beginning of the suffix are both consonants.

     e.g. hemat/o/logy

4. An overview of prefixes and suffixes

The following figures provide a comprehensive reference for the most frequently encountered modifiers in biological language. Figure 1 outlines a variety of prefixes, illustrating how they define the location, quantity, or timing of a biological process. In contrast, Figure 2 details essential suffixes, which categorize the nature of a condition, disease, or clinical procedure. Together, these figures serve as a visual dictionary to assist in the systematic decoding of complex scientific terms.

The Tables below provide a comprehensive reference for the most frequently encountered modifiers in biological language. **Tables** outlines a variety of **prefixes**, illustrating how they

define the location, quantity, or timing of a biological process. In contrast, **Table 6** details essential suffixes, which categorize the nature of a condition, disease, or clinical procedure. Together, these figures serve as a visual dictionary to assist in the systematic decoding of complex scientific terms, ranging from descriptions of position like: sub-, infra- to specific medical actions such as surgical repair: -plasty or incision -tomy.

Table 6: Common biological prefixes and their meanings.

Prefix	Meaning	Prefix	Meaning
a-, an-	without	**inter-**	between
ab-	away from	**intra-**	within
ad-	to; toward, or near	**macro-**	large
ante-	before	**micro-**	small
anti-	against	**mono-**	one
bi-	two or both	**para-**	alongside
brady-	slow	**peri-**	around
circum-	around	**poly-**	many
con-	together or with	**post-**	after or behind
contra-	against	**pre-, pro-**	before
de-	from, down, or not	**quadr/i-**	four
dys-	painful, difficult, or faulty	**sub-**	below or deficient
en-, endo-	within	**super-, supra-**	above or excessive
epi-	upon	**tachy-**	fast
eu-	good or normal	**uni-**	one
hemi-	half	hypo-	below or deficient
hyper-	above or excessive	infra-	below or deficient

Table 7: Common biological suffixes and their meanings.

Suffix	Meaning	Suffix	Meaning	Suffix	Meaning
-a	condition of	**-iatrics, -iatry**	treatment	**-otomy**	cutting or separation
-ac, -al, -ar, -ary	pertaining to	**-ic**	pertaining to	**-ous**	pertaining to
-acusis	hearing	**-ism**	condition of	**-plasty**	surgical repair or reconstruction
-algia	pain	**-itis**	inflammation	**-plegia**	paralysis
-arche	beginning	**-ium**	structure or tissue	**-pnea**	breathing
-ation	process	**-lepsy**	seizure	**-rrhage, -rrhagia**	to burst forth
-cele	pouching or hernia	**-logist**	one who specializes in the study of	**-rrhea**	discharge
-centesis	puncture for aspiration	**-logy**	study of	**-scope**	instrument for examination
-dynia	pain	**-lysis**	breakdown or dissolution	**-scopy**	process of examination
-eal	pertaining to	**-malacia**	softening	**-spasm**	involuntary contraction
-ectomy	excision	**-megaly**	enlargement	**-stomy**	creation of an opening

-emesis	vomiting	**-meter**	instrument for measuring	**-tic**	pertaining to
-emia	blood condition	**-oma**	tumor	**-tomy**	incision
-gram	record	**-osis**	condition or increase	**-tripsy**	crushing
-graphy	process of recording			**-y**	condition or process of
-ia	condition of				

1.2. Rules of biological terminology

1.2.1. Prefixes and suffixes

a. Common Prefixes :

Understanding common prefixes is essential for grasping the meanings of biological terms. These prefixes are added to the beginning of a word to modify its meaning, for instance:

1. Hypo-: means below or under.
2. Hyper-: signifies above or over.
3. Exo-, endo-, trans-: often indicating location or position.

Example :

1. **Hypo-**
   - **Hypoxia**: A condition where there is a deficiency of oxygen reaching the tissues.
   - **Hypotonic**: Refers to a solution with a lower concentration of solutes compared to another solution.
   - **Hypoglycaemia**: Abnormally low levels of sugar (glucose) in the blood.

- **Hypoallergenic**: Products or substances designed to cause fewer allergic reactions.
- **Hypodermis**: The layer of skin beneath the dermis, consisting mainly of fat cells and connective tissue.

2. **Hyper-**
   - **Hypertension**: High blood pressure.
   - **Hyperactive**: Characterized by excessive activity or overstimulation.
   - **Hyperlipidaemia**: Elevated levels of lipids (fats) in the blood.
   - **Hypersecretion**: Excessive production and release of a substance, such as hormones, by a gland or organ.
   - **Hyperkalaemia**: Excessive levels of potassium in the blood.
3. **Exo-**
   - **Exocytosis:** The process by which a cell releases substances to the outside by enclosing them in vesicles that fuse with the cell membrane.
   - **Exoskeleton:** A hard external covering or support structure, such as the shell of arthropods.
   - **Exothermic:** Refers to chemical reactions or processes that release heat energy to
   - the surroundings.
4. **Endo-**
   - **Endocytosis:** The process by which cells take in substances by engulfing them through the cell membrane.
   - **Endoderm:** The innermost of the three primary germ layers in the early embryo, giving rise to the digestive and respiratory tracts.
   - **Endocrine:** Referring to glands that secrete hormones directly into the bloodstream.

- **Endophyte:** fungus, that lives within the tissues of a plant without causing apparent harm.

5. **Trans-**
    - **Transduction:** The process of transferring genetic material from one bacterium to another via a viral vector.
    - **Transmembrane:** Referring to proteins or structures that span across a biological membrane.
    - **Transamination:** The transfer of an amino group from one molecule to another during the synthesis of amino acids.

b. Common suffixes

They are often used to provide information about the function, structure, or characteristics of biological terms. Understanding common suffixes can be helpful in deciphering the meanings of unfamiliar terms, for instance:

1. **-ase:** Enzyme names often end with the suffix -ase.
    - **Protease**: Enzyme that breaks down proteins into amino acids.
    - **Cellulase**: Enzyme that breaks down cellulose into glucose units.

2. **-phyte:** Words ending in "-phyte" refer to plants.
    - **Halophyte**: A plant that can tolerate and thrive in salty environments.
    - **Helophyte**: A plant adapted to grow in marshes or wetlands
3. **-genesis:** The suffix -genesis indicates the formation of something.
    - **Oogenesis**: The process of formation and development of eggs (ova) in the ovaries.
    - **Neurogenesis**: The formation of new neurons or nerve cells in the nervous system.

1.2.2. Simple and compound words

a. Rules

- **Use of Hyphens (-):** hyphens may be used to connect two words to form a single term, often when the combination is being used as an adjective, for instance : anti-inflammatory
- **Capitalization:** biological terms are not capitalized unless deriving from proper nouns or starting a sentence.
- **Word Order: t**he correct order of word parts is essential for precise communication and understanding.

b. Simple words

- **Species**: A group of organisms that can interbreed and produce fertile offspring.
- **Digit**: A finger or toe.
- **Dorsal**: On or near an animal's back.

c. Compound words

- **Cardiopulmonary**: Relating to the heart and lungs (cardio - heart, pulmo - lung).
- **Hemoglobin**: The protein in red blood cells that carries oxygen (hemo - blood, globin - protein).
- **Herbivorous**: Feeding on plants (herbi - plants, vorous - eating).

1.2.3. Singular and plural

In biology, as in other scientific fields, the formation of singular and plural forms often follows standard rules of English grammar. Comprehending both the singular and plural forms of these terms is crucial for precise communication.

a. Rules

a.1. Invariant singular and plural

Some biological terms have the same form for both singular and plural. For instance, it is possible to say "one species" and "several species." Species her is (singular and plural).

Example:

Bacteria, Data, Cactus: While traditionally considered as plural words, they are commonly used as singular words.

a.2. Singular transforms into plural

1) **If the singular form ends in -us, the plural form usually ends in -i.**

Example:

Fungus (singular) becomes Fungi (plural).

Stimulus, ……Stimuli

It's important to note that while the -us to -i pattern is common, there are exceptions and variations in usage. Some words may have alternative plural forms or follow different rules.

- **Octopus (Singular) / Octopuses (Plural):**

A marine mollusc with a soft body, tentacles, and a bulbous head, known for its intelligence and ability to change colour.

- **Nucleus (Singular) / Nuclei (Plural):**

In biology, the central and essential part of a cell that contains genetic material. In physics, the central core of an atom.

- **Hippopotamus (Singular) / Hippopotami or Hippopotamuses (Plural):**

A large, herbivorous mammal with a barrel-shaped body and semiaquatic habits, commonly found in rivers and lakes in Africa.

2) **If the singular form ends in -um, the plural form often ends in -a.**

Example:

Bacterium (singular) becomes Bacteria (plural).

Serum…… Sera

Keep in mind that usage may vary, and not all words ending in -um necessarily follow this rule.

- **Spermium (Singular) / Spermia (Plural):**

A term referring to a single sperm cell, part of the male reproductive system.

- **Ovum (Singular) / Ova (Plural):**

The mature female reproductive cell or egg.

- **Stratum (Singular) / Strata (Plural):**

A layer or sheet of tissue, often used in anatomical or geological contexts.

- **Lumen (Singular) / Lumina (Plural):**

The central, open space within a tubular structure, such as a blood vessel or organ.

3) **If the singular form ends in -is, the plural form often ends in -es**

In this case, Diagnosis is (singular), it becomes Diagnoses (plural).

Example:

- **Singular: Iris, Plural: Irises**

The coloured part of the eye that surrounds the pupil, controlling the amount of light entering the eye.

- **Singular: Bacteriosis, Plural: Bacterioses**

A condition or disease caused by bacteria.

- **Singular: Epiphysis, Plural: Epiphyses**

The end part of a long bone, initially growing separately from the shaft and later becoming fused.

- **Singular: Metamorphosis, Plural: Metamorphoses**

A process of transformation or development, often used to describe the stages in the life cycle of insects.

4) **If the singular form ends in -nx or -ex, the plural form often ends in -nges or -ices**

Example:

Appendix (singular) becomes Appendices (plural).

- **Singular: Cortex, Plural: Cortices or Cortexes**

The outer layer of an organ or structure, particularly used in reference to the brain.

- **Singular: Phalanx, Plural: Phalanges**

A bone of a finger or toe, specifically one of the three segments in each digit.

- **Singular: Helix, Plural: Helices**

A spiral or coiled structure, often used to describe the shape of certain biological molecules.

- **Singular: Apex, Plural: Apices or Apexes**

The highest point or tip of a structure or organ.

- **Singular: Thorax, Plural: Thoraces or Thoraxes**

The part of the body between the neck and the abdomen, housing the heart, lungs, and other vital organs.

a.3. Irregular plurals

Biological terms derived from Greek or Latin may follow specific rules based on the original language. Some biological terms have irregular plural forms.

Example:

Alga (**Singular**)……Algae (**Plural**)

It's important to note that these are general guidelines, and there may be exceptions. Additionally, as biological terminology is often standardized, specific terms may have their own unique rules for forming plurals. In such cases, referring to dictionaries or resources is recommended.

Chapter II

2. Writing a scientific report

Writing scientific report is the most common form of scientific communication. Mastering this essential skill leads to better collaboration and easier access to interdisciplinary knowledge. Although, a scientific report provides a formal version of the results of an experiment or scientific project. It is fundamentally a method to communicate and transfer knowledge with other persons within the same field.

2. 1. Common aspects of a scientific report

Creating a scientific report requires a specific process, which can sometimes be difficult. However, following the most important steps, from understanding the purpose of the report to organizing data and results, and finally presenting the findings, will make it easier.

- **Style**: objective, concise, and well-organized language. Usually, the font style used to write is Times New Roman, while the size of main headings and the sub-heading are respectively: 16 points bold, and 14 points bold, and 12 points for all other text. In addition, the line spacing required is 1.5.
- **Content**: it is structured and includes sections (introduction, methods, results, discussion, and conclusion), to ensure that all the information is presented in a logical order.
- **Objectivity**: avoid personal opinions or biases, and focus on presenting facts and observations in a neutral and unbiased way.

2.2. Types of scientific reports

Some common types of scientific reports that you might encounter in your scientific studies are laboratory work report and internship report. Indeed, some times, the quality of the reports is poor and therefore prejudicial to the student, even if her/his report is excellent from a scientific viewpoint. Nevertheless, weaknesses of a report may be due to the lack of preparation and organization during the work. Consequently, it is crucial to guide the focus of your report by being familiar with specific topic covered in the lecture. Furthermore, your professor's instructions are always respected. Therefore, pay attention to any specific guidelines provided by your professor regarding the report format, length, and content requirements.

2.3. Laboratory work report

A lab (laboratory) work report is a document that describes a scientific experiment. Usually, it provides a formal record using clear and precise language, with enough detail so that readers can recreate the experience if they wish. The typical laboratory report follows the format described below and contains most or all of the components listed. A lab work report dose not only presents the data, results, and concepts behind them, but also demonstrates the student's understanding.

2.3.1. Different part of laboratory work report

In almost all fields of science, the style and structure of a laboratory work report is similar, except for some minor differences in style and formatting. So, it is always best to follow your teacher's instructions. It is important to adopt and become familiar with the language and style used in your discipline. They adopt IMRAD format, where the main components are:

a) Cover page

Cover page or title page, will include the following general arrangement:

1. The date.
2. The students full name, section, group, and sub-group.
3. The number of the lab work report.
4. The title of the report which directly, usually short, and containing the key words. It directly follows the number of the lab work report.
5. The work plan in the case of short reports. for length reports (usually 6 pages or more) a table of contents is required.

b. Introduction

Establish the background information needed to make your experiment understood in your own words. In addition, present the objective of your experiment and/or your hypothesis. Usually you will answer this questions :

- why did you do this experiment?
- What problem are you trying to solve? Or what you hope to achieve?

c. Materials and Methods

This section may also be called procedures. Here you describe the materials used, the protocols you followed of your experiment. It's important to provide sufficient information such as exact timing, measurements, temperatures, to replicate the experiment. As you are describing what you did, use past tense, and avoid the use of personal pronounce. In this part will generally include the following questions:

- What materials were used?
- How were the materials used?

d. Results or observation

Present the obtained results or observation in a logical clear and understandable order. It usually consists of data and some comment on the most significant aspects of the findings. In most of case, they are arranged in tables, diagrams or graphs through concise titles, but do not duplicate the data in different formats.

e. Discussion

This section is also named results analysis or results interpretation. It is a fundamental stage, in which the results should be compared to the standard value and be explained or justified thoroughly, and analyse the meaning of the obtained results in relation to the aims and objectives mentioned in the introduction, especially if there are any unexpected results. Furthermore, it should analyse what the results mean in relation to the aims and objectives mentioned in the introduction.

f. Conclusion

The Conclusion should only consist of a few sentences that summing up the arguments and relates them back to the Introduction. Remember, always tailor your report according to your professor's specific instructions.

2.4. Internship report

In your academic career, whether you're studying for your bachelor's or master's degree, you will write an organized report. This integral part of your course is considered to evaluate your learning experience. Furthermore, it evaluates the tasks and responsibilities undertaken,

besides, the skills you learnt during this opportunity. In addition, it explores how these helped you improve overall communication skills and especially writing.

2.4.1. Different part of internship report

The internship report is a document between 6-10 pages long. When writing, you should maintain clarity and use a formal, Clear and Concise scientific Language. Accurately select your information, and structure your report logically, with clear transitions between sections. Before you proofread and edit it. It should contain the following information:

i. Title page

It should include the title of the report, your name, course name, professor's name, and university name.

It is the first page of the report. It gives a first impression and key information about the internship and the student. It's an important page, that should contain the following information:

Name and logo of the university, Faculty, department

1. Name and logo of the school, company or organization where you completed your internship.
2. Title of your internship report.
3. Name of diploma and current academic year.
4. Title of your internship report.
5. Duration of your internship and the start and end dates.
6. Student full name,
7. Name of your supervisor.

Note: Depending on the university instructions, other elements may be included on the cover page. It's important to maintain the title page simple and also professional. Use a simple font to make all the information easily readable.

ii. Acknowledgement

The acknowledgements are optional. It must be sober and mention the name of your advisors, the organisation, the people at the company who helped you during the training period with a brief justification by mentioning how they helped you and what you learned in particular

from each person (for instance: financial support, facilitation of data collection, encouragement, coordinator, suggestions etc.).

iii. Table of content

This section is also called summary. It should be clear and precise, listing all heading and sub-headings with their corresponding page numbers. It helps the reader to get an overview of the different parts of your internship report. It would also make the sections easy for readers to find.

Tables figures and abbreviation list

Tables, figures and graphics can enhance the clarity and readability of a document. They should be listed separately by number, followed by the title and respective page to easily locate theme.

iv. Introduction

The introduction should include tree main points. A description of the internship location and the nature of the work done. There is no need to give a highly detailed explanation, just focus on the necessary evidences related to the report. In addition, it includes background information required to understand the work completed during the internship. It states the main internship objectives leading up to the project or study, besides the question that you will try to answer in this study. Furthermore, it includes a brief plan dealing with the issues addressed in this report.

v. Development

This part could also be named body / core of the report or technical section. It contained, a summary of the material and methods used, and discussion of the obtained results. This section may be provided in the form of chapters, or in any other format relevant to the subject of the report. Furthermore, in this section, besides the description of the accomplished work and the objectives achieved, it may be necessary to clearly state your general evaluation of the internship experience.

It is appropriate to state your personal experience summary for instance, the technique learnt, the skills acquired (scientific and professional), challenges experienced the contribution made, and also the responsibilities assumed.

vi. Conclusion and recommendations

This tow parts are often confused but they are not the same thing. For the conclusion answer the questions raised in the introduction basing on the obtained findings, or list the different problems solved. Instead set the objectives reached, as well as the techniques learned, and the importance of the internship. Whereas, recommendations are not just suggestions for further studies or targeted implications, but also a proof of the right direction of the learning experience.

vii. Post-textual part

This section includes four main element which are:

viii. References lists

All books, scientific articles, web pages, which are relevant to your report. They should reflect a high degree of credibility. Moreover, It must follow a well-established and consistent style (APA, MLA, etc.).

ix. Glossary

It is required if mathematical symbols, specialized terms or professional jargon are used in an extensive way.

x. Nomenclature

It is only required if a large number of symbols are used.

xi. Appendix (appendices)

They are provided, if necessary, to give supplementary information. they are identified by numbers or letters.

xii. Abstract

It is also called executive summary, and should have to be self-contained. Likewise, it includes brief summary of all the major point of your project from introduction to conclusions. It allows you to comprehend the report's key facts without having to read the entire text. In

addition, it could be at the end or at the beginning of the report, should not exceed one page in length, and you can write it after you have written the full report.

learning how to write a scientific report enables you to effectively convey your research results. Ensuring a clear and logical presentation of your work involves following the key sections. Keep in mind that a proficiently written report informs the scientific community and sets the foundation for future research and progress. When starting a scientific report, keep in mind this chapter, and make sure your findings are shared effectively through your report to advance the field of scientific knowledge.

Chapter III

3. Introduction to reading and understanding a scientific article

A scientific article (also known as a research paper or journal article) is a formal, written report that describes original research results or reviews existing knowledge within a specific field of study. It is primarily characterized by its objective tone, standardized structure, and a rigorous evaluation process known as peer review. The fundamental goal of a scientific article is to contribute new knowledge to the "permanent scientific record" and allow other researchers to evaluate, replicate, and build upon the findings.

3.1. Reading scientific articles

While textbooks, due to their extensive publishing process, may become outdated over the years, academic journals provide a real-time reflection of ongoing research, offering a dynamic and immediate account of current developments in the respective disciplines. Scholarly journals provide comprehensive details that enable readers to replicate experiments. The depth of information allows for the verification of research findings, facilitating the potential replication of experiments with the aim of corroborating results It has current data! If you need to know exact results or properties for your own research, articles include actual data, uncertainties, conditions of the experiment, and much more. Articles provide the authors' explanation of their results and conclusions. You can see their assumptions and determine whether you believe them or not.

3.1.1. The importance of reading scientific articles

Reading scientific articles is crucial for various reasons:

- Dissemination of knowledge: share findings and contribute new knowledge to their respective fields.
- Staying informed: about the latest developments, and discoveries within their disciplines
- Building a foundation: of a particular subject or field, helping them stay abreast of current research.
- Career development: staying current in the field is crucial for career growth and opportunities

- International collaboration: by allowing researchers worldwide to access and contribute to a shared body of knowledge.

Furthermore, it improves personal skills such as: critical thinking and evaluation, teaching and education, identification of gaps, evidence-based decision making, inspiration of new ideas. It is not just a task for researchers but a fundamental practice that benefits individuals, the scientific community, and society as a whole. It is an integral part of the scientific process, promoting the growth of knowledge and the advancement of various disciplines.

3.1.2. Deciding which paper to read

Indicating which papers to read can be a strategic process, especially given the enormous amount of scientific literature accessible. Here are some tips to help you decide which papers to select. Define your purpose, set criteria, use keywords and filters, look for recent publications, and use online tools.

It helps you focus on papers that are directly relevant to your goals. For instance, the publication date, methodology, reputation of the journal or author, and study type narrows down the search results, and also ensure that you are accessing the latest research.

Note: scientific article selection is an interactive process, and your choices may change as you research deeper into your study. It is crucial to regularly adjust your reading list based on emerging research and the evolving needs of your project.

3.1.3. Structure of a typical scientific article

Scientific article has a structured which enables readers to read and understand the research easily. This structure may vary slightly based on the specific journal's guidelines; however, the main elements remain consistent. Here is the typical structure of a scientific article.

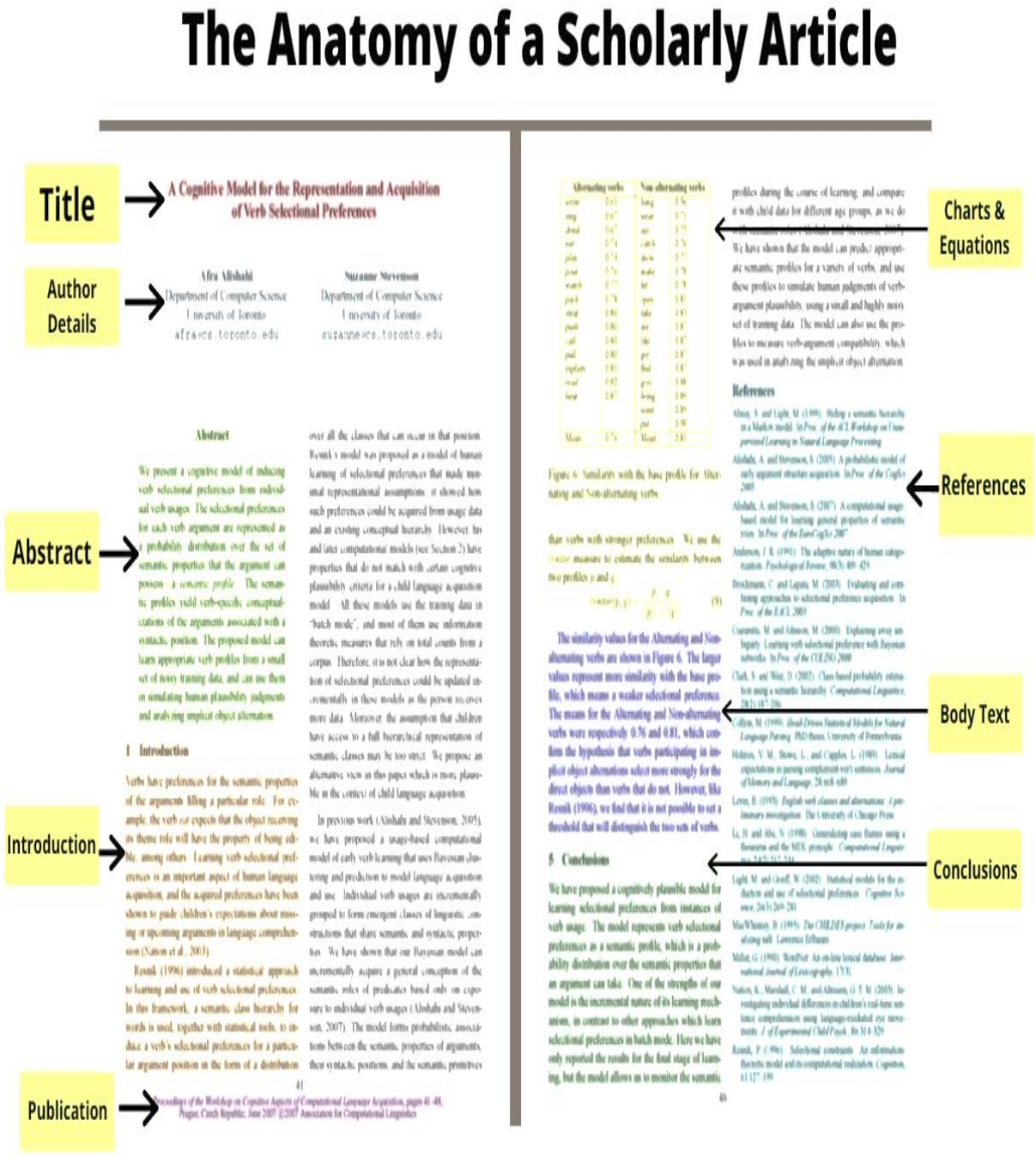

Figure 2: Structure of a typical scientific article.

- **The main elements are:**

1. Title: clearly states the topic of the research.

2. Authors and affiliations: it represents the names of the authors and their affiliations.

3. Abstract: it is a brief summary of the study.

4. Keywords: relevant words or phrases to help index the article for search engines.

5. Introduction: it states the hypothesis, or research question, and explains the importance and objectives of the article.

6. Literature review: analyzes existing literature related to the research topic of the aforementioned and existing studies.

7. Methods: defines the study's design of the research, besides, allowing the study to be replicated by other researchers.

8. Results: presents the data obtained from the study, such as: tables, figures, graphs.

9. Discussion: demonstrates the interpretation of the results.

10. Conclusion: recapitulates the key findings and suggests perspectives, or practical applications or implications.

11. References: according to a specific citation style such as APA, MLA, and Chicago, all the used sources will be cited.

12. Acknowledgments.

3.2. Understanding scientific articles (original article)

Scientific articles are the essence of scientific progress. They provide a platform for sharing discoveries, ensure quality control, and stimulate further exploration. Analysing scientific articles isn't just about understanding research, it is about actively engaging with it.

Analysing scientific papers is the key to unlocking its potential for deeper learning, identifying research opportunities, and ultimately, shaping your role as a future scholar or researcher. By critically evaluating and building upon the knowledge presented in these articles, science continues to advance our understanding of the world around us. Furthermore, credible

and reliable sources are crucial. Here are some key pointers to help you assess the credibility and reliability of scientific articles.

3.2.1. The title

Reading the title of a scientific article gives a first impression. It acts as a window into the research, provides a concise overview of the research topic. In addition, it is often the first piece of information researchers encounter in databases or literature reviews. The title can give you a preliminary idea of the research focus. This is why we check if the content aligns with the research question, methodology, and findings presented in the article. Titles can also be helpful for searching for related research. By understanding the terminology used in the title, you can formulate effective search queries to find articles on similar topics.

3.2.2. The authors' credentials, affiliations, backgrounds, publications in this field

When evaluating the reliability of information, the authors' credentials serve as a vital context clue that helps determine a source's overall credibility. By examining an author's professional affiliations, such as their connection to reputable universities or established research institutions, you can gauge whether they are operating within a framework of academic accountability. Furthermore, investigating an author's background and publication history—specifically their record of contributing to peer-reviewed journals—provides tangible evidence of their expertise and long-term standing in the field. Together, these indicators move a source from being merely informative to being a validated contribution to the scientific conversation.

3.2.3. Source of publication and journal reputation:

Is the article published in a peer-reviewed journal with a good reputation in the field?

Look for journals with high impact factors and established editorial boards.

3.2.4. Open Access in opposition to paywalled journals:

Open access journals can be legitimate, but be cautious of those with lax peer-review processes. Paywalled journals generally undergo a more rigorous review process.

3.2.5. The structure of the article

Focus on the structure and arrangement of the sequence of sections such as abstract, introduction, review, methods, results, conclusions, as well as how the information is presented, besides the quality of the writing.

a. Abstracts

Analysing abstract for crucial details is a necessary ability for promptly grasping the main points and significance of a scientific paper. Below are a few guidelines for thoroughly analysing abstracts and identifying essential information:

1. To comprehend the article's key points and findings, carefully read the entire abstract. This first reading aids in comprehending the study's context and extent.
2. Identify the main aim or objective of the research as outlined in the abstract. Search for statements that discuss the research question, purpose, or aim.
3. Search for details regarding the techniques applied in the research. Recognize important aspects like the research design, sample, gathering of information, and methods of analysis.
4. Determine the primary findings or outcomes highlighted in the abstract. Focus on important results, developments, or trends identified in the research.
5. Determine the authors' conclusions or implications derived from their findings. Search for remarks that encapsulate the study's overall importance and its possible influence.
6. Evaluate the significance of the study based on the information provided in the abstract.

Analysing abstracts systematically ensures that you extract the essential information needed to decide whether to read the full article.

b. Keywords

Keywords are terms that represent the main concepts, variables, or topics within the study. Identifying keywords is an important step in finding information and the focus of the research, especially when performing searches, literature reviews, or online searches.

The importance of identifying keywords lies in their role as anchor points for information retrieval.

Note: when creating a search query, using a well-thought-out set of keywords increases the probability of finding relevant and valuable information.

c. Introduction

The introduction of a scientific article provides background information to help understand the existing knowledge in the field. The authors might discuss relevant concepts, theories, or previous research findings. Furthermore, it states a clear picture of what the study is about and why it is important. A literature review is often included within this section. Here is how to effectively understand the introduction of a scientific article:

1. Read the beginning and the end of the introduction first, if the introduction is lengthy, before reading the section in its entirety,
2. Identify the gap in current knowledge, this gap justifies why the current study is being conducted. It could be :
    - an unanswered question,
    - a limitation in existing research,
    - a lack of understanding in a specific area.

3.Identify the research question or hypothesis, they are the central focus of the entire article.

- the research question that the study aims to answer.
- the hypothesis which is a specific prediction about the outcome of the research.

4.Identify the significance of the Study: This explains

- why the findings might be important?
- how they could contribute to the field?
- how they could have broader implications?

By properly understanding the meaning of the introduction, you establish a strong base for understanding the study's methods, findings, and the overall importance of the academic paper.

d. Materials and Methods

This section provides technical details on how to perform the experiments. In most research articles, there are rarely complete details, but there should be enough information to understand how the research was conducted. Information on the number of subjects included in

the study and how they were classified, sampling methods, inclusion criteria (may be part of an exclusion criteria (may not be part) and selected variables can be derived by reading this section. Readers should familiarize themselves with the procedures and equipment used in data collection and determine whether they are appropriate.

d.1.Materials

In a scientific paper, the materials section usually combined with methods under the heading "Materials and Methods" serves as the outline for the experiment or study. It details the components, tools and organizations involved in the study.

A key principle of science is that experiments can be performed by others. It allows the scientific community to evaluate the validity of research.

- **Contents**

1. Chemicals and reagents: this section includes listing the exact names and purity of all chemicals used.
2. Equipment and instruments: The specific equipment used in the study is described here.
3. Biological materials: details such as species, age, sex or origin of the organism will be provided, if the research involves a living organism. This can range from microscopes and centrifuges to computers and software.
4. Data source: existing datasets or published information may be used.

- **Understanding the materials section**

1. Pay attention to details such as the concentration, quantity and brand of the material, and also the controls used in the experiment.
2. Focus on documents directly related to the research question being addressed.

By understanding the literature, you will gain a deeper appreciation of the foundation on which scientific discoveries have been built.

d.2.Methods

It follows the introduction and precedes the results. Methods serves as a roadmap for the research. It analyses the "how" and "why" of the investigation. It allows you to assess if the chosen methods were appropriate to answer the research question (evaluating credibility). It

enables other researchers to replicate the study and verify the findings (reproducibility). The main elements of the method section are:

1. Research Design: it summary the overall approach taken in the study to answer a question. Common designs include experimental design, observational design, survey design, case studies, or computational modelling.
2. Data collection technique: it could include conducting interviews, administering surveys, measuring specific variables in an experiment (observational or controlled), or collecting data from existing sources.
3. Data analysis methods: this explains the statistical tools or qualitative approaches used to analyse the collected data.

- **Understanding methodology**

1. Look for clear explanations of the methods used and why these specific methods were chosen.
2. Consider how the research design or data collection techniques might introduce bias into the study.
3. Look for controls (if applicable): in experiments, the methodology should describe any control groups used to account for external factors that might influence the results.
4. Identify the sample size, data collection procedures, and any relevant equipment or software used.

Note: the research's strengths and weaknesses are assessed from this section. It clarifies how researchers arrived at their findings.

e. Results and Data

Results and data are the main part of the scientific article. They reveal the findings of the research and provide the evidence to support the conclusions. They reveal what the researchers actually observed or measured, offering a clear picture of the study's outcomes.

Data serves as the objective evidence for the research findings. By examining the data, readers can evaluate the validity of the conclusions drawn.

- **Content**

Results can be quantitative (numerical) or qualitative (descriptive), and this according to the data collected over the research methods. They could be presented as:

1. Textual descriptions: expressed in the past tense.
2. Tables: presenting numerical findings in an organized way.
3. Figures: represent relationships in the data (graphs, charts, and images).

e.1. Understanding results and data

- Ensure that the results presented are connected to the research question
- Interpret what the data means in the context of the research question.
- Pay attention to any interesting patterns emerging from the data.
- Look for statistical tests and their p-values to understand the significance of statistical analyses, then the observed effects.

Reminder: results and data are vital. They enable researchers to explain their results objectively and readers to critically assess the study and its implications.

f. Discussion

The heading titled "Discussion" or "Discussion and Conclusion" typically following the results section. It relates the results and the introduction. The discussion is a scientific dialogue with the reader. It needs critical thinking and encourages readers to consider the significance of the research presented.

It interprets the findings mean, propose explanations, and clarify the mechanisms, analyse their significance, and connect them to existing knowledge. Researchers compare their findings with previous studies, highlighting any converging or diverging results.

f.1. How to understand the discussion

1. Look for how the authors interpret their findings:
    - The meaning of the results in the context of the research question.
    - The process or the mechanisms that might explain the obtained results.
2. Look for how the authors compares the results:
    - Compare their findings with previous studies.
    - Notice any agreements or disagreements with previous research.
    - Position the work within the broader body of knowledge.
3. Look for how the discussion effectively answered the question asked in the introduction.

4. Look for how the authors discuss the limitations of the study

By completing these steps, you will obtain a better knowledge of the study and its role in the scientific environment. You will go from simply accepting the data to critically examining their significance and implications.

g. Conclusion

The conclusion of a scientific paper summarises the important ideas, emphasise the significance of their study, suggests further inquiry, and leave a lasting impression on the reader. Understanding the conclusion enables you to have a complete view of the research, how it may influence future scientific searches, and how they add to the current body of knowledge. This might include proposing further studies or emphasising unsolved questions arising from the current work.

g.1. How to understand conclusion in a scientific article

Here is how to effectively understand the conclusion of a scientific article:

- Recap of main findings: the conclusion won't be a lengthy rehash, but it should succinctly remind you of the study's most important results.
- Look for how the authors emphasize the importance of their findings. How does the research contribute to the field?
- Limitations and future directions: the conclusion might acknowledge limitations of the study and propose avenues for future research that could address them.
- Pay close attention to the language used. Phrases like "This highlights the importance of..." or "These findings suggest..." indicate significant takeaways.
- Connect to the introduction: recall the research questions posed in the introduction. Does the conclusion effectively address them and showcase the research's significance?
- Think about how the research might influence other scientific endeavours or real-world applications. Are there any unanswered questions the conclusion raises?
- Understand the interpretations and contextualization from the discussion aids comprehension of the significance emphasized in the conclusion.

Note: conclusion does not just repeat results. It raises them to a comprehensive level, highlighting their contribution to the field. It allows you to understand the results, the significance of the research and its impact.

h. References

The references are also known as bibliography. It is usually found at the end of the article, after the conclusion. The references are used briefly within the main text of the article. Whereas, the complete citation is in the reference list. In a scientific article, references have two important purposes:

- Academic integrity by correctly acknowledging the research or ideas of other scholars cited in the article.
- The article's credibility by reinforcing claims, offering evidence and background information.

Citations enable readers to further explore the references mentioned by the writers.

h.1. Examine the list of references

Evaluate the reliability of the research by taking into account the variety of sources cited. Do they consist of respected peer-reviewed journals or trustworthy academic books?

Understanding the functionality of references helps in recognizing the significance of correct citation and efficiently exploring the sources utilized to back up the research in a scientific article.

3.3. Understanding scientific articles (review article)

A review paper is a secondary source that synthesizes and analyses existing research on a specific topic. It provides an overview of the current state of knowledge in a particular field. It does not present new findings or original research. Instead, they summarize, evaluate, and critically analyse the findings from previously published primary research articles. The main purpose is to offer a comprehensive understanding of a research topic by condensing information from various sources. Identify gaps in current knowledge and potential areas for future research. Provide a foundation for researchers to build upon existing knowledge.

a. Advice

Think of a review paper like a map leading you through a complicated research landscape on a certain subject. It displays the main points (important discoveries from various research) and guides you through the subject. Alternatively, a research paper can be compared to an in-depth description of a recently identified area in that same environment. It offers a direct report

on the process of exploration, the characteristics of the new area (discoveries), and its importance in comparison to the current map.

b. Importance

- Review papers are essential resources for researchers and individuals looking to gain a thorough understanding of a particular research subject. The reason why they are of great significance is as follows:
- Review papers provide an efficient and structured examination of the most important research findings, reducing the amount of time and effort needed.
- Review papers establish a strong base by summarizing important discoveries, methodologies, and discussions in a specific area. This aids researchers in expanding on current knowledge and pinpointing areas for their own research to tackle.
- This assists readers in comprehending the present research environment, spotting upcoming trends, and becoming informed about ongoing discussions within a specific field.
- Review articles can identify knowledge gaps or flaws in current research methods by evaluating existing studies. This could lead to the development of new research inquiries and motivate researchers to investigate uncharted paths in a particular field.
- Review papers provide researchers and professionals with a valuable source to keep abreast of the most recent advancements and discoveries in their field.

Note: essentially, grasping review papers helps you navigate scholarly research more efficiently and with greater focus in mind. They provide you with the information and understanding required to efficiently delve into specific research areas and make valuable contributions to your field.

3.3.1. Types of review article

There are various kinds of review papers, each fulfilling a particular role and using unique methods. Here is a detailed explanation of the three primary divisions:

a. Narrative Reviews

Reviews that provide a narrative summary of existing literature. The main focus is to provide a comprehensive overview of a subject by summarizing and combining various research studies. It Uses a more relaxed search strategy, frequently relying on the author's

knowledge to choose appropriate studies. This may involve research that has been published or unpublished, with unpublished data being less frequent. It Offers a comprehensive insight into the industry and is able to recognize important patterns or developments. Beneficial for gaining a basic understanding of a fresh research field. Search strategy could be more disorganized, which might cause bias in study selection. Conclusions can vary depending on the author's viewpoint, and may be considered subjective.

b. Systematic Reviews

Reviews that follow a structured methodology and process to summarize and analyse existing research studies. It Investigates a particular research query through a thorough and predetermined search approach. it Utilizes a structured exploration of databases and additional resources to find appropriate research based on predetermined criteria for inclusion and exclusion. Emphasizes on research that has been published and peer-reviewed.

Advantages: Offers a more unbiased and thorough assessment of the research on a particular topic. Decreases prejudice in selecting studies by adhering to a explicit protocol.

Downsides: It may require a lot of time and resources to carry out. Excluding unpublished studies may result in not including all pertinent research.

c. Meta-analyses

Combining data from various studies statistically to make more robust conclusions about a research question. Access to the original data in the studies is needed. Utilizes statistical methods to merge numerical findings from various research studies.

- Advantages: Offers the most robust evidence for or against a specific impact by pooling information from various sources. Decreases the influence of chance variations in single research trials.
- Weaknesses: The need for access to each participant's data may not be met in all cases. Depends on the quality of the studies included and the suitability of the statistical methods utilized.

3.3.2. How to understand a review paper

Review articles provide valuable perspectives on a particular research field; however, it is important to note that not all reviews are of the same quality. Improving your critical reading

abilities is crucial in order to maximize their benefits. Here is a plan to lead you through the process:

3.3.3. Assessment of the Review Procedure

- **Examine the search strategy carefully**
  - How were the researches identified?
  - Was an extensive search carried out on pertinent databases and sources?
  - Were specific criteria established to make sure that relevant studies were not missed?
  - Beware of reviews that lack comprehensive search information or those that appear to depend too much on only one source.
- **Evaluate the Criteria for Selection**
  - Were the studies included restricted by a certain publication date, language, or methodology?
  - Do the criteria align with the research question at hand?

Excluding important studies based on arbitrary criteria could result in an incomplete assessment.

- **Evaluating the Content**

i. The clarity of the research question is important

- Is the review focused on an explicit and clearly defined question?
- Does the inquiry hold importance and relevance to the field?

A review without a clear question may have difficulty offering a concentrated analysis.

ii. Remaining unbiased and precise: Objectivity and Accuracy

- Is the review providing an unbiased and precise presentation of the included studies' results?
- Are the strengths and limitations advantages and disadvantages of each study analysed objectively?

Beware of reviews that appear to support certain research or endorse a specific perspective

iii. Level of examination: Depth of Analysis

- Does the review explore more than just presenting the results?
- Does it assess the methodologies used in the studies included with a critical approach?

A thorough evaluation will analyse the quality of the evidence and identify potential limitations or conflicting findings.

iv. Identifying the Author's Bias

- Consider the author's background and affiliation. Do they have a vested interest in a particular outcome?
- Analyse the language used. Is it objective and neutral, or does it seem to favour specific studies or viewpoints?
- Look for a balanced presentation of both supporting and opposing evidence.

A high-quality paper should clearly explain its methodology, remain objective in its analysis, and offer a critical assessment of the studies it includes

Chapter IV

4. Self-assessment Questions

4.1. Chapter I: Terminology

- **Question 1**: Why are most biological word roots derived from Greek or Latin rather than modern languages?
- **Question 2**: If you encounter the term intracellular, how would you decode its meaning using the suffix-backwards method?
- **Question 3**: Why is it more effective to learn word roots, prefixes, and suffixes rather than memorizing thousands of individual biological terms?
- **Question 4**: The terms hypodermis and infrascapular both indicate position. What distinguishes the meaning of hypo- from infra-?
- **Question 5**: Why does the combining vowel "o" appear in cardiology but not in gastritis? Explain the rule.
- **Question 6**: The term bacterium becomes bacteria in plural, but cactus is commonly used as both singular and plural in modern English. What does this tell you about the evolution of scientific terminology?
- **Question 7**: If a student confuses hyperthermia with hypothermia in a lab report, what would be the real-world consequence?
- **Question 8**: The suffix -logy means study of, while -logist means one who studies. Why does this distinction matter in professional contexts?
- **Question 9**: Why might two different roots (e.g., dermatos: Greek and cutane: Latin) both mean skin? What historical reason explains this duplication?
- **Question 10**: The term appendices is the plural of appendix, but thoraxes and thoraces are both accepted plurals for thorax. What does this variation suggest about terminology standardization?
- **Question 11**: Why do we emphasize to read a term from the suffix backwards rather than left to right?

- **Question 12**: The prefix eu- means good or normal (e.g., eupnea = normal breathing). Its opposite dys- means painful, difficult, faulty (dyspnea = difficult breathing). Why is this contrast particularly important in terminology?
- **Question 13**: How would you form the plural of spermium and ovum based on the rules provided? What pattern do you notice?
- **Question 14**: The prefixes are optional, while every biological term requires at least one root. Why is the root considered non-negotiable while prefixes are optional?
- **Question 15**: Consider the word transmembrane. If you remove the prefix, you get membrane. Does membrane alone have the same meaning? Why or why not?
- **Question 16**: Why might a student struggle to understand "pseudopseudohypoparathyroidism" despite knowing basic roots? What does this reveal about terminology limits?
- **Question 17**: The suffix -centesis means puncture for aspiration (e.g., amniocentesis). Why would this suffix be particularly concerning for a patient?
- **Question 18**: Oogenesis (formation of eggs) and neurogenesis (formation of neurons) share the suffix -genesis. How does recognizing this pattern help you understand new terms like angiogenesis?
- **Question 19**: The prefixes including (a-/an-) (without) and (ab-) (away from). How would you distinguish (abnormal) from (anormal)? Which is correct in English?
- **Question 20**: Why does biological terminology include both (brachy-) (short) from Greek and (brevi-) (short) from Latin? How would you decide which to use?

4.2. Chapter II: Writing a Scientific Report

- **Question** 1: We state that a lab report does not only present data but demonstrates the student's understanding. What distinguishes presenting data from demonstrating understanding?
- **Question** 2: Why would a professor consider a scientifically excellent report prejudicial to the student if it is poorly written?
- **Question** 3: The IMRAD format (Introduction, Methods, Results, Discussion) is standard for lab reports. Why is this specific order logical rather than arbitrary?
- **Question** 4: In the Materials and Methods section, the document specifies using past tense and avoiding personal pronouns. Why are these grammatical choices important for scientific objectivity?
- **Question** 5: The Results section says do not duplicate data in different formats. Why is duplication problematic even if each format shows the same information differently?
- **Question** 6: The Discussion section requires comparing results to standard values. What does this imply about the importance of published literature in interpreting your own findings?
- **Question** 7: Why does the Conclusion only consist of a few sentences while the Discussion can be several paragraphs? What different functions do these sections serve?
- **Question** 8: For an internship report, the document recommends including personal experience summary (techniques learned, skills acquired, challenges experienced). How does this differ from the objective tone required in lab reports?
- **Question** 9: We distinguishes conclusion from recommendations in internship reports. Why are these considered different rather than the same section?
- **Question** 10: The abstract is described as self-contained and written after completing the full report. Why write it last if it appears first?
- **Question** 11: We specifie font sizes (16pt bold headings, 14pt subheadings, 12pt text). Why would a professor penalize formatting deviations if content is correct?
- **Question** 12: Why might an internship report require a glossary and nomenclature section while a lab report typically does not?

- **Question** 13: We recommend including both tasks and responsibilities undertaken AND responsibilities assumed in internship reports. What is the distinction between these two phrases?
- **Question** 14: In the Materials and Methods section, why is exact timing, measurements, temperatures considered essential rather than optional detail?
- **Question** 15: The Results section should present data in a logical, clear, and understandable order. What determines whether an order is logical for a given experiment?
- **Question** 16: Why do we specify that the internship report should be 6-10 pages long? What is lost with shorter or longer reports?
- **Question** 17: The discussion section should analyse unexpected results thoroughly. Why give MORE attention to unexpected results rather than expected ones?
- **Question** 18: The acknowledgment section is described as sober and requiring brief justification for each person thanked. Why not simply list names?
- **Question** 19: Some times, the quality of reports is poor...due to lack of preparation and organization during the work. How does poor laboratory organization translate into poor report writing?
- **Question** 20: The cover page includes both the title of the report and work plan for short reports or table of contents for long reports. What does this distinction reveal about how report length affects reader needs?

Chapter III: Understanding Scientific Articles

- **Question** 1: We state that textbooks may become outdated over the years while journals provide real-time reflection. Why would a researcher trust a journal article published last month over a textbook published this year?
- **Question** 2: Why do we distinguish between original research articles and review articles as fundamentally different types of scientific literature?
- **Question** 3: We warn about open access journals with lax peer-review processes. How can a reader distinguish legitimate open access from predatory journals?
- **Question** 4: When evaluating an author's credentials, why does affiliation with a reputable university matter more than the author's individual reputation for a new researcher?
- **Question** 5: We suggest reading the beginning and end of the introduction first if lengthy. Why is this skimming strategy effective rather than lazy?
- **Question** 6: In the Methods section, why is it acceptable that rarely are there complete details to fully replicate an experiment? Shouldn't replication be possible?
- **Question** 7: The Results section may include p-values to indicate statistical significance. Why might a statistically significant result ($p < 0.05$) still be scientifically unimportant?
- **Question** 8: The Discussion compares findings to previous studies, noting converging or diverging results. Why are diverging results potentially more valuable than converging ones?
- **Question** 9: We state that references serve academic integrity and credibility. What is the difference between these two functions?
- **Question** 10: Why would a researcher read a narrative review rather than conducting their own literature search? What does the review provide that a database search cannot?
- **Question** 11: We describe systematic reviews as more unbiased than narrative reviews. Why can no review be completely unbiased?
- **Question** 12: Meta-analysis combines data statistically across studies. Why might combining data from different studies be problematic despite statistical appropriateness?

- **Question** 13: We advise readers to identify the gap in current knowledge in the Introduction. Why is a research gap necessary for publication? What would a paper without a gap represent?

- **Question** 14: When examining the reference list, why should you check whether sources are from peer-reviewed journals or trustworthy academic books rather than websites or preprints?

- **Question** 15: We mention limitations and future directions in both Discussion and Conclusion. Why discuss limitations at all? Doesn't this weaken the paper?

- **Question** 16: The authors' publication history provides tangible evidence of expertise. Why is quantity of publications less important than consistency and relevance?

- **Question** 17: We advise checking if the journal has an established editorial board. Why does an editorial board matter more than the journal's name recognition?

- **Question** 18: When reading an abstract, the document suggests identifying primary findings or outcomes BEFORE evaluating conclusions or implications. Why this order?

- **Question** 19: We compare a review paper to a map and a research paper to a detailed description of a newly discovered area. Why would you consult a map before exploring a new area?

- **Question** 20: Why do we emphasize that reading scientific articles improves critical thinking beyond simply learning facts?

Conclusion

This module has provided you with a solid foundation in the important aspects of scientific research. the first chapter on biological terms has given a firm grasp of the vocabulary used in biology, enabling you to accurately explain and talk about scientific ideas. In Chapter Two, you learned the necessary structure and format for creating well-defined scientific reports to effectively share your research results. In addition, in the third chapter, scientific article reading and comprehension, you have developed the skills to critically analyse scientific articles, identify essential details, assess methodologies, and grasp the implications of research. Mastering these fundamental skills, allow you to: participate in scientific discussions with clear and precise communication. Effectively document your scientific work on your own. Carry out extensive research by carefully examining current scientific literature. As you progress further in your scientific exploration, make sure to enhance your use of terminology, writing reports, reading critically, and understanding the scientific material. This module acts as a starting point for you to explore deeper into the intriguing realm of scientific research.

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