Міністерство освіти та науки України
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Методичні вказівки

до практичної роботи з дисципліни «Англійська мова»
для здобувачів вищої освіти освітньо-наукової програми третього рівня
(підготовка докторів філософії) для усіх спеціальностей
(1 курс)

ЗАТВЕРДЖЕНО:
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Методичні вказівки до практичної роботи з дисципліни «Англійська мова» для здобувачів вищої освіти освітньо-наукової програми третього рівня (підготовка докторів філософії) для усіх спеціальностей (1 курс) Укл. – доцент Воронова З.Ю., старший викладач Лещенко О.П., Кам'янське: ДДТУ, 2018, 76 стор.

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Коротка анотація: Методичні вказівки складено відповідно до програми з курсу. Вказівки містять теоретичний матеріал та практичні завдання і прзначені для аудиторної та самостійної роботи аспірантів над курсом, можуть бути використані для повторення матеріалу та підготовки до кандидатського іспиту.

Зміст

ТЕМА 1. АНГЛІЙСЬКА МОВА ЯК ЗАСІБ НАУКОВОГО СПІЛКУВАННЯ

HIGHER EDUCATION IN GREAT BRITAIN

After finishing secondary school or college you can apply to a university, polytechnic, college of education or you can continue to study in a college of further education.

The academic year in Britain's universities, Polytechnics, Colleges of education is divided into 3 terms, which usually run from the beginning of October to the middle of December, the middle of January to the end of March, from the middle of April to the end of June or the beginning of July.

There are 46 universities in Britain. The oldest and best-known universities are located in Oxford, Cambridge, London, Leeds, Manchester, Liverpool, Edinburgh, Southampton, Cardiff, Bristol and Birmingham.

Good A-level results in at least 2 subjects are necessary to get a place at a university. However, good exam passes alone are not enough. Universities choose their students after interviews. For all British citizens a place at a university brings with it a grant from their local education authority.

English universities greatly differ from each other. They differ in date of foundation, size, history, tradition, general organization, methods of instruction and way of student life.

After three years of study a university graduate will leave with the Degree of Bachelor of Arts, Science, Engineering, Medicine, etc. Some courses, such as languages and medicine, may be one or two years longer. The degrees are awarded at public degree ceremonies. Later he/she may continue to take Master's Degree and then a Doctor's Degree.

The 2 intellectual eyes of Britain – Oxford & Cambridge Universities – date from the 12 & 13 centuries. They are known for all over the world and are the oldest and most prestigious universities in Britain. They are often called collectively Oxbridge, but both of them are completely independent. Only education elite go to Oxford and Cambridge.

The Scottish universities of St. Andrews, Glasgow, Aberdeen & Edinburgh date from the fifteenth and sixteenth centuries.

In the nineteenth and the early part of the twentieth centuries the so-called Redbrick universities were founded. These include London, Manchester, Leeds, Liverpool, Sheffield, and Birmingham. During the late sixties and early seventies some 20 'new' universities were set up. Sometimes they are called 'concrete and glass' universities. Among them are the universities of Sussex, York, East Anglia and some others.

During these years the government set up 30 Polytechnics. The Polytechnics, like the universities, offer first and higher degrees. Some of them offer full-time and sandwich courses [sandwich course курс обучения, чередующий теорию с практикой; сочетание общеобразовательного и профессионального обучения с работой на производстве] (for working students). Colleges of Education provide two-year courses in teacher education or sometimes three years if the graduate specializes in some Particular subjects.

Some of them who decide to leave school at the age of 16 may go to a further education college where they can follow a course in typing, engineering, town planning, cooking, or hairdressing, full-time or part-time. Further education colleges have strong ties with commerce and industry.

There's an interesting form of studies which is called the Open University. It's intended for people who study in their own free time and who 'attend' lectures by watching TV and listening to the radio. They keep in touch by phone and letter with their tutors and attend summer schools. The Open University students have no formal qualifications and would be unable to enter ordinary universities.

Some 80,000 overseas students study at British universities or further education colleges or train in nursing, law, banking or in industry.

Подробнее на сайте: http://study-english.info/topic-uk-higher-education.php#ixzz35LAxqBht
http://study-english.info/

HIGHER EDUCATION IN THE USA

Many students, upon finishing high school, choose to continue their education. The system of higher education includes 4 categories of institutions. The community college, which is financed by the local community in different professions. Tuition fees are low in these colleges, that's why about 40 per cent of all American students of higher education study at these colleges. On graduation from such colleges American students get "associate degree" and can start to work or may transfer to 4-year colleges or universities (usually to the 3rd year). The technical training institution, at which h igh school graduates may take courses ranging from six months to three-four years, and learn different technical skills, which may include design business, computer programming, accounting, etc. The best-known of them are: the Massachusetts Institute of Technology and the Technological Institute in California. The four-year college, which is not a part of a university. The graduates receive the degree of Bachelor of Arts (BA) or Bachelor of Science (BS). There are also small Art Colleges, which grant degrees in specialized fields such as ballet, film-making and even circus performance. There are also Pedagogical Colleges.

The university, which may contain: several colleges for students who want to receive a bachelor's degree after four years of study; one or more graduate schools for those who want to continue their studies after college for about two years to receive a master's degree and then a doctor's degree.

There are 156 universities in the USA. Any of these institutions of higher education may be either public or private. The public institutions are financed by state. Most of the students, about 80 per cent, study at public institutions of higher education, because tuition fees here are much lower. Some of the best-known private universities are Harvard. Yale and Princeton. It is not easy to enter a college at a leading university in the United States. Successful applicants at colleges of higher education are usually chosen on the basis of: their high-school records which include their class rank, the list of all the courses taken and all the grades received in high school, test results; recommendation from their high school teachers; the impression they make during interviews at the university, which is in fact a serious examination; scores on the Scholastic Aptitude Tests.

The academic year is usually nine months, divided into two terms. Studies usually begin in September and end in July. Each college or university has its own curriculum. During one term a student must study 4 or 5 different courses. There are courses that every student has to take in order to receive a degree. These courses or subjects are called major subjects or "majors".

At the same time there are subjects which the student may choose himself for his future life. These courses are called 'electives". A student has to earn a certain number of "credits" (about 120) in order to receive a degree at the end of four years of college. Credits are earned by attending lectures or laboratory classes and completing assignments and examinations.

Students who study at a university or four-year college are known as undergraduates. Those who have received a degree after 4 years of studies are known as graduates. They may take graduate program for another 2 years in order to get a master's degree. Further studies are postgraduate which result in a doctor's degree.

HIGHER EDUCATION IN UKRAINE

Higher education is generally recognized as preparing individuals to realize more fully their human potential, enrich their understanding of life and make them more productive to society.

Future specialists in various fields of science, technology, economies and art get a fundamental general and specialized training, all students regardless of their specialty study foreign languages.

Apart from educational work and schooling Ukrainian higher schools carry out a great deal of scientific work in all branches of knowledge. They have either a students' research Society (Club) or a Technological Design Bureau which provide excellent facilities for young researches.

Our country needs specialists in all fields of science and all branches of industry and agriculture. Institutes exist not only in big cities like Kyiv, Kharkiv, Lviv, but in many towns of Ukraine like Irpin.

Higher educational establishments of our country fall into three main types. The first type includes the universities and institutes where there are only full-time students, which receive state grants. Students who do not live at home get accommodation in the hostels.

The second and third types of higher schools provide educational facilities for factory and office workers who combine work with studies.The second type of higher education in establishments includes evening faculties and evening higher schools for those who study in their spare time.

The third type covers extra-mural higher schools where students take correspondence courses. Every year extra-mural students receive from 30 to 40 days’ leave to prepare for their exams.

The diplomas by the evening faculties and extra-mural higher schools have the same value as the diplomas of all other institutes and universities.

The period of study at higher schools is from 4 to 6 years. According to the subjects studied there exist three groups of higher schools’ universities, polytechnic and specialized institutes.

COMPREHENSION QUESTIONS:

1. What is the difference between higher educational systems of Great Britain, the USA and Ukraine?
2. What are the advantages and disadvantages between these systems?
3. If you had to choose your stydying, what educational system would you prefer?
4. What would you change in educational system of our country to improve its effectiveness?

ТЕМА 2. НАВЧАННЯ В АСПІРАНТУРІ

Scientific degrees

The four types of college degrees include an associate's degree, bachelor's degree, master's degree and finally a doctor of philosophy. These degrees are based on various educational programs and curricula. Each type of these degrees plays its own set of critical roles in career advancement, intellectual fulfillment and personal satisfaction for different people.

Here is a list of the types of degrees offered in colleges:

Types of Associate Degrees

- **A.A. (Associate of Arts)** – This degree requires students to complete a coursework of 60 hours, including courses in general education and other courses related to the degree program. A.A. degree is often awarded in liberal art areas, like English, music or history.
- **A.S. (Associate of Science)** – It focuses on science and requires students to complete many hours of coursework in general education. Common A.S. programs include biology and chemistry.
- **A.A.S. (Associate of Applied Science)** – It is designed to ready students to join the working world. There are several types of this degree, including programs in business or engineering.
- **A.E. (Associate of Engineering)** – Focuses on engineering
- **A.A.A. (Associate of Applied Arts)** – Deals with applied arts
- **A.P.S. (Associate of Political Science)** – Mainly focuses on political science

Types of Bachelor's Degrees

- **B.A. (Bachelor of Arts)** – It is considered as the widest bachelor's degree. The BA degree focuses on arts but also require the students to take some general education classes.
- **B.S. (Bachelor of Science)** – It usually covers majors such as engineering, physics, accounting or business or any of the sciences. A B.S. degree requires some general studies courses.
- **B.F.A. (Bachelor of Fine Arts)** – Professional actors, dancers, singers, sculptors and painters are perfect candidates for this degree. BFA degree is also offered in fields such as digital media and web design.
- **B.B.A. (Bachelor of Business Administration)** – BBA degree often covers courses in management strategy, decision making and even organizational psychology. You should opt for this course if you aspire to be a general manager.
- **B.Arch. (Bachelor of Architecture)** – This is a degree program that future architects must complete.

Types of Master's Degrees

M.A. (Master of Arts) or M.F.A. (Master of Fine Arts) – It can cover various graduate studies. These include education, communication, social sciences and music.

M.S. (Master of Science) – This degree could be earned in a wide range of science, health and even social science professions. Major focus is on research, though a few courses can have a combination of research-based courses and class-based courses.

M.Res. (Master of Research) – It's designed to offer training on how to carry out a research. MRes may help you a lot if you intend to pursue a research career or PhD.

M.Phil. (Master of Philosophy) – It's a research-only degree and is often a precursor to PhD. Most PhD students register for this degree in their initial 1-2 years of study and must produce a report after this period to change their registration status to that of a PhD student.

LL.M. (Master of Laws) – This degree usually takes one year as a full time program or 2-4 years as a part time course. While professional Law degrees just give a general coverage of all the skills required to become an attorney, LLM would give you an opportunity to specialize.

M.B.A. (Master of Business Administration) – These degrees are often designed for management professionals with some experience. Intensive and demanding, MBA focuses on creating future successful business leaders.

Types of Doctorate Degrees

PhD (Doctor of Philosophy) – These are research-based doctorate degrees often awarded to recognize peer-reviewed published academic research. **M.D. (Doctor of Medicine)** – This is the most advanced degree for medical students and must be completed to professionally practice medicine. M.D. students often choose a specialty area.

Ed.D. (Doctor of Education) – This is the highest level degree of education in the education field. People who hold this degree often work in administrative, research or academic positions related to education.

J.D. (Juris Doctor) – This degree is the most advanced one available to lawyers in the US. A thesis is typically not required in J.D. degree program.

In this stiff competition of job opportunities and the eligibility of qualifying for a given profession, these degrees do play an important role. Hopefully, the aforementioned list of degrees gave you a better understanding of the different types of degrees available. All you have to do is choose the right one for you depending on your interests, career aspirations as well as capability.

COMPREHENSION QUESTIONS:

1. Are there any differences between scientific degrees in our country and in the world?

2. Discuss this question with your partner. Give your considerations.

ТЕМА 3.
ОСОБЛИВОСТІ НАУКОВОГО СТИЛЮ АНГЛІЙСЬКОЇ МОВИ
LEXICAL, SYNTACTIC, GRAMMATICAL FEATURES OF THE SCIENTIFIC AND TECHNICAL FUNCTIONAL STYLE AND ITS TRANSLATION PECULIARITIES INTO UKRAINIAN

Functional style is the formation which is based on the ability of linguistic texts to have certain qualitative characteristics. This formation functions in a certain sphere of communication which belongs to a certain sphere of human activity.

The characteristic features of the scientific and technical style are informativity, consistency, precision, comprehensibility and lucidity.

The scientific and technical texts are also characterized by:

- the extensive use of scientific terminology;
- the presence of charts, tables, diagrams, maps, mathematical, physical, chemical and other signs;
- the usage of abstract, mainly foreign words;
- the usage of purely scientific phraseology;
- the presence of clear structure of the text.

We have conducted the analysis of lexical, syntactic and grammatical features of English scientific and technical texts. On the basis of our study we may draw the conclusion that nouns, adjectives and non-finite verb forms prevail in such texts. Finite verb forms are not as widely used in the scientific and technical texts as in the belletristic literature and if used, as a rule, they take passive form. It is explained by the fact that in the scientific and technical literature the close attention of the author is directed to the specific facts which are to be explained. Thus the personality of the author is not so essential. It is important for the names of the objects and processes to take the first place and become the subject of the sentence.

The definition of concepts and the description of real objects by means of their qualities specification are characteristic features of the scientific and technical texts. This explains the extensive usage of simple sentences with a predicate, consisting of a verb-copula and a nominal part.

Another feature of English scientific and technical texts is the wide usage of the passive voice. This is explained, firstly, by the fact that it is not accepted in such texts to use the first person singular, secondly, most verbs that denote actions, processes or reactions are transitive.

Having also considered the translation peculiarities of English scientific and technical texts into Ukrainian, we came to conclusion that there exist three main ways of rendering English passive constructions:

- using the similar construction in Ukrainian;
- with the help of the non-finite verb forms;
- changing active form of the verb into passive form.

On the basis of our study we may draw the following conclusion: lexical, syntactic and grammatical peculiarities of the scientific and technical texts influence greatly the communicative aspect of these materials. The appropriate rendering of the communicative aspect, in its turn, is essential during the translation of the scientific and technical literature.

COMPREHENSION QUESTIONS:

1. Study the information above and decide what are the main features of scientific style?
2. Find the text on your speciality and discuss its peculiarities with yor partner.

ТЕМА 4. ІНОЗЕМНИЙ НАУКОВИЙ ТЕКСТ

Reading Scientific and Technical Texts

Practitioners entering scientific and technical fields are confronted with an ocean of information, and the tide will constantly rise. As a reader, you will struggle to stay current with the literature in order to maintain and advance your position in your field. It is a truism that the task of reading all the information published in leading journals, in all but the most narrowly defined specialties, is impossible. The problem for you as a reader will not be reading faster, but learning how to select what is worthwhile to read slowly. As a layperson reading in areas outside your field of expertise, you will confronted by a language not your own. The problem for you as a reader will not be to become an expert in dozens of fields, but to recognize the techniques for reading in your own field, and relate them to other fields. In this chapter we will examine strategies for how to read and critically assess scientific and technical literature.

The articles to reading often vary widely, and for the most part remain unexamined. Typically, we understand reading as a passive, individual activity about which we receive no formal instruction after childhood. Implicitly, it seems, we develop our own reading strategies. You may prefer to read in a certain place under specific conditions. Pressed for time, you may only read the introduction, conclusion and subheadings to an article to be discussed in class that day. You may skip the words in a physics textbook altogether to get to the mathematical formulas. You may read a newspaper in a ritual manner, one section proceeding the next. While each these strategies are unique, academic disciplines encourage certain possibilities for reading by regulating the expression, production and presentation of a text. In part, how we read results from the activities going on "behind the scenes" of the words we read.

Behind the scenes of a text may lie the complex linguistic skills of a poet, or the complex research skills of researchers in a laboratory. In a poet's case, the activity of writing is generally private. Poets use imagination and personal insight in deciding what is true. However, consumers usually see the services of poets as minor. Reading poetry is associated with leisure. In a researcher's case, the activity of writing is public within their profession. Researchers use each other's work in deciding what is true or factual. Consumers see research as valuable. Reading science is associated with accomplishing a task. What we face, in part, when reading a poem or research article is the organizational structure that helps write the text. As readers we approach poetry, rightly or wrongly, as the product of a less formal, highly individual process, which makes poetry more accessible. Reading poetry, one does not have to contend with the technical apparatus, graphs, charts, references to instruments, jargon, and references to other work, found in scientific and technical writing. Scientific and technical writing is less accessible. Further, readers of scientific and technical writing await a unusual dilemma:

The peculiarity of the scientific literature is now clear: the only three possible readings lead to the demise of the text. If you give up, the text does not count and might as well not have been written at all. If you go along, you believe it so much *that it is quickly abstracted, abridged, stylized and sinks into tacit practice. Lastly, if you work through the author's trials, you quit the text and enter the laboratory. Thus the scientific text is chasing its readers away whether or not it is successful. Made for attack and defense, it is no more a place for a leisurely stay than a bastion or a bunker. This makes it quite different from the reading of the Bible, Stendhal or the poems of T.S. Eliot.* (Bruno Latour, *Science in Action*,1987, p. 61).

A First Reading

It may surprise you to learn that many technical documents are written not to be read. More precisely, documents are designed to allow certain readers to avoid reading certain parts: a company president, for instance, might read only the recommendation section of a final report; the project manager might read only the recommendation and conclusion; only a study group for a subsequent project might read the entire report. What allows this procedure is a commonly recognized format: the company president knows there will be a recommendation section, and knows where to look for it: she opens the document to the table of contents page, looks to the bottom for a page number, then moves to it. When she has found the information she needs, she files the report, or sends it to the next reader. A first reading of scientific and technical texts generally includes a consideration of what you need, and how you initially respond to the text.

Responding to Assumptions

As you approach scientific and technical literature, consider the assumptions you bring to bear on a text, and how these assumptions affect how you react and read the text.

Presuppositions. Consider what reactions or impressions do you hold about a particular field or profession, its representatives, and its methods. On what grounds, personal experience, hearsay, news reports, reading literature in that field, are these reactions and impressions based? Laypersons sometimes allow their presuppositions to prevent them from going outside their personal field of expertise, or to provide an excuse to ignore the work of others. This reaction can lead to confusion with respect to legal, medical and insurance documents, or lead to a missed opportunity to bring to insight to bear on your own work and the work of others. Everyone must deal with representatives of other professions. Compare the image of your profession or field to the one you approach as a layperson. By relating the images, language and presentation of ideas of other professions to your own, you can build a context with which to understand the language of experts.

Presentation. Consider how you respond to the way the text looks. Are you impressed by the print quality? Is the text dense with words, tables, statistics, logical notation and/or visual aids? Does the look of the text invite you to read it? Typically, readers have similar reactions to the way a text looks. On one hand, if a page has a number of pictures and visual aids the information presented may not be taken as seriously. On the other hand, a page with many words, tables, or mathematical formulas gives the information authority. The use of color, high quality paper and type, suggests the financial commitment to the presentation. By comparing the look of past and present issues of a journal or the books in a series, you can get an indication of how the information is valued and why it is pursued.

Presence of the authors. Consider how you respond to the presence of the authors in the text. Do you get an impression of who the authors are and what they want to accomplish? Does the use of first-person and active voice make the information presented personal and therefore less legitimate? Does third person and passive voice suggest that the findings have been confirmed by other researchers? The authority we place in a text, as readers, results from the mental picture we get of the authors. Ordinarily in scientific and technical communication, we get no feeling for the authors on first reading; rather the research is presented as the product of faceless institutions or disciplines. Your reaction to the authors of a text creates a personal context which can sustain your interest in dense and complex material.

Characteristics of Technical Literature

Next time you travel to the library go to the periodicals section. Of course, depending on the library the number of periodicals being received will vary, but survey the major journals in your field. Here, you will get some idea of the writing standards of your field and profession. In comparing the range of practices of journals published in the natural sciences, social sciences and humanities you will encounter the following rough trends:

Articles in the natural science disciplines (physics, chemistry and biology) are more likely to have multiple authors than articles in the social sciences and the humanities;

Articles in the natural sciences are more likely to be significantly shorter in length than articles in the social sciences and the humanities;

Articles in the natural and social sciences are more likely to follow the same format (note the use of subheadings) than articles in the humanities;

Articles in the humanities are more likely to have larger bibliographies, more footnotes and refer to a greater number of different scholars, than articles in the natural and social sciences;

Articles in the natural and social sciences are more likely to rely on visual aids than articles in the humanities;

Articles for each discipline have a good deal of jargon and specialist language, the audience for professional journals is usually small, similarly educated specialists and professionals.

Scanning the Literature

As a potential practitioner, you will need to determine which sources of information best suit your needs. These needs will be quite different from your needs as a lay reader. As a lay reader, you may, for example, find secondary sources more helpful in acquainting you with the current debates in a particular field. Here are some factors practitioners and laypersons can consider in choosing primary and secondary sources. Keep in mind that these factors should be considered together as a guideline, not as the sole basis for your choices. As you become familiar with the literature in a particular field, you will be able to more readily define the scope of your reading.

The press and/or journal: Within specific disciplines, commercial and university presses, which publish books and journals, and journals, which publish articles, garner reputations based on who sits on the editorial board, commercial success, circulation and the percentage of manuscripts they accept and reject. With notable exceptions, high prestige journals in a field have higher rejection and circulation rates than lesser known journals. Most journals and presses adhere to blind review system in which a manuscript, with the author's name removed, is sent to a number of referees (usually between 3 and 5). Each referee writes a report calling for the papers' acceptance, rejection or conditional acceptance depending on the author's willingness to revise the paper.

The well-regarded journal *Science* rejects about 80 percent of the manuscripts submitted; the *New England Journal of Medicine* has a rejection rate of about 85 percent. In many cases, the author will resubmit a rejected manuscript to another journal. Given the proliferation of journals, tenacious authors can eventually find a home for their work. To determine how a paper has been received, examine the time lag between the original presentation of the manuscript and the actual date of publication. You can determine this by looking to see when the paper was first presented at a conference (usually indicated in an acknowledgments footnote), or the dates of the original experiment. Knowing the specialties and rejection rates of journals and presses are a first step in the evaluation of information sources.

The Title: The title of a source will have key words that will allow you to determine its relevance to your needs.

The Author(s): Practitioners recognizing an author's name can select a source based on his/her reputation. The layperson unfamiliar with the author's reputation can consult citation indices to a degree, help establish the regard the work has in the field, or related fields.

Affiliation of the authors: Just as the reputations of researchers can help you decide what sources to read, so can the reputation of the institution with which the researchers are affiliated. Usually researchers are affiliated with either a university, a private laboratory, a national laboratory, or a think tank. Knowing the reputation or political leaning of a particular institution (especially in the case of think tanks) will enable you locate the strengths and potential biases of the research.

Support: The National Science Foundation (NSF) is the dominant source of funds for scientific and technological research and development. In 1987, according to one estimate, the NSF funded slightly less than half of the research projects in physics; the major source for the other half of physics funding came from the Department of Energy. Over 80 percent of funding for research in civil engineering and anthropology came from NSF. The extent of federal funding in certain research areas has triggered debate over how research priorities are set, and how "politicized" the content of science has become. Still there are other source of funding for research such as private donors, pharmaceutical companies and private foundations (e.g., The Heritage Foundation). Many of these contributors to research and development express clear interests and political agendas. As with knowledge of the affiliation of the authors, knowledge about the source of funds can give lay readers and practitioners a sense of the purpose, importance and direction of the research.

A Second Reading

Scientific and technical writing does not inspire readers, especially from outside a given subject area, to perform a second, more thoughtful reading. As Latour suggests, one reason for this is the armor plating of the text, references and devices designed to take readers straight from the text to the laboratory. Lay readers cannot get around these devices. But reading is a truly interdisciplinary activity,we learn, at least implicitly how to read a variety of material in a number of different ways. On a second reading, you can bring to light aspects of a technical text by techniques you have learned in other disciplines. In this section we will draw a comparison among reading literary and scientific texts. Both types of kinds of texts depend on shared and specialized uses of vocabulary and metaphor. In comparing and contrasting how vocabulary and metaphor work in science and other disciplines, we can take the first steps, as potential practitioners and lay readers, to understanding one of the unique rhetorical features of scientific and technical texts, witnessing.

Using and Translating Technical Vocabulary

You are coming into possession of a highly technical vocabulary. The disciplines and fields you study distinguish themselves by the use of technical terms. While it is impossible to draw a sharp distinction between a technical vocabulary and general vocabulary, you can get an idea of a technical vocabulary by the frequency in which the words appear in ordinary conversation. Words such as 'catalysis', 'heuristic' and 'homeostasis' would be unknown (while possibly recognized) to the ordinary person. Accordingly, technical terms originating in one field, or used differently in various fields, 'magneto-hydrodynamics', 'fermions', 'induction', pose a problem for practitioners who must communicate across professional boundaries. Here lies the problem of the absence of a shared vocabulary among experts and laypersons.

For the author of a text, one task is to determine the educational level of the readers and the best way to present information to them. For the reader of the text, one task is to derive the author's meaning. However, many scientific and technical communicators face the task of writing for multiple audiences, with multiple educational backgrounds. The simple solution to this problem has been to choose a "lowest common denominator", determine that groups' technical knowledge and write or speak to them. Often this solution offers more problems than it solves by being inefficient, and possibly offensive to the reader. By examining the causes and possible solutions to the use of exaggerated technical vocabulary, you can devise strategies for presenting and reading scientific and technical documents for different audiences.

Causes of Confusion

Assumptions. While authors must make assumptions about the knowledge of the reader, they usually draw a series of inconsistent conclusions as a result. If the writer assumes the reader knows the meaning of 'friction' then they may conclude the reader must know about convection, radiation, and the laws of thermodynamics. Assumptions on the part of the writer can develop into an almost endless chain of other assumptions and conclusions. Relatedly, the author may take the time to explicate an easier term while neglecting a more difficult one. The lack of consistency in the author's level of assumption can frustrate the reader and needs to be avoided by the writer.

Habits. Authors and speakers fall into customary patterns of vocabulary use. These patterns are reinforced within disciplines and professions. As a practitioner in a field, you need to be aware that the habits you develop do not exclude diverse audiences.

Lack of recognition. Practitioners in a field may fail to realize the language they are using is indeed technical to a given audience. In attempting to define or simplify a term, the author or speaker can lend a definition as difficult or esoteric as the term itself. The definition reflects assumptions the author or speaker about the audience's knowledge, and can neglect how common terms have specialized uses. For example, charm can be defined as the fourth flavor of quark. Even with the proper context, subatomic particle physics, this definition gives no insight to the lay reader because it involves other technical terms, quark, as well as idiosyncratic uses of daily language, flavor.

Specialized use. As illustrated in the example above, another source of confusion between scientific and technical communicators and audiences and can be the use of words common to everyday speech in a specialized sense. Subatomic physicists in describing particles of matter not only refer to their 'charm', but 'color' and 'spin' as well. We are familiar with all of these words, but their meaning is quite different in reference to subatomic particles. The specialized use of terms and concepts also changes over time. Scientific concepts such as 'force', 'matter' and 'time' have historical origins and different applications in given theoretical frameworks. As theories have changed, so have the meanings of these concepts.

Possible Solutions

Attention to use. Paying attention to how you use technical vocabulary is, of course, necessary for both the writer and reader keeping in mind the points of confusion mentioned earlier. By considering scientific and technical communication in context, the social and historical contexts in which the use of a word or term evolves (like mass or weight for example), you can begin to see beyond your disciplinary training in considering the perspectives of diverse audiences. Reading critically, you can begin trace the source of confusion, assumptions, habits, lack of recognition, ambiguous use, between what the author tries to convey and what you are able to understand. In instances where the author uses everyday vocabulary in a clear, commonly accepted manner, the lay reader can establish grounds on which to understand technical vocabulary.

Word lists. Some researchers suggest that the ultimate solution for bridging the communications needs of experts and lay persons would be to develop a list of words to which the author must confine her exposition. Once determined, this standard vocabulary could then be taught in schools. Specifically, such a list would be developed for writers, news reporters and science popularizers, who must convey highly technical information to lay audiences. Insofar as popular accounts of science and technology depends on a technical vocabulary lay readers can understand (Tom Clancy's novels are an example) a word list does exist. Accordingly, proponents of scientific literacy argue that students be taught an essential vocabulary of words and terms so that they are prepared to make informed public and personal decisions about science and technology.

Word Origins. Most scientific and technical terms (medical terms are a good example) are formed by Greek and Latin roots, prefixes and suffixes. Knowledge of these root elements enables lay readers to make sense of certain technical terms.

Information Sources

In the sciences and technology, journal articles are the staple of published work. Journal articles are generally written for practitioners, not wide audiences. Recent changes in editorial practices of some academic journals, however, are based on a desire to reach out to the lay public. Still one of the better sources for understanding the communicative practices of your profession, and other professions with which you will interact, can be found in academic journals. Nevertheless, there are a variety of information sources about which you will need to make judgments. Determining whether a source of information is good or bad, or appropriate or inappropriate depends on individual judgment, the methods and research being pursued and the standards of the community in which you participate.

Roughly, information sources can be distinguished as primary or secondary. Primary sources are original works, journal articles, conference papers, monographs (textbooks, published symposia). Secondary sources, reviews, indexes, abstracts, data collections, dictionaries, manuals, literature reviews (in dissertations), are derivative of original works. An example of a primary source would be Charles Darwin's The Origin of Species. Secondary sources would be those works commenting on Darwin's research, or research using Darwin's findings as an empirical basis. The cumulative nature of science and technology, however, denies such a hard and fast distinction, almost all scientific and technical literature is secondary in that it derives from previous work.

Discussion

1. Consider the different contexts in which you read, for pleasure, for class assignments, for work. How do you approach reading in each of those contexts? How does having a choice of what you read influence how you read? What strategies do you employ in choosing what you read? How do you approach assigned readings in class? In what specific manner do you read? Do you skip sections of the text? What triggers your attention? Particular words? Images? Equations? How much time do spend reading each week?

2. What does Bruno Latour means by "the demise of the text"? How are facts established in scientific texts? Why should facts be challenged? How is it possible for a lay person to challenge a claim of scientific knowledge? What role does the laboratory place in the writing and reading of scientific and technical texts?

3. What role do you think the reader's purpose plays in defining a reading strategy? How do your own social roles, as a student, parent, resident, voter, fan, employee, influence what and how you read?

4. In surveying how physicists read in their discipline Charles Bazerman challenges: "Sometimes the articles are so poorly written that the reader cannot follow the argument or its meaning." Generally, what do you think bad writing indicates? When reading bad or confusing writing do you stop to re-read the material or give up? What strategies does a writer use to write well and accessibly about complex or dense subjects?

5. The piecemeal reading of texts makes information seem personal. Frequently, the basis of scientific knowledge, from reading journal articles, is not a question of comparing experimental results against the framework of nature, but against personal frameworks. Often researchers admit that if they know the writer personally, and their reputation is bad, they won't read a journal article. How do these attitudes response square with your image of how science is conducted? If reading practices are often personal, in what respects does that make scientific knowledge more personal than objective? Why should a person's reputation make a difference in choosing to read scientific literature?

6. How does reading on the job differ from other types or reading? When you are asked to read something, as a requirement doping your job or performing a task, what do you assume about the writing itself?

Exercises

1. During the semester keep a reading journal. Document the kind of material that you read and how you read it. In the journal consider (among other things) your personal habits, when you read, in what location, if you mark the text, if you read a text from beginning to end, if you read selections, your preferences, the way you select material, and how you read material selected for you.

2. Go to the library and pick a leading professional journal (the journal needs to have existed for 20 or more years) representing a discipline with which you are not familiar. Once you have selected the journal the journal, find a copy of it (bound in the stacks) from 15 to 20 years ago. In a short report to your instructor, compare the two journals according to the criteria in this chapter. Consider, for example:

Does the journal look the same, cover design, length, font type, print size, how the table of contents is presented, ratio of words to figures, use of graphics? What are the differences and similarities?

Are there any common members of the editorial board from the two eras? Is the journal still published by the same company, or located at the same university?

If you can find a statement of the purpose of the journal (perhaps on the back cover of the journal) draw a comparison the stated purpose of the journal and the editorial policies from the two eras. Are there any differences?

Are there differences in the journal articles themselves, consider relative length of the articles, the number of footnotes, the number of sources cited.

In comparing these characteristics, draw some general conclusions about the health of the discipline. Does the discipline appear to be growing and changing, staying the same, or declining? What are some of the characteristics you found in comparing the journals which leads you to you conclusions?

3. Before the modern scientific era, metaphor was used frequently, but with some hesitation, by early modern naturalists, scientists and inventors such as Francis Bacon, Galileo Galilei, Isaac Newton, Benjamin Franklin, Michael Faraday, Jean Lamark, William Paley, and Charles Darwin. And today metaphor is a device often used by popular science writers such as Stephen J. Gould and Carl Sagan. Select a piece of historical technical writing and identify the metaphors used. Nature, for example, is often considered metaphorically. In a brief paper provide an analysis of the rhetorical purpose of the use of metaphor. In your analysis consider whether or not you think the use of metaphors led to a particular approach to doing science. From where do these metaphors originate? Do you think this approach is wrong in the modern era?

ТЕМА 5. ЖАНРИ ІНОМОВНОГО ТЕКСТУ

THE GENRES OF SCIENTIFIC PROSE STYLE

The purpose of science as a branch of human activity is to disclose by research the inner substance of things and phenomena of objective reality and find out the laws regulating them, thus enabling man to predict, control and direct their future development in order to improve the material and social life of mankind. The style of scientific prose is therefore mainly characterized by an arrangement of language means which will bring proofs to clinch a theory. The main function of scientific prose is proof. The selection of language means must therefore meet this principle requirement

The genre of scientific works is mostly characteristic of the written form of language (scientific articles, monographs or textbooks), but it may also be found in its oral form (in scientific reports, lectures, discussions at conferences, etc.); in the latter case this style has some features of colloquial speech. The language of science is governed by the aim of the functional style of scientific prose, which is to prove a hypothesis, to create new concepts, to disclose the internal laws of existence, development, relations between different phenomena, etc. The language means used, therefore, tend to be objective, precise, unemotional, and devoid of any individuality; there is a striving for the most generalized form of expression.

The first and most noticeable feature of this style is the logical sequence of utterances with clear indication of their interrelations and interdependence, that is why in no other functional style there is such a developed and varied system of connectives as in scientific prose. The most frequently words used in scientific prose are functional words & dash; conjunctions and prepositions. The first 100 most frequent words of this style comprises the following units:
a) prepositions: of, to, in, for, with, on, at, by, from, out, about, down;
b) prepositional phrases: in terms of; in view of, in spite of, in common with, on behalf of, as a result of; by means of, on the ground of, in case of;
c) conjunctional phrases: in order that, in case that, in spite of the fact that, on the ground that, for fear that;
d) pronouns: one, it, we, they;
e) notional words: people, time, two, like, man, made, years

As scientific prose is restricted to formal situations and, consequently, to formal style, it employs a special vocabulary which consists of two main groups: words associated with professional communication and a less exclusive group of so-called learned words. The term “learned”includes several heterogeneous subdivisions of words. Here one can find numerous words that are used in scientific prose and can be identified by their dry, matter-of-fact flavour, for example, comprise, compile, experimental, heterogeneous, homogeneous, conclusive, divergent, etc. Another group of learned word comprises literary or refined words. They are mostly polysyllabic words drawn from the Romance languages and, though fully adapted to the English phonetic system, some of them continue to sound singularly foreign. Their very sound seems to create complex associations: deleterious, emollient, incommodious, meditation, illusionary.

A particularly important aspect of scientific and technological language is the subject-neutral vocabulary which cuts across different specialized domains. In particular, a great deal of scientific work involves giving instructions to act in a certain way, or reporting on the consequences of having so acted.

The general vocabulary employed in scientific prose bears its direct referential meaning, that is, words used in scientific prose will always tend to be used in their primary logical meaning. Hardly a single word will be found here which is used in more than one meaning. Nor will there be any words with contextual meaning. Even the possibility of ambiguity is avoided.

Likewise neutral and common literary words used in scientific prose will be explained, even if their meaning is slightly modified, either in the context or in a foot-note by a parenthesis, or an attributive phrase.

The second and no less important feature and, probably, the most conspicuous, is the use of terms specific to each given branch of science. Due to the rapid dissemination of scientific and technical ideas, particularly in the exact sciences, some scientific and technical terms begin to circulate outside the narrow field they belong to and eventually begin to develop new meanings. But the overwhelming majority of terms do not undergo this process of de-terminization and remain the property of scientific prose. There they are born, develop new terminological meanings and there they die. No other field of human activity is so prolific in coining new words as science is. The necessity to penetrate deeper into the essence of things and phenomena gives rise to new concepts, which require new words to name them. A term will make more direct reference to something than a descriptive explanation, non-term. Furthermore, terms are coined so as to be self-explanatory to the greatest possible degree. But in spite of this, a new term in scientific prose is generally followed or preceded by an explanation.

In modern scientific prose one can observe an exchange of terms between various branches of science. It is due to the interpenetration of scientific ideas. Self-sufficiency in any branch is now a thing of the past. Collaboration of specialists in related sciences has proved successful in many fields. The exchange of terminology may therefore be regarded as a natural outcome of this collaboration. Mathematics has priority in this respect. Mathematical terms have left their own domain and travel freely in other sciences, including linguistics.

The third characteristic feature of scientific style is special sentence-patterns. They are of three types: postulatory, argumentative and formulative. A hypothesis, a scientific conjecture or a forecast must be based on facts already known, on facts systematized and defined. Therefore every piece of scientific prose will begin with postulatory statements which are taken as self-evident and needing no proof. A reference to these facts is only preliminary to the exposition of the writer’s ideas and is therefore summed up in precisely formulated statements accompanied, if considered necessary, by references to sources.

If all the wavelengths are mixed, a white light will be produced. (postulatory)

This one-celled organism ate, grew, responded to its surroundings, reproduced itself, and spread throughout the oceans. All life has probably evolved from that single original cell. (argumentative)

Chemical energy is potential energy that is stored in gasoline, food or oil; mechanical energy is energy related to the movements of objects. (formulative)

Scientific material, although challenging in content, seems easy to read due to its grammatical and discourse structure. There is a number of central features of textual structure to present arguments transparently and coherently, distributing its information content in ways which make it seem accessible and digestible. Here are some of them:

Discourse Structure

There is a balance between abstract and concrete points. General discussion alternates with accounts of experiments.

The problems are explained as they arose over time. The reader is told how the thinking developed.

Most paragraphs begin with a general thematic point, and later sentences elaborate. The theme of the next paragraph then drives from the previous one.

A new element at the end of one sentence is often picked up as a given element at the beginning of the next.

The relations between the sentences and clauses are often made explicit through the use of connectives.

The sentences usually have a cross-reference back to a preceding sentence or clause. This makes it clear that a given topic is still being discussed, and reduces the scope for vagueness.

Sentence Structure

Sentences range from 7 to 52 words. This is typical of academic writing.

Clauses have short subjects, with most of the information stated after the verb. Such sentences are much easier to understand than alternative.

Points of contrast are rhetorically balanced.

The passive constructions are a helpful way of ensuring a smooth flow of ideas, and are important in allowing objects to receive prominence within clause structure.

The syntax of scientific speech is characterized by the use of complete (non-elliptical) sentences, the use of extended complex and compound sentences without omission of conjunctions, as they enable the author to express the relations between the parts more precisely (as different from the asyndetic connection typical of colloquial speech), the use of bookish syntactic constructions with non-finite forms of the verb, the use of extended attributive phrases, often with a number of nouns as attributes to the head-noun, e.g. the germ plasma theory; the time and space relativity theory; the World Peace Conference; a high level consensus; the greenhouse effect; carbon dioxide emission; fossil fuel burning; deforestation problems.

The fourth observable feature of the style of modern scientific prose, and one that strikes the eye of the reader, is the use of quotations and references. These sometimes occupy as much as half a page. The references have a definite compositional pattern, namely, the name of the writer referred to, the title of the work quoted, the publishing house, the place and the year it was published, and the page of the excerpt quoted or referred to. One of the internationally recognized styles of bibliographic records is known as the Harvard System. It lists references in alphabetical order of authors’ names. Where there is more than one work by the same author, these are listed chronologically. If there is more than one work in the same year, a letter is added: 2004a, 2004b. The Harvard System has a number of different formats, depending on the type of references, for example, consider reference to a book, here the sequence is: Author’s name, initials; year of publication; title in italics; edition (if not the first); place of publication; publisher: Cruse A.(2000). Meaning in Language: An Introduction to Semantics and Pragmatics. Oxford & New York: Oxford University Press

The fifth feature of scientific style, which makes it distinguishable from other styles, is the frequent use of foot-notes, not of the reference kind, but digressive in character. This is in full accord with the main requirement of the style, which is logical coherence of ideas expressed. Anything that seems to violate this requirement or seems not to be immediately relevant to the matter in hand but at the same time serves indirectly to back up the idea will be placed in a foot-note.

From the above one may conclude that a language is a code understood only by its users (speakers). Translation is a process of decoding a message in one code and encoding it in another which is understood by another group of users using a different code.

The impersonality of scientific writings can also be considered a typical feature of this style. The author of scientific works tends to sound impersonal, hence the use of the pronoun WE (instead of I), of impersonal constructions. This quality is mainly revealed in the frequent use of passive constructions. Scientific experiments are generally described in the Passive voice, for example, Then acid was taken instead of (we) then took acid.

In connection with the general impersonal tone of expression, it should be noted that impersonal passive construction are frequently used with the verbs suppose, assume, presume, conclude, infer, point out, etc., as in “It should be pointed out”, “It must not be assumed”, “It must be emphasized”, “It can be inferred”, etc.

The characteristic feature of scientific prose style is the use of typically **bookish syntactic structures** for example, the compound type of predicate: *These gases are easy to control but they are persistent once emitted (= It is easy to control these gases, but it is hard to stop them when they come out)*; Deforestation is probably even harder to change (= It is even harder to change the situation when forests begin to disappear). Another feature is **the use of abstract nouns, gerundial, participial or infinitive constructions** instead of the much simpler clauses with conjunctions: *Apart from this, controlling emission of greenhouse gases would require huge increase in energy efficiency (= Besides, if we want to control the gases which come out when the air becomes warmer, we shall have to* *produce much more energy); Agreement to implement such huge projects would require overcoming differences between the countries (=If we want to agree to carry out such big projects, we shall have to change the situation when every country is different from another); The measures suggested are worth considering / require careful consideration (= It is necessary to think about what we have suggested).*

There is a noticeable difference in the syntactical design of utterances in the exact sciences (mathematics, chemistry, physics, etc.) and in the humanities. The passive constructions frequently used in the scientific prose of the exact sciences are not indispensable in the humanities. This perhaps is due to the fact that the data and methods of investigations applied in the humanities are less objective. The necessity to quote the passages under observations and to amplify arguments seriously affects syntactical patterns. In the humanities some seemingly well-known statement may be and often is subjected to revaluation, whereas in the exact sciences much can be accepted without question and therefore needs no comment.

Here are two samples of scientific prose, one from the medical field and the other from an article in neurolinguistics as its subject-matter is to do with language at a point where the issues are anatomical and technological.

(a) *Of the twenty-two different drugs in opium that we know of, including codeine and papaverine, the active ingredient or dominant one is morphine. But morphine and opium affect the same person quite differently. The synergy among morphine and the other drugs changes its effects. Foxglove contains digitalis, one the most important heart medications. But because foxglove also contains verodoxin, a supposedly inert substance, a lower dosage of the intact plant form achieves the same results as a higher dose of the extract.*

(b) *We measured the regional CBF* (cerebral blood flow) *during each of the experimental conditions, on the same day, with a 60–75 min interval between measurements. The CBF was assessed using a single photon tomograph (TOMOMATIC 64, Medimatic, Copenhagen) and intravenous injection of Xenon 133 (2200 Mbeq). Data were collected from three transverse slices, each of 2cm thickness, parallel and centred at 1.5 and 9cm above the orbito-metal plane respectively. The in-plane resolution was about 1.7cm FWHM. During the 4 min data collection, PCO2 was continuously monitored using a cutaneous electrode and a Kontron 634PCO2 monitor.* (From Celcis P., et al. (1991), p.256.)

The remarkable difference between the two samples lies in the fact that the second one requires a far greater amount of preliminary knowledge than the first one. The samples differ in the amount of objectivity, the first being less objective in stating data. Further, in the first excerpt, views and opinions are expressed, in the second none are given. In both samples the syntax is governed by logical reasoning, and there are no emotional elements whatsoever.

However emotiveness is not entirely or categorically excluded from scientific prose. There may be hypotheses, statements and conclusions which, being backed up by strong belief, therefore call for the use of some emotionally-coloured words. Our emotional reaction to facts and ideas may bear valuable information, as it itself springs from the inner qualities of these facts and ideas. We depend to no small degree upon our emotional reactions for knowledge of the outer world. In modern scientific prose emotional words are very seldom used. At least they are not constituents of the modern scientific style. Nor can we find emotional structures or stylistic devices which aim at rousing aesthetic feelings. But scientific prose style uses special emphatic constructions to lay logical stress on some part of the sentence: *It is not solely from water that oxygen is to be obtained (= we can get oxygen not only from water). It is on these terms that the company would be prepared to conclude an agreement (= The company will conclude an agreement only on these conditions).*

Comprehension Questions:
1.What is the aim of scientific prose functional style?
2. How would you explain the fact that there is a developed system of connectives in scientific prose?
3.Characterize the vocabulary of scientific style.
4.Why is science prolific in coining new words?
5.Give a definition if term. What are the peculiarities of the semantics of terms?
6.What types of special sentence-patterns are used in scientific prose?
7.Describe syntactic patterns used in science.
8.What is a compositional pattern of references in accord with the Harvard System?
9.What is a foot-note?
10. What language means are used in scientific prose to keep the impersonal tone of expression?

Exercises
Exercise 1. Read a piece of scientific writing. Comment on the grammar patterns used.
Structure of Matter
The atom of any elementary substance consists of a positively-charged nucleus and electrons, negatively-charged particles surrounding the nucleus. The charge of an electron e is equal to 4.8029 x 10-10 electro-static units. The mass of an electron is about 1,840 times smaller than atomic mass unit and is equal to 9.108 x 10-28 g. The absolute value of the electron charge is called the elementary (smallest) charge. The atomic nucleus is about 10,000 – 100,000 times smaller than the atom (the linear dimension of an atom is about 10-8 cm and that of the nucleus – 10-13 to 10-12 cm). Nearly all the mass of an atom is concentrated in its nucleus which is positively charged. The charge of a nucleus is determined by the number of protons it contains. This number is called the atomic number of the element and is denoted by Z. Z coincides with the number of the place the element occupies in the Periodic Table. When in the normal state, the atom is neutral; this means that the number of its positively charged particles is equal to the number of electrons. For example, the nuclear charge of lithium (Z = 3) is equal to three

positive charge units, hence the atom contains three electrons. Iron occupies the 26th place in the Periodic Table and has 26 electrons and a positive charge of 26 elementary charges. Attractive forces act between the positively charged nucleus and negatively charged electrons. The electrons are able to keep their orbit, if they do not receive additional energy.

Exercise 2. The italicized words and word-groups in the following extracts belong to scientific style. Describe the stylistic peculiarities of each extract in general and state to what professional activity the italicized units belong.

a) I want you to keep an eye on that *air-speed indicator*. Remember that an airplane stays in the air because of its *forward speed*. If you let the speed drop too low, it stalls – and falls out of the air. Any time the *ASI shows a reading* near 120, you tell George instantly. Is that clear? Yes, Captain. I understand. Back to you, George... I want you to unlock the *autopilot*s clearly marked on the *control column* and take the airplane yourself...George, you watch the *artificial horizon*. *Climb and descent indicator* should stay at zero.” (From *Runway Zero-Eight* by A. Hailey, J. Castle)

b) Mr. Claud Gurney production of *The Taming of the Shrew* shows a violent *ingenuity*. He has learnt much from Mr. Cochran; there is also a touch of Hammersmith in his *ebullient* days. *The speed, the light, the noise, the deployment* of expensively coloured figures amuse the senses and sometimes *divert* the mind from the unfunny brutality of the play, which *evokes* not one natural smile. (From a theatrical review)

c) It was none other than Grimes, the Utility *outfielder*, Connie had been forced to use in the last game because of the injury to Joyce Grimes whose miraculous *catch* in the *eleventh inning* had robbed Parker of *a home run*, and whose own *homer* a fluky one had given the Athletics another World’s Championship. (From *Short Stories* by R. Lardner)

ТЕМА 6. КОМПОЗИЦІЯ РІЗНИХ ВИДІВ НАУКОВОГО ТЕКСТУ ТА СТРУКТУРА АБЗАЦУ
COMPOSITION OF SCIENTIFIC TEXTS. PRAGRAPH STRUCTURE

The oldest tradition in writing is, of course, literature. Literature has ancient roots. But literature is distinct from the use of language within the field of science. In the humanities, history is close to literature. In ancient times history actually was literature: writing about past events was not done with the purpose of trying to understand what had actually happened; rather, the purpose of historical texts was normally moral. History was not established as an academic discipline until the late 19thcentury.

Journalism is a practice which is independent of the sciences, and which is influenced by both literature and historical writing. A journalist records what has actually happened and presents a text that may be more or less literary. Investigative journalism and action research within the social sciences are related to each other in so far as they have influenced one another.

Writing in the natural sciences

When the natural sciences were established during the scientific revolution, writing became realist and descriptive. The **IMRaD** format has developed within the past 100 years and is the best choice for papers reporting laboratory studies.

The first scientific journal appeared in 1895. Currently some scientific journals are published throughout the world. On principle, scientific journals in scientific fields accept only scientific papers. A scientific paper is based on original research that has not been published before. Another kind of paper is the review paper. A review paper summarizes, analyses, evaluates or synthesizes information that has already been published.

In the **IMRaD** format the text is structured in the following way:

Introduction: What question was studied and why?

Methods: How was the problem studied?

Results: What were the findings?

and

Discussion: What do these findings mean?

Developing a Title

Titles should

- Describe contents clearly and precisely, so that readers can decide whether to read the report
- Provide key words for indexing

Titles should NOT

- Include wasted words such as "studies on," "an investigation of"
- Use abbreviations and jargon

- Use "cute" language

The Relationship of Luteinizing Hormone to Obesity in the Zucker Rat

Poor Titles

An Investigation of Hormone Secretion and Weight in Rats

Fat Rats: Are Their Hormones Different?

The Abstract

The guidelines below address issues to consider when writing an abstract

What is the report about, in miniature and without specific details?

- State main objectives. (What did you investigate? Why?)
- Describe methods. (What did you do?)
- Summarize the most important results. (What did you find out?)
- State major conclusions and significance. (What do your results mean? So what?)

What to avoid:

1. Do not include references to figures, tables, or sources.
2. Do not include information not in report.

Additional tips:

1. Find out maximum length (may vary from 50 to 300+ words).
2. Process: Extract key points from each section. Condense in successive revisions.

The Introduction

Guidelines for effective scientific report introductions.

What is the problem?

- Describe the problem investigated.
- Summarize relevant research to provide context, key terms, and concepts so your reader can understand the experiment.

Why is it important?

- Review relevant research to provide rationale. (What conflict or unanswered question, untested population, untried method in existing research does your experiment address? What findings of others are you challenging or extending?)

What solution (or step toward a solution) do you propose?

- Briefly describe your *experiment*: *hypothesis*(es), *research question*(s); general experimental *design* or *method*; *justification of method* if alternatives exist.

Additional tips:

1. Move from general to specific: problem in real world/research literature --> your experiment.
2. Engage your reader: answer the questions, "What did you do?" "Why should I care?"
3. Make clear the links between problem and solution, question asked and research design, prior research and your experiment.
4. Be selective, not exhaustive, in choosing studies to cite and amount of detail to include. (In general, the more relevant an article is to your study, the more space it deserves and the later in the Introduction it appears.)
5. Ask your instructor whether to summarize results and/or conclusions in the Introduction.

Methods Section

Below are some questions to consider for effective methods sections in scientific reports.

How did you study the problem?

- Briefly explain the general type of scientific procedure you used.

What did you use?

(May be subheaded as *Materials*)

- Describe what materials, subjects, and equipment (chemicals, experimental animals, apparatus, etc.) you used. (These may be subheaded Animals, Reagents, etc.)

How did you proceed?

(May be subheaded as **Methods** or **Procedures**)

- Explain the steps you took in your experiment. (These may be subheaded by experiment, types of assay, etc.)

Additional tips:

1. Provide enough detail for replication. For a journal article, include, for example, genus, species, strain of organisms; their source, living conditions, and care; and sources (manufacturer, location) of chemicals and apparatus.
2. Order procedures chronologically or by type of procedure (subheaded) and chronologically within type.
3. Use past tense to describe *what you did*.
4. Quantify when possible: concentrations, measurements, amounts (all metric); times (24-hour clock); temperatures (centigrade)

What to avoid:

1. Don't include details of common statistical procedures.
2. Don't mix results with procedures.

Results Section

The section below offers some questions asked for effective results sections in scientific reports.

What did you observe?

For **each** experiment or procedure:

- Briefly describe experiment without detail of Methods section (a sentence or two).
- Report main result(s), supported by selected data:
  - **Representative:** most common
  - **Best Case:** best example of ideal or exception

Additional tips:

1. Order multiple results logically:
   - from most to least important
   - from simple to complex
   - organ by organ; chemical class by chemical class
2. Use past tense to describe *what happened.*

What to avoid:

1. Don't simply repeat table data; **select.**
2. Don't interpret results.
3. Avoid extra words: "It is shown in Table 1 that X induced Y" **-->** "X induced Y (Table 1)."

Discussion Section

The table below offers some questions effective discussion sections in scientific reports address.

What do your observations mean?

- Summarize the most important findings at the beginning.

What conclusions can you draw?

For each major result:

- Describe the patterns, principles, relationships your results show.
- Explain how your results relate to expectations and to literature cited in your Introduction. Do they agree, contradict, or are they exceptions to the rule?
- Explain plausibly any agreements, contradictions, or exceptions.
- Describe what additional research might resolve contradictions or explain exceptions.

How do your results fit into a broader context?

- Suggest the theoretical implications of your results.
- Suggest practical applications of your results?
- Extend your findings to other situations or other species.
- Give the big picture: do your findings help us understand a broader topic?

Additional tips:

1. Move from specific to general: your finding(s) **-->** literature, theory, practice.
2. Don't ignore or bury the major issue. Did the study achieve the goal (resolve the problem, answer the question, support the hypothesis) presented in the Introduction?
3. Make explanations complete.
   - Give evidence for each conclusion.
   - Discuss possible reasons for expected and unexpected findings.

What to avoid:

1. Don't overgeneralize.
2. Don't ignore deviations in your data.
3. Avoid speculation that cannot be tested in the foreseeable future.

PARAGRAPH FUNCTIONS

In the previous sections we considered some basic properties of paragraphs, particularly the introductory paragraph(s), the concluding paragraphs, and the structure of paragraphs in the middle of an argument. In this section, we continue to look at paragraphs, but in a more complex way. The material here will be particularly relevant to organizing and writing a longer research paper.

The Basic Functions of Paragraphs

In the previous section, we stressed that any one paragraph can make only a single point, if we wish to maintain the unity and coherence of that paragraph. Another way of saying the same thing is to state that any one paragraph can carry out only a single function. Once you have decided on what you want that paragraph to do, then it becomes easier to fit it into the developing logic of the entire argument.

To develop a fuller understanding of paragraphs as having particular functions, here is a list of all the things which paragraphs in an argument can do.

1. Introduction to an Argument: We have already discussed this in some detail earlier in this handbook (the subject-focus-thesis paragraph at the start). You should be very clear about the key function this sort of a paragraph carries out.

2. Definition: The paragraph can offer an extended definition of a key term or series of terms, of the sort we have considered earlier in this handbook.

3. Narration: A paragraph can serve the function of telling a story, a chronological series of details which will clarify for the reader facts important for the argument.

4. Physical Description: A paragraph can describe at length a particular scene or object, in order to clarify important details for the reader.

5. Illustration: A paragraph can provide a single detailed example at some length (of a person, a sample of a text, and so on).

6. Analysis: A paragraph can serve the function of breaking a complex topic up into its component parts so that the reader understands just what is involved in the larger term (e.g., the paragraph might analyze the various parts of a nuclear reactor or, to take something more bewildering, the administrative structure of a college).

7. Comparison: A paragraph can compare two different objects or characters or styles under a common heading.

8. Argument from Causes to Effects: A paragraph can make the argument that certain factors will lead to certain results (e.g., how the present abortion law affects the lives of pregnant women for the worse).

9. Argument from Effects to Causes: A paragraph can make the argument that certain effects have particular causes (e.g., Hamlet behaves the way he does because he is terrified of his father).

10. Argumentative Assertion: A paragraph can present a case for an argumentative assertion that does not fit one of the above categories (as we outlined in the previous section).

11. Conclusion to an Argument: A paragraph can serve to conclude an argument (with or without recommendations included), as we considered at the end of Section 8.

It's important you review this list carefully. It tells you the various tools you have for structuring your argument. Notice that some of these paragraphs (especially the first six and the last) do not usually have an argumentative function;

instead they define, clarify, illustrate, or in other ways supplement the argument (i.e., present information necessary to follow the argument).

Paragraphs of Illustration, Narration, and Description

We have already talked about using paragraphs of narration and physical description and definition as part of the introduction to the argument. Sometimes it is preferable to hold back on such background information until the appropriate point in the argument (i.e., when the reader first needs it). In other words, instead of giving the reader right at the start of the argument all the background facts he is going to need to understand every part of your argument, you reserve some of the information that you might put in the essay as part of the introduction and insert it where it is first needed.

COMPREHENSION QUESTIONS:

1. How can you characterize the composition of scientific texts?
2. What are the constituents of IMRaD format of the text?
3. Find the text on your specialty and analyze the composition of the text with your partner.
4. What are the main paragraph functions?

ТЕМА 7. НАУКОВО-ПИСЬМОВА КОМУНІКАЦІЯ

SCIENTIFIC WRITING COMMUNICATION

Scientific writing

History

Scientific writing in English started in the 14th century.

The Royal society established good practice for scientific writing. Founder member Thomas Sprat wrote on the importance of plain and accurate description rather than rhetorical flourishes in his *History of the Royal Society of London*. Robert Boyle emphasized the importance of not boring the reader with a dull, flat style.

Because most scientific journals accept manuscripts only in English, an entire industry has developed to help non-native English speaking authors improve their text before submission. It is just now becoming an accepted practice to utilize the benefits of these services. This is making it easier for scientists to focus on their research and still get published in top journal.

Writing style guides

Different fields have different conventions for writing style, and individual journals within a field usually have their own style guides.

Some style guides for scientific writing recommend against use of the passive voice, while some encourage it. Some journals prefer using "we" rather than "I" as personal pronoun. Note that "we" sometimes includes the reader, for example in mathematical deductions. Publication of research results is the global measure used by all disciplines to gauge a scientist's level of success.

In the mathematical sciences, it is customary to report in the present tense.

WRITING A SCIENTIFIC RESEARCH ARTICLE

FORMAT FOR THE PAPER

Scientific research articles provide a method for scientists to communicate with other scientists about the results of their research. A standard format is used for these articles, in which the author presents the research in an orderly, logical manner. This doesn't necessarily reflect the order in which you did or thought about the work. This format is:

| Title | Authors | Introduction | Materials and Methods | Results (with Tables and Figures) | Discussion | Acknowledgments | Literature Cited |

TITLE

1. Make your title specific enough to describe the contents of the paper, but not so technical that only specialists will understand. The title should be appropriate for the intended audience.
2. The title usually describes the subject matter of the article: Effect of Smoking on Academic Performance"
3. Sometimes a title that summarizes the results is more effective: Students Who Smoke Get Lower Grades"

AUTHORS

1. The person who did the work and wrote the paper is generally listed as the first author of a research paper.

2. For published articles, other people who made substantial contributions to the work are also listed as authors. Ask your mentor's permission before including his/her name as co-author.

ABSTRACT

1. An abstract, or summary, is published together with a research article, giving the reader a "preview" of what's to come. Such abstracts may also be published separately in bibliographical sources, such as Biologic al Abstracts. They allow other scientists to quickly scan the large scientific literature, and decide which articles they want to read in depth. The abstract should be a little less technical than the article itself; you don't want to dissuade your potent ial audience from reading your paper.

2. Your abstract should be one paragraph, of 100-250 words, which summarizes the purpose, methods, results and conclusions of the paper.

3. It is not easy to include all this information in just a few words. Start by writing a summary that includes whatever you think is important, and then gradually prune it down to size by removing unnecessary words, while still retaini ng the necessary concepts.

3. Don't use abbreviations or citations in the abstract. It should be able to stand alone without any footnotes.

INTRODUCTION

What question did you ask in your experiment? Why is it interesting? The introduction summarizes the relevant literature so that the reader will understand why you were interested in the question you asked. One to fo ur paragraphs should be enough. End with a sentence explaining the specific question you asked in this experiment.

MATERIALS AND METHODS

1. How did you answer this question? There should be enough information here to allow another scientist to repeat your experiment. Look at other papers that have been published in your field to get some idea of what is included in this section.

2. If you had a complicated protocol, it may helpful to include a diagram, table or flowchart to explain the methods you used.

3. Do not put results in this section. You may, however, include preliminary results that were used to design the main experiment that you are reporting on. ("In a preliminary study, I observed the owls for one week, and found that 73 % of their locomotor activity occurred during the night, and so I conducted all subsequent experiments between 11 pm and 6 am.")

4. Mention relevant ethical considerations. If you used human subjects, did they consent to participate. If you used animals, what measures did you take to minimize pain?

RESULTS
1. This is where you present the results you've gotten. Use graphs and tables if appropriate, but also summarize your main findings in the text. Do NOT discuss the results or speculate as to why something happened; t hat goes in th e Discussion.
2. You don't necessarily have to include all the data you've gotten during the semester. This isn't a diary.
3. Use appropriate methods of showing data. Don't try to manipulate the data to make it look like you did more than you actually did.
"The drug cured 1/3 of the infected mice, another 1/3 were not affected, and the third mouse got away."
TABLES AND GRAPHS
1. If you present your data in a table or graph, include a title describing what's in the table ("Enzyme activity at various temperatures", not "My results".) For graphs, you should also label the x and y axes.
2. Don't use a table or graph just to be "fancy". If you can summarize the information in one sentence, then a table or graph is not necessary.
DISCUSSION
1. Highlight the most significant results, but don't just repeat what you've written in the Results section. How do these results relate to the original question? Do the data support your hypothesis? Are your results consistent with what other investigators have reported? If your results were unexpected, try to explain why. Is there another way to interpret your results? What further research would be necessary to answer the questions raised by your results? How do y our results fit into the big picture?
2. End with a one-sentence summary of your conclusion, emphasizing why it is relevant.
ACKNOWLEDGMENTS
This section is optional. You can thank those who either helped with the experiments, or made other important contributions, such as discussing the protocol, commenting on the manuscript, or buying you pizza.
REFERENCES (LITERATURE CITED)
There are several possible ways to organize this section. Here is one commonly used way:
1. In the text, cite the literature in the appropriate places:
Scarlet (1990) thought that the gene was present only in yeast, but it has since been identified in the platypus (Indigo and Mauve, 1994) and wombat (Magenta, et al., 1995).
2. In the References section list citations in alphabetical order.
Indigo, A. C., and Mauve, B. E. 1994. Queer place for qwerty: gene isolation from the platypus. Science 275, 1213-1214.
Magenta, S. T., Sepia, X., and Turquoise, U. 1995. Wombat genetics. In: Widiculous Wombats, Violet, Q., ed. New York: Columbia University Press. p 123-145.

Scarlet, S.L. 1990. Isolation of qwerty gene from S. cerevisae. Journal of Unusual Results 36, 26-31.

EDIT YOUR PAPER!!!

"In my writing, I average about ten pages a day. Unfortunately, they're all the same page."

Michael Alley, The Craft of Scientific Writing

A major part of any writing assignment consists of re-writing.

Write accurately

1. Scientific writing must be accurate. Although writing instructors may tell you not to use the same word twice in a sentence, it's okay for scientific writing, which must be accurate. (A student who tried not to repeat the word "hamster" produced this confusing sentence: "When I put the hamster in a cage with the other animals, the little mammals began to play.")
2. Make sure you say what you mean.

   Instead of: The rats were injected with the drug. (sounds like a syringe was filled with drug and ground-up rats and both were injected together)

   Write: I injected the drug into the rat.
3. Be careful with commonly confused words:

Temperature has an *effect* on the reaction.
Temperature *affects* the reaction.
I used solutions in various concentrations. (The solutions were 5 mg/ml, 10 mg/ml, and 15 mg/ml)
I used solutions in varying concentrations. (The concentrations I used changed; sometimes they were 5 mg/ml, other times they were 15 mg/ml.)
Less food (can't count numbers of food)
Fewer animals (can count numbers of animals)
A large amount of food (can't count them)
A large number of animals (can count them)
The erythrocytes, which are in the blood, contain hemoglobin.
The erythrocytes that are in the blood contain hemoglobin. (Wrong. This sentence implies that there are erythrocytes elsewhere that don't contain hemoglobin.)

Write clearly

1. Write at a level that's appropriate for your audience.
"Like a pigeon, something to admire as long as it isn't over your head."
Anonymous
2. Use the active voice. It's clearer and more concise than the passive voice.
Instead of: An increased appetite was manifested by the rats and an increase in body weight was measured.
Write: The rats ate more and gained weight.
3. Use the first person.
Instead of: It is thought
Write: I think

Instead of: The samples were analyzed
Write: I analyzed the samples
4. Avoid dangling participles.
"After incubating at 30 degrees C, we examined the petri plates." (You must've been pretty warm in there.)

<u>Write succinctly</u>

1. Use verbs instead of abstract nouns
Instead of: take into consideration
Write: consider
2. Use strong verbs instead of "to be"
Instead of: The enzyme was found to be the active agent in catalyzing...
Write: The enzyme catalyzed...
3. Use short words.

> *"I would never use a long word where a short one would answer the purpose. I know there are professors in this country who 'ligate' arteries. Other surgeons tie them, and it stops the bleeding just as well."*
> *Oliver Wendell Holmes, Sr .*

Instead of:	**Write:**
possess	have
sufficient	enough
Utilize	use
demonstrate	show
assistance	help
terminate	end

4. Use concise terms.

Instead of:	**Write:**
prior to	before
due to the fact that	because
in a considerable number of cases	often
the vast majority of	most
during the time that	when
in close proximity to	near
it has long been known that	I'm too lazy to look up the reference

5. Use short sentences. A sentence made of more than 40 words should probably be rewritten as two sentences.
"The conjunction 'and' commonly serves to indicate that the writer's mind still functions even when no signs of the phenomenon are noticeable." Rudolf Virchow, 1928

Check your grammar, spelling and punctuation

1. Use a spellchecker, but be aware that they don't catch all mistakes.

"When we consider the animal as a hole,..." Student's paper

2. Your spellchecker may not recognize scientific terms. For the correct spelling, try Biotech's Life Science Dictionary or one of the technical dictionaries on the reference shelf in the Biology or Health Sciences libraries.

3. Don't, use, unnecessary, commas.

4. Proofread carefully to see if you any words out.

COMPREHENSION QUESTIONS:

1. What can you say about scientific writing style guides?
2. Learn the text and discuss the main features of scientific writing with your partner.
3. Analyze the main rules of scientific writing and express your opinion.

ТЕМА 8. НАУКОВЕ ДОСЛІДЖЕННЯ ДИСЕРТАНТА

Postgraduate research

Postgraduate research represents a formal area of study that is recognized by a university or institute of higher learning. By definition, the notion of “postgraduate” (United States) carries the implication that the candidate undertaking such research has already completed a formal Master's degree and at some instances the PhD, at an accredited university or tertiary institution. The resulting qualifications arising from postgraduate research leads to Post (Doctorates).

Structure

The structure of postgraduate research programs can vary significantly from one country to another. To enter into a PhD program in the United States, students generally must have some form of prerequisite study beyond their basic graduate qualification. This may be a Master’s coursework program, which acts as a qualifier for entry. In other countries, entry to Doctoral or Master’s research programs is based on the academic track record of the candidates in their undergraduate degrees.

Many students confuse the notion of postgraduate research with “invention” and “discovery”. Postgraduate research ultimately represents an apprenticeship in the field of research. In his text book, "Key Factors in Postgraduate Research - A Guide for Students". Dario Toncich explains that the objective of postgraduate research is not necessarily to make a breakthrough invention or, indeed, a major scientific discovery.

It is, rather, a mechanism by which graduate students learn how to undertake a systematic investigation, founded upon the work built by peers in the field, and then to extend the current state of knowledge. In the context of assessing a postgraduate research program, it is generally the systematic process of research and investigation that is given more attention than the level to which knowledge is extended. The title "doctor" emanates from the Latin word *docera*—to teach. Hence there is an expectation that the recipient of a doctorate would go on to become some form of "teacher" in the broad sense of the word.

History

In the 19th century, postgraduate research was a rarity, with countries such as the United States only having a small number of candidates across their university spectrum. However, by the start of the 21st century, postgraduate research, and postgraduate qualifications, had become commonplace. In any one year, at a global level, there are hundreds of thousands of candidates undertaking postgraduate research programs. For this reason the nature of postgraduate research has also changed.

At Doctoral level, there is some recognition that it is no longer reasonable to expect major research breakthroughs as part of a postgraduate research program. To this end, Doctoral research more commonly now represents an extension of knowledge, rather than some form of breakthrough. There is also some recognition that modern postgraduate research programs now have to be conducted in the light of massive amounts of previously published work, and hence the literature review process has become significantly more complex.

The nomenclature associated with titles arising from postgraduate research vary from one institution to another and one country to another. Postgraduate research programs generally result in a thesis/dissertation, which is assessed by independent experts in the field. The specific nature of the thesis varies from one discipline to another and from one country to another. In addition, some universities insist that students also undertake a *viva-voce* oral examination in which they can defend their research and processes before an expert panel.

In India, generally, the higher the level of the research degree the less association it has with a specific discipline. For example, at Bachelor's level, it would be common to receive a BSc (Chemistry). At Master's level, the corresponding degree would be an MSc (without the specific subdiscipline). At Doctoral level, the degree would be simply PhD with no discipline stated. This is intended to show that the recipient of the award has mastered techniques that are more generic than those encapsulated in a specific discipline or subdiscipline. There are some exceptions to this. In a professional Doctorate, where the objective is to demonstrate an in-depth research knowledge of a particular area, the discipline is usually included (e.g., Doctor of Business).

In some universities, it is also possible for candidates to achieve what is referred to as a "higher doctorate". This is generally an award bestowed upon people who have made a substantial contribution to their discipline through their research. Higher doctorates would normally be awarded after a significant research career and therefore those who receive such awards generally already have a basic PhD to begin with. Like professional doctorates, higher doctorates generally carry the title of the discipline to which the research contributions have been made—for example, Doctor of Engineering.

COMPREHENSION QUESTIONS:

1. How can you define the notion “postgraduate research”?
2. Is there any difference between notions “invention”, “discovery” and “research”?
3. What is the main purpose of postgraduate research?
4. Discuss the history of postgraduate research development with your partner. Use more information from Internet-resources.

ТЕМА 9. СТАН ВИВЧЕННЯ ПРОБЛЕМИ Й НАУКОВІ ДЖЕРЕЛА

Scientific method

The **scientific method** is a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge. To be termed scientific, a method of inquiry must be based on empirical and measurable evidence subject to specific principles of reasoning. The *Oxford English Dictionary* defines the scientific method as "a method or procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses."

The chief characteristic which distinguishes the scientific method from other methods of acquiring knowledge is that scientists seek to let reality speak for itself, supporting a theory when a theory's predictions are confirmed and challenging a theory when its predictions prove false. Although procedures vary from one field of inquiry to another, identifiable features distinguish scientific inquiry from other methods of obtaining knowledge. Scientific researchers propose hypotheses as explanations of phenomena and design experimental studies to test these hypotheses via predictions which can be derived from them. These steps must be repeatable to guard against mistake or confusion in any particular experimenter. Theories that encompass wider domains of inquiry may bind many independently derived hypotheses together in a coherent, supportive structure. Theories, in turn, may help form new hypotheses or place groups of hypotheses into context.

Scientific inquiry is intended to be as objective as possible in order to minimize bias. Another basic expectation is the documentation, archiving and sharing of all data collected or produced and of the methodologies used so they may be available for careful scrutiny and attempts by other scientists to reproduce and verify them. This practice, known as full disclosure, also means that statistical measures of their reliability may be made.

The scientific method is the process by which science is carried out. Because science builds on previous knowledge, it consistently improves our understanding of the world. The scientific method also improves itself in the same way, meaning that it gradually becomes more effective at generating new knowledge. For example, the concept of falsification (first proposed in 1934) reduces confirmation bias by formalizing the attempt to *disprove* hypotheses rather than prove them.

The overall process involves making conjectures (hypotheses), deriving predictions from them as logical consequences, and then carrying out experiments based on those predictions to determine whether the original conjecture was correct. There are difficulties in a formulaic statement of method, however. Though the scientific method is often presented as a fixed sequence of steps, they are better considered as general principles. Not all steps take place in every scientific inquiry (or to the same degree), and are not always in the same order. As noted by William Whewell (1794–1866), "invention, sagacity, [and] genius"are required at every step:

Formulation of a question: The question can refer to the explanation of a specific *observation*, as in "Why is the sky blue?", but can also be open-ended, as in "How can I design a drug to cure this particular disease?" This stage also involves looking up and evaluating evidence from previous experiments, personal scientific observations or assertions, and/or the work of other scientists. If the answer is already known, a different question that builds on the previous evidence can be posed. When applying the scientific method to scientific research, determining a good question can be very difficult and affects the final outcome of the investigation.

Hypothesis: An hypothesis is a conjecture, based on knowledge obtained while formulating the question, that may explain the observed behavior of a part of our universe. The hypothesis might be very specific, e.g., Einstein's equivalence principle or Francis Crick's "DNA makes RNA makes protein", or it might be broad, e.g., unknown species of life dwell in the unexplored depths of the oceans. A statistical hypothesis is a conjecture about some population. For example, the population might be people with a particular disease. The conjecture might be that a new drug will cure the disease in some of those people. Terms commonly associated with statistical hypotheses are null hypothesis and alternative hypothesis. A null hypothesis is the conjecture that the statistical hypothesis is false, e.g., that the new drug does nothing and that any cures are due to chance effects. Researchers normally want to show that the null hypothesis is false. The alternative hypothesis is the desired outcome, e.g., that the drug does better than chance. A final point: a scientific hypothesis must be falsifiable, meaning that one can identify a possible outcome of an experiment that conflicts with predictions deduced from the hypothesis; otherwise, it cannot be meaningfully tested.

Prediction: This step involves determining the logical consequences of the hypothesis. One or more predictions are then selected for further testing. The more unlikely that a prediction would be correct simply by coincidence, then the more convincing it would be if the prediction were fulfilled; evidence is also stronger if the answer to the prediction is not already known, due to the effects of hindsight bias (see also postdiction). Ideally, the prediction must also distinguish the hypothesis from likely alternatives; if two hypotheses make the same prediction, observing the prediction to be correct is not evidence for either one over the other. (These statements about the relative strength of evidence can be mathematically derived using Bayes' Theorem.)

Testing: This is an investigation of whether the real world behaves as predicted by the hypothesis. Scientists (and other people) test hypotheses by conducting experiments. The purpose of an experiment is to determine whether observations of the real world agree with or conflict with the predictions derived from an hypothesis. If they agree, confidence in the hypothesis increases; otherwise, it decreases. Agreement does not assure that the hypothesis is true; future experiments may reveal problems. Karl Popper advised scientists to try to falsify hypotheses, i.e., to search for and test those experiments that seem most doubtful. Large numbers of successful confirmations are not convincing if they arise from experiments that avoid risk. Experiments should be designed to minimize possible errors, especially through the use of appropriate scientific controls. For example, tests of medical treatments are commonly run as double-blind tests. Test personnel, who might unwittingly reveal to test subjects which samples are the desired test drugs and which are placebos, are kept ignorant of which are which. Such hints can bias the responses of the test subjects. Furthermore, failure of an experiment does not necessarily mean the hypothesis is false. Experiments always depend on several hypotheses, e.g., that the test equipment is working properly, and a failure may be a failure of one of the auxiliary hypotheses. Experiments can be conducted in a college lab, on a kitchen table, at CERN's Large Hadron Collider, at the bottom of an ocean, on Mars (using one of the working rovers), and so on. Astronomers do experiments, searching for planets around distant stars. Finally, most individual experiments address highly specific topics for reasons of practicality. As a result, evidence about broader topics is usually accumulated gradually.

Analysis: This involves determining what the results of the experiment show and deciding on the next actions to take. The predictions of the hypothesis are compared to those of the null hypothesis, to determine which is better able to explain the data. In cases where an experiment is repeated many times, a statistical analysis such as a chi-squared test may be required. If the evidence has falsified the hypothesis, a new hypothesis is required; if the experiment supports the hypothesis but the evidence is not strong enough for high confidence, other predictions from the hypothesis must be tested. Once a hypothesis is strongly supported by evidence, a new question can be asked to provide further insight on the same topic. Evidence from other scientists and experience are frequently incorporated at any stage in the process. Depending on the complexity of the experiment, many iterations may be required to gather sufficient evidence to answer a question with confidence, or to build up many answers to highly specific questions in order to answer a single broader question.

This model underlies the scientific revolution. One thousand years ago, Alhazen demonstrated the importance of forming questions and subsequently testing them, an approach which was advocated by Galileo in 1638 with the publication of *Two New Sciences*. The current method is based on a hypothetico-deductive modelformulated in the 20th century, although it has undergone significant revision since first proposed.

Resources for Finding and Accessing Scientific Papers

Introduction

Reading scientific literature is a critical part of conceiving of and executing a successful advanced science project. The How to Read a Scientific Paper guide can help you get the most out of each paper you read—first, of course, you have to actually get your hands on the paper! That's where this guide comes in. Below you'll find tips and resources for both searching for and acquiring free copies of scientific papers to read.

Academic Search Engines: Resources for Finding Science Paper Citations

When you start your background research, one of the early steps is finding and reading the scientific literature related to your science project. Mentors are a great resource for recommendations about which scientific papers are critical for you to read and you should definitely ask your mentor, or another expert in the field, for advice. But there'll also be times when your mentor is busy or isn't up-to-date on a particular experimental method, in which case, you'll need to be proactive and hunt for papers on your own. It turns out that just plugging search terms into a regular search engine, like Google, Yahoo, or MSN, isn't very effective. The pages you get back will be a wide mixture of websites, and very few will be links to peer-reviewed scientific papers. To find scientific literature, the best thing to use is an academic search engine.

There are many different academic search engines. Some focus on a single discipline, while others have citations from multiple fields. There are a handful of free, publicly available academic search engines that can be accessed online; some of these are listed in Table 1, below. The remainder, like the ISI Web of Science, are subscription-based. Universities and colleges often subscribe to academic search engines. If you can't find what you need using a free search engine, you may be able to access these resources from computers in a university or college library. Consult the school's library webpage, or call the library directly, to find out to which academic search engines they subscribe to and whether or not you'd be allowed into the library to access them.

Table 1: This table provides a list of free, online academic search engines for various science disciplines.

Academic Search Engine	URL	Disciplines	Help Files
Google Scholar	scholar.google.com	All	scholar.google.com/intl/en/scholar/help.html
Scirus	www.scirus.com	All	www.scirus.com/html/help/index.htm
Pubmed	www.ncbi.nlm.nih.gov/pubmed	Life sciences	www.nlm.nih.gov/bsd/disted/pubmedtutorial
IEEE Xplore	ieeexplore.ieee.org/Xplore/guesthome.jsp	Electronics, Electrical engineering, Computer science	ieeexplore.ieee.org/guide/g_oview_guidepdf.jsp
National	agricola.nal.usda.gov	Agricult	agricola.nal.usda.gov/help/quicks

Academic Search Engine	URL	Disciplines	Help Files
Agricultural Library (AGRICOLA)		ure	earch.html
Education Resources Information Center (ERIC)	eric.ed.gov	Education	eric.ed.gov/WebHelp/ApplicationHelp.htm

Here are a few tips to help you get started with the academic search engines:

- Each search engine works slightly differently, so it's worth taking the time to read any available help pages to figure out the best way to use each one.
- When you're beginning your literature search, try several different key words, both alone and in combination. Then, as you view the results, you can narrow your focus and figure out which key words best describe the kinds of papers in which you are interested.
- As you read the literature, go back and try additional searches using the jargon and terms you learn while reading.

Note: The results of academic search engines come in the form of an abstract, which you can read to determine if the paper is relevant to your science project, as well as a full citation (author, journal title, volume, page numbers, year, etc.) so that you can find a physical copy of the paper. Search engines do not necessarily contain the full text of the paper for you to read. A few, like PubMed, do provide links to free online versions of the paper, when one is available. Read on for help finding the full paper.

How to Get a Copy of a Scientific Paper

Once you've found the citation for a paper that is relevant to your advanced science project, the next step is actually getting a copy so that you can read it. As mentioned above, some search engines provide links to free online versions of the paper, if one exists. If the search engine doesn't, or if you got the citation somewhere else, like the bibliography of another science paper you were reading, there are several ways to find copies.

Searching for Newer Papers (published during Internet era)

- **Check the library of a local college or university.** Academic institutions, like colleges and universities, often subscribe to many scientific journals. Some of these libraries are free to the public. Contact the library, or look at their website, to see if you may use their resources and if they subscribe to the journals in which you're interested. Often, the library's catalog of holdings is online and publicly searchable.

   a. *Note:* If you do go to a university or college library to photocopy or print journal articles, make sure to bring plenty of change with you, because they won't have any!

- **Look for a free online version.** Try searching for the full title of the paper in a regular search engine like Google, Yahoo, or MSN. The paper may come up multiple times, and one of those might be a free, downloadable copy. So, if the first link isn't downloadable, try another.
- **Go directly to the online homepage of the journal** in which the paper was published. Some scientific journals are "open-source," meaning that their content is always free online to the public. Others are free online (often after registering with the website) if the paper was published more than a year ago. The Directory of Open Access Journals is also a good place to check to see which journals are free in your field of interest. The website lists journals by subject, as well as by title.
- **Search directly for the homepage of the first or last author** of the paper and see if he or she has a PDF of the paper on his or her website. If so, you can download it directly from there. Generally it is only worth looking up the first author (the one who contributed the most to the paper) or the last author (usually the professor in whose lab the work was done and who supervised the science project).
- **Look for the paper (using the title or authors) in a science database,** like those listed below, in Table 2. These databases contain free, full-text versions of scientific papers, as well as other relevant information, like publicly accessible data sets.

Table 2: List of databases containing free, full-text scientific papers and data sets.

Database	URL	Disciplines
NASA Scientific and Technical Information (STI)	www.sti.nasa.gov/STI-public-homepage.html	Aerospace
SOA/NASA Astrophysics Data System	adswww.harvard.edu/	Astronomy, physics
arXiv	arxiv.org/	Physics, Mathematics, Computer science, Quantitative biology, Quantitative finance and statistics
CiteSeer^X	citeseerx.ist.psu.edu/	Computer science
Public Library of	www.plos.org/search.php	Life sciences

Database	URL	Disciplines
Science (PLOS)		
High Wire Press	highwire.stanford.edu/lists/freeart.dtl	Life sciences

- **Purchase a copy.** Depending on the science magazine publisher, you may also come across offers for purchasing a copy of the paper. This is an expensive option, particularly if you have multiple papers you'd like to read; try some of the other searching methods first

Searching for Older Papers (published pre-Internet era)

Even with all of the above searching methods, you may not be able to find a free copy of the paper online. This is particularly true for older science papers, which were published before online content became routine. In these cases, there are additional ways to get the paper at no or minimal cost.

- **Contact the author via email.** As mentioned above, the first and last authors are your best bets. Briefly explain your situation and request a copy of the paper directly from him or her. If you do this, make sure to be polite and brief in your email.
- **Check the library of a local college or university.** Academic institutions, like colleges and universities, often subscribe to many scientific journals. Some of these libraries are free to the public. Contact the library, or look at their website, to see if you may use their resources and if they subscribe to the journals in which you're interested. Often, the library's catalog of holdings is online and publicly searchable.
    a. *Note:* If you do go to a university or college library to photocopy or print journal articles, make sure to bring plenty of change with you, because they won't have any!
- **Contact your mentor** and ask if he or she can help you acquire a copy of the paper. Use this as a last resort though, because you may find that your request falls pretty far down on a mentor's lengthy to-do list.

COMPREHENSION QUESTIONS:

1. How can you characterize scientific method? What are the chief characteristics of scientific method?
2. How can you estimate the importance of reading scientific literature?
3. What resources do you use for searching scientific paper citations?
4. What is your own method in searching for newer and older papers?

ТЕМА 10. ЗАГАЛЬНОНАУКОВІ ТА СПЕЦІАЛЬНІ МЕТОДИ ДОСЛІДЖЕННЯ

The Science Process Skills

by Michael J. Padilla, Professor of Science Education, University of Georgia, Athens, GA

Introduction

One of the most important and pervasive goals of schooling is to teach students to think. All school subjects should share in accomplishing this overall goal. Science contributes its unique skills, with its emphasis on hypothesizing, manipulating the physical world and reasoning from data.

The scientific method, scientific thinking and critical thinking have been terms used at various times to describe these science skills. Today the term "science process skills" is commonly used. Popularized by the curriculum project, Science - A Process Approach (SAPA), these skills are defined as a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behavior of scientists. SAPA grouped process skills into two types-basic and integrated. The basic (simpler) process skills provide a foundation for learning the integrated (more complex) skills. These skills are listed and described below.

Basic Science Process Skills

Observing - using the senses to gather information about an object or event. *Example:* Describing a pencil as yellow .Inferring - making an "educated guess" about an object or event based on previously gathered data or information. Example: Saying that the person who used a pencil made a lot of mistakes because the eraser was well worn. Measuring - using both standard and nonstandard measures or estimates to describe the dimensions of an object or event. Example: Using a meter stick to measure the length of a table in centimeters. Communicating - using words or graphic symbols to describe an action, object or event. Example: Describing the change in height of a plant over time in writing or through a graph.

Classifying - grouping or ordering objects or events into categories based on properties or criteria. Example: Placing all rocks having certain grain size or hardness into one group. Predicting - stating the outcome of a future event based on a pattern of evidence. *Example*: Predicting the height of a plant in two weeks time based on a graph of its growth during the previous four weeks.

Integrated Science Process Skills

Controlling variables - being able to identify variables that can affect an experimental outcome, keeping most constant while manipulating only the independent variable. *Example:* Realizing through past experiences that amount of light and water need to be controlled when testing to see how the addition of organic matter affects the growth of beans. Defining operationally - stating how to measure a variable in an experiment. Example: Stating that bean growth will be measured in centimeters per week.

Formulating hypotheses - stating the expected outcome of an experiment. *Example:* The greater the amount of organic matter added to the soil, the greater the bean growth.

Interpreting data - organizing data and drawing conclusions from it. *Example:* Recording data from the experiment on bean growth in a data table and forming a conclusion which relates trends in the data to variables.

Experimenting - being able to conduct an experiment, including asking an appropriate question, stating a hypothesis, identifying and controlling variables, operationally defining those variables, designing a "fair" experiment, conducting the experiment, and interpreting the results of the experiment. *Example:* The entire process of conducting the experiment on the affect of organic matter on the growth of bean plants.

Formulating models - creating a mental or physical model of a process or event. *Examples:* The model of how the processes of evaporation and condensation interrelate in the water cycle.

COMPREHENSION QUESTIONS:

1. How do you understand the notions “scientific method”, “scientific thinking” and “critical thinking”? Discuss them with your partner.
2. What can you say about basic science process skills? Do you use them in your research?
3. What’s your opinion of integrated science process skills? Are they useful in writing your research?

ТЕМА 11. ПОСТАНОВКА ЕКСПЕРИМЕНТУ
EXPERIMENT

An **experiment** is an orderly procedure carried out with the goal of verifying, refuting, or establishing the validity of a hypothesis. Controlled experiments provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated. Controlled experiments vary greatly in their goal and scale, but always rely on repeatable procedure and logical analysis of the results. There also exist natural experimental studies.

In the scientific method, an **experiment** is an empirical method that arbitrates between competing models or hypotheses. Experimentation is also used to test existing theories or new hypotheses in order to support them or disprove them.

An experiment usually tests a hypothesis, which is an expectation about how a particular process or phenomenon works. However, an experiment may also aim to answer a "what-if" question, without a specific expectation about what the experiment will reveal, or to confirm prior results. If an experiment is carefully conducted, the results usually either support or disprove the hypothesis. According to some Philosophies of science, an experiment can never "prove" a hypothesis, it can only add support. Similarly, an experiment that provides a counterexample can disprove a theory or hypothesis. An experiment must also control the possible confounding factors—any factors that would mar the accuracy or repeatability of the experiment or the ability to interpret the results. Confounding is commonly eliminated through scientific control and/or, in randomized experiments, through random assignment.

In engineering and other physical sciences, experiments are a primary component of the scientific method. They are used to test theories and hypotheses about how physical processes work under particular conditions (e.g., whether a particular engineering process can produce a desired chemical compound). Typically, experiments in these fields will focus on replication of identical procedures in hopes of producing identical results in each replication. Random assignment is uncommon.

In medicine and the social sciences, the prevalence of experimental research varies widely across disciplines. When used, however, experiments typically follow the form of the clinical trial, where experimental units (usually individual human beings) are randomly assigned to a treatment or control condition where one or more outcomes are assessed. In contrast to norms in the physical sciences, the focus is typically on the average treatment effect (the difference in outcomes between the treatment and control groups) or another test statistic produced by the experiment. A single study will typically not involve replications of the experiment, but separate studies may be aggregated through systematic review and meta-analysis.

Of course, these differences between experimental practice in each of the branches of science have exceptions. For example, agricultural research frequently uses randomized experiments (e.g., to test the comparative effectiveness of different fertilizers). Similarly, experimental economics often involves experimental tests of theorized human behaviors without relying on random assignment of individuals to treatment and control conditions.

Types of experiment

Experiments might be categorized according to a number of dimensions, depending upon professional norms and standards in different fields of study. In some disciplines (e.g., Psychology or Political Science), a 'true experiment' is a method of social research in which there are two kinds of variables. The independent variable is manipulated by the experimenter, and the dependent variable is measured. The signifying characteristic of a true experiment is that it randomly allocates the subjects in order to neutralize the potential for experimenter bias and ensures, over a large number of iterations of the experiment, that all confounding factors are controlled for.

COMPREHENSION QUESTIONS:

1. Give the definition to the notion “experiment”. What is thr purpose of experiment?
2. What are the differences between experimental practice in each of the branches of science?
3. What types of experiment do you know and use in your research? Discuss with your partner.

ТЕМА 12. ЛЕКСИКО-СТИЛІСТИЧНІ ТА СТРУКТУРНО-ЗМІСТОВІ ОСОБЛИВОСТІ НАУКОВОГО ТЕКСТУ

Lexical and grammatical peculiarities of scientific-technical texts

In any scientific and technical text, irrespective of its contents and character, can be completely precisely translated from one language to other, even if in an artwork such branch of knowledge is required, for which in language of translation there is no appropriate nomenclature. In such cases the interpreter more often resorts to interpretation, but becoming of a necessary nomenclature of a realization in a sphere of production or those scientific circles, which are engaged in data by problems.

To ensure valuable translation, it is necessary to an interpreter to present the following requests:

1. The substantial acquaintance to a subject, which is treated in the original text.
2. Good enough knowledge of language of an artwork and its lexical and grammatical features in comparison to the native language.
3. Knowledge of the bases' theory of translation, and also receptions of technical translation and skill to use them.
4. Legible introducing about the character of scientific and technical functional style both in language of the original, and in the native language.
5. Acquaintance to accepted conventional signs, abbreviations (cuttings), systems of measures and weights, both in language of the original and in the native language.

Good possession of the native language and the right use of a nomenclature.

Structures of scientific-technical texts

Identifying structure

Five common types of structure used in scientific texts are:

- **Generalization**: the extension or clarification of main ideas through explanations or examples
- **Enumeration**: listing of facts
- **Sequence**: a connecting series of events or steps
- **Classification**: grouping items into classes
- **Comparison / contrast**: examining the relationships between two or more things

Let's look at these in a little more detail.

Generalization

In generalization, a paragraph always has a main idea. Other sentences in the paragraph either clarify the main idea by giving examples or illustrations, or extend the main idea by explaining it in more detail. Here's an example:

Irritability is defined as an organism's capacity to respond to conditions outside itself. ... The organism's response is the way it reacts to stimulus. For example, a plant may have a growth response. This happens when ...

Enumeration

Enumeration passages may be a bulleted or numbered list, or a list of items in paragraph form, for example: *There are four general properties of solids. Tenacity is a measure of ... Hardness is ... Malleability refers to ... Ductility is ...*

Sequence

A sequence describes a series of steps in a process. For example: *Hearing can be described in five separate stages. First, ...*

Classification

In classification, items are grouped into categories. For example: *Experimental variables can be grouped into one of two categories, either a manipulated variable or a controlled variable. A variable that can ...*

Comparison / contrast

This type of text looks at relationships between items. In comparison, both similarities and differences are studied. In contrast, only the differences are noted. For example: *There are two different hypotheses for the origin of the earth: the nebular hypothesis and the comet-produced hypothesis. The nebular hypothesis maintains ... In contrast, the comet-produced hypothesis states ... The first hypothesis assumes ... The latter hypothesis asserts ...* [examples taken from Cook & Mayer 1988]

A study [1] involving undergraduate students inexperienced in reading science texts (although skilled readers otherwise) found that even a small amount of training substantially improved the students' ability to classify the type of structure and use it appropriately.

Let's look briefly at the training procedures used:

Training for generalization

This involved the following steps:

- identify the main idea
- list and define the key words
- restate the main idea in your own words
- look for evidence to support the main idea
    - what kind of support is there for the main idea?
    - are there examples, illustrations?
    - do they extend or clarify the main idea?

Training for enumeration

This involved the following steps:

- name the topic
- identify the subtopics
- organize and list the details within each subtopic, in your own words

Training for sequence

This involved the following steps:

- identify the topic
- name each step and outline the details within each
- briefly discuss what's different from one step to another

[Only these three structures were covered in training]

Most effective text structures

Obviously, the type of structure is constrained by the material covered. We can, however, make the general statement that text that encourages the student to make connections is most helpful in terms of both understanding and memory.

In light of this, compare/contrast would seem to be the most helpful type of text. Another text structure that is clearly of a similar type has also been found to be particularly effective: **refutational** text. In a refutational text, a common misconception is directly addressed (and refuted). Obviously, this is only effective when there is a common misconception that stands in the way of the reader's understanding -- but it's surprising how often this is the case! Incompatible knowledge is at least as bad as a lack of knowledge in hindering the learning of new information, and it really does need to be directly addressed.

Refutational text is however, not usually enough on its own. While helpful, it is more effective if combined with other, supportive, strategies. One such strategy is elaborative interrogation, which involves (basically) the student asking herself **why** such a fact is true.

Unfortunately, however, text structures that encourage connection building are not the most common type of structure in scientific texts. Indeed, it has been argued that "the presentation of information in science textbooks is more likely to resemble that of a series of facts [and thus] presents an additional challenge that may thwart readers' efforts to organize text ideas relative to each other".

COMPREHENSION QUESTIONS:

1. What are the lexical and grammatical peculiarities of scientific-technical texts?
2. Give charecteristis of five common types of structure used in scientific texts. Discuss them with your partner.

ТЕМА 13. ОСНОВНІ ЖАНРИ НАУКОВОГО ПИСЬМА: РЕЗЮМЕ (SUMMARY)

Writing the Summary

Like an abstract in a published research article, the purpose of an article summary is to give the reader a brief overview of the study. To write a good summary, identify what information is important and condense that information for your reader. The better you understand a subject, the easier it is to explain it thoroughly and briefly.

Write a first draft. Use the same order as in the article itself. Adjust the length accordingly depending on the content of your particular article and how you will be using the summary.

- State the research question and explain why it is interesting.
- State the hypotheses tested.
- Briefly describe the methods (design, participants, materials, procedure, what was manipulated [independent variables], what was measured [dependent variables], how data were analyzed.
- Describe the results. Were they significant?
- Explain the key implications of the results. Avoid overstating the importance of the findings.
- The results, and the interpretation of the results, should relate directly to the hypothesis.

For the first draft, focus on content, not length (it will probably be too long). Condense later as needed. Try writing about the hypotheses, methods and results first, then about the introduction and discussion last. If you have trouble on one section, leave it for a while and try another.

If you are summarizing an article to include in a paper you are writing it may be sufficient to describe only the results if you give the reader context to understand those results.

For example: "Smith (2004) found that participants in the motivation group scored higher than those in the control group, confirming that motivational factors play a role in impression formation". This summary not only tells the results but also gives some information on what variables were examined and the outcome of interest. In this case it is very important to introduce the study in a way that the brief summary makes sense in the larger context.

Edit for completeness and accuracy. Add information for completeness where necessary. More commonly, if you understand the article, you will need to cut redundant or less important information. Stay focused on the research question, be concise, and avoid generalities.

Edit for style. Write to an intelligent, interested, naive, and slightly lazy audience (e.g., yourself, your classmates). Expect your readers to be interested, but don't make them struggle to understand you. Include all the important details; don't assume that they are already understood.

• **Eliminate wordiness**, including most adverbs ("very", "clearly"). "The results clearly showed that there was no difference between the groups" can be shortened to "There was no significant difference between the groups".
• **Use specific, concrete language**. Use precise language and cite specific examples to support assertions. Avoid vague references (e.g. "this illustrates" should be "this result illustrates").
• **Use scientifically accurate language.** For example, you cannot "prove" hypotheses (especially with just one study). You "support" or "fail to find support for" them.
• **Rely primarily on paraphrasing, not direct quotes.** Direct quotes are seldom used in scientific writing. Instead, paraphrase what you have read. To give due credit for information that you paraphrase, cite the author's last name and the year of the study (Smith, 1982).
• **Re-read what you have written.** Ask others to read it to catch things that you've missed.

COMPREHENSION QUESTIONS:

1. What is the purpose of an article summary?
2. What are the requirements for writing a first draft?
3. What are the main rules and steps in summary writing?
4. Read scientific article in your area and try to write a summary according to the requirements.

ТЕМА14. АНОТАЦІЯ (ABSTRACT)

How to write an abstract

The key trick is to plan your argument in six sentences, and then use these to structure the entire thesis/paper/essay. The six sentences are:

1. **Introduction. In one sentence, what's the topic?** Phrase it in a way that your reader will understand. If you're writing a PhD thesis, your readers are the examiners – assume they are familiar with the general field of research, so you need to tell them specifically what topic your thesis addresses. Same advice works for scientific papers – the readers are the peer reviewers, and eventually others in your field interested in your research, so again they know the background work, but want to know specifically what topic your paper covers.
2. **State the problem you tackle**. What's the key research question? Again, in one sentence. (Note: For a more general essay, I'd adjust this slightly to state the central question that you want to address) Remember, your first sentence introduced the overall topic, so now you can build on that, and focus on one key question within that topic. If you can't summarize your thesis/paper/essay in one key question, then you don't yet understand what you're trying to write about. Keep working at this step until you have a single, concise (and understandable) question.
3. **Summarize (in one sentence) why nobody else has adequately answered the research question yet**. For a PhD thesis, you'll have an entire chapter, covering what's been done previously in the literature. Here you have to boil that down to one sentence. But remember, the trick is *not* to try and cover all the various ways in which people have tried and failed; the trick is to explain that there's this one particular approach that nobody else tried yet (hint: it's the thing that your research does). But here you're phrasing it in such a way that it's clear it's a gap in the literature. So use a phrase such as "previous work has failed to address…". (if you're writing a more general essay, you still need to summarize the source material you're drawing on, so you can pull the same trick – explain in a few words what the general message in the source material is, but expressed in terms of what's missing)
4. **Explain, in one sentence, how you tackled the research question.** What's your big new idea? (Again for a more general essay, you might want to adapt this slightly: what's the new perspective you have adopted? or: What's your overall view on the question you introduced in step 2?)
5. **In one sentence, how did you go about doing the research that follows from your big idea**. Did you run experiments? Build a piece of software? Carry out case studies? This is likely to be the longest sentence, especially if it's a PhD thesis – after all you're probably covering several years worth of research. But don't overdo it – we're still looking for a sentence that you could read aloud without having to stop for breath. Remember, the word 'abstract' means a summary of the main ideas with most of the detail left out. So feel free to omit detail! (For those of you who got this far and are

still insisting on writing an essay rather than signing up for a PhD, this sentence is really an elaboration of sentence 4 – explore the consequences of your new perspective).

6. **As a single sentence, what's the key impact of your research?** Here we're not looking for the outcome of an experiment. We're looking for a summary of the implications. What's it all mean? Why should other people care? What can they do with your research. (Essay folks: all the same questions apply: what conclusions did you draw, and why would anyone care about them?)

COMPREHENSION QUESTIONS:

1. How can you define the notion "abstract"? What is its purpose?
2. Try to write an abstract on your article or research. Use recommendation given in the chapter.

ТЕМА 15. ТЕЗИ (CONFERENCE ABSTRACT)

Abstract Guidelines for Papers

How to write an Abstract for a Conference Paper

An Abstract is a short document that is intended to capture the interest of a potential reader of your paper. Thus in a sense it is a marketing document for your full paper. If the Abstract is poorly written or if it is boring then it will not encourage a potential reader to spend the time reading your work.

Thus the first rule of Abstract writing is that it should engage the reader by telling him or her what your paper is about and why they should read it. Although strictly not part of your Abstract, the title of the proposed paper is also important. Short attention-catching titles are the most effective. However, it is also important, for a conference paper, to ensure that the title describes the subject you are writing about. You should limit the length of the title to no more than 12 words.

With regards the body of the Abstract you need to make a clear statement of the topic of your paper and your research question. You need to say how your research was/is being undertaken. For example, is it empirical or theoretical? Is it quantitative or qualitative? Perhaps it follows the critical research method. What value are your findings and to whom will they be of use?

The Abstract should then briefly describe the work to be discussed in your paper and also give a concise summary of the findings. Finally your Abstract should not include diagrams and in general references are not required in the Abstract.

The marketing of your proposed paper needs to be done within the word limit of 300 to 500 words. It is poor practice not to use the 300 word minimum and it is considered a bad tactic to go over the limit of 500 words.

Keywords and Key Phrases

Although not part of the Abstract as such, most journals and conferences now expect authors to provide key words at the same time as the Abstract. Key words or phrases are used by Internet search engines to locate the paper. Somewhere between 5 and 10 Key Words are normally required and they should be the words which most closely reflect the content of the paper.

12 points used in the Selection Process

During the abstract selection process the following 12 points are used as a guide. We strongly recommend that you ensure your abstract satisfies these points.

1. Does the abstract capture the interest of a potential reader of the paper?
2. Is the abstract well written in terms of language, grammar, etc.?
3. Does the abstract engage the reader by telling him or her what the paper is about and why they should read it?
4. Does the abstract title describe the subject being written about?
5. Does the abstract make a clear statement of the topic of the paper and the research question?
6. Does the abstract say how the research was/is being undertaken?
7. Does the abstract indicate the value of the findings and to whom will they be of use?

8. Does the abstract describe the work to be discussed in the paper?
9. Does the abstract give a concise summary of the findings?
10. Does the abstract conform to the word limit of 300 to 500 words?
11. Does the abstract have between 5 and 10 keywords or phrases that closely reflect the content of the paper?
12. Should the abstract be accepted?

Authors who do not follow these guidelines are more likely to have their work rejected.

COMPREHENSION QUESTIONS:

1. What is an intention of an Abstract?
2. What are the rules of Abstract writing?
3. Study the rules of Abstract writing and use them in preparing your own one.

ТЕМА 16. ОГЛЯД ЛІТЕРАТУРИ (REVIEW)

WHAT IS A LITERATURE REVIEW?

It is not a term paper. You are not reviewing information as much as you are reviewing the literature that contains the information. The creation of a literature review is one of the most difficult and important tasks faced by scientists. It requires the culmination of many skills including library research, logical arrangement of information, and scientific writing. The purpose of the literature review may be manyfold but usually it is the first step in the process of doing scientific research. Before any scientist approaches the lab bench, they first approach the body of primary literature. It might surprise you to learn that most literature in science is rather useless in that it is never cited in other publications. It is estimated that only 5% of the publications in the natural sciences are useful in terms of being accurate, significant and worthy of guiding future research. Thus, the role of a good literature review is to find and present the pertinent work from the primary literature in a logical, organized manner and to bring the reader as up-to-date as possible. Primary literature is defined as peer-reviewed journals that publish the original research findings. Review articles and general science coverage articles are called secondary literature. One way of looking at this is to find the latest review article on a subject, use that information for your introduction, and then update that with the primary literature throughout the text of the review.

Most are aware that literature review is a process of gathering information from other sources and documenting it, but few have any idea of how to evaluate the information, or how to present it.

A literature review can be a precursor in the introduction of a research paper, or it can be an entire paper in itself, often the first stage of large research projects, allowing the supervisor to ascertain that the student is on the correct path.

A literature review is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper to establish why you are pursuing this particular research program. A good literature review expands upon the reasons behind selecting a particular research question.

What Is a Literature Review Not?

It is not a chronological catalog of all of the sources, but an evaluation, integrating the previous research together, and also explaining how it integrates into the proposed research program. All sides of an argument must be clearly explained, to avoid bias, and areas of agreement and disagreement should be highlighted.

It is not a collection of quotes and paraphrasing from other sources. A good literature review should also have some evaluation of the quality and findings of the research.

A good literature review should avoid the temptation of impressing the importance of a particular research program. The fact that a researcher is undertaking the research program speaks for its importance, and an educated reader may well be insulted that they are not allowed to judge the importance for themselves. They want to be re-assured that it is a serious paper, not a pseudo-scientific sales advertisement.

Whilst some literature reviews can be presented in a chronological order, it is best avoided.

For example, a review of Victorian Age Physics, could present J.J. Thomson's famous experiments in a chronological order. Otherwise, this is usually perceived as being a little lazy, and it is better to organize the review around ideas and individual points.

As a general rule, certainly for a longer review, each paragraph should address one point, and present and evaluate all of the evidence, from all of the differing points of view.

Conducting a Literature Review

Evaluating the credibility of sources is one of the most difficult aspects, especially with the ease of finding information on the internet.

The only real way to evaluate is through experience, but there are a few tricks for evaluating information quickly, yet accurately.

There is such a thing as 'too much information,' and Google does not distinguish or judge the quality of results, only how search engine friendly a paper is. This is why it is still good practice to begin research in an academic library. Any journals found there can be regarded as safe and credible.

The next stage is to use the internet, and this is where the difficulties start. It is very difficult to judge the credibility of an online paper. The main thing is to structure the internet research as if it were on paper. Bookmark papers, which may be relevant, in one folder and make another subfolder for a 'shortlist.'

- The easiest way is to scan the work, using the abstract and introduction as guides. This helps to eliminate the non-relevant work and also some of the lower quality research.
  If it sets off alarm bells, there may be something wrong, and the paper is probably of a low quality. Be very careful not to fall into the trap of rejecting research just because it conflicts with your hypothesis. Failure to do this will completely invalidate the literature review and potentially undermine the research project. Any research that may be relevant should be moved to the shortlist folder.
- The next stage is to critically evaluate the paper and decide if the research is sufficient quality. Think about it this way: The temptation is to try to include as many sources as possible, because it is easy to fall into the trap of thinking that a long bibliography equates to a good paper. A smaller number of quality sources is far preferable than a long list of irrelevance.
- Check into the credentials of any source upon which you rely heavily for the literature review. The reputation of the University or organization is a factor, as is the experience of the researcher. If their name keeps cropping up, and they have written many papers, the source is usually OK.

- Look for agreements. Good research should have been replicated by other independent researchers, with similar results, showing that the information is usually fairly safe to use.

  If the process is proving to be difficult, and in some fields, like medicine and environmental research, there is a lot of poor science, do not be afraid to ask a supervisor for a few tips. They should know some good and reputable sources to look at. It may be a little extra work for them, but there will be even more work if they have to tear apart a review because it is built upon shaky evidence.

Conducting a good literature review is a matter of experience, and even the best scientists have fallen into the trap of using poor evidence. This is not a problem, and is part of the scientific process; if a research program is well constructed, it will not affect the results.

COMPREHENSION QUESTIONS:

1. What is a literature review?
2. What are the indications of a good literature review?
3. What can you say about conducting a good literature review?

ТЕМА 17. РІЗНОВИДИ ТА СПОСОБИ ПЕРЕКЛАДУ

Translation Techniques

Direct Translation Techniques

Direct Translation Techniques are used when structural and conceptual elements of the source language can be transposed into the target language. Direct translation techniques include:

- Borrowing
- Calque
- Literal Translation

Borrowing

Borrowing is the taking of words directly from one language into another without translation. Many English words are "borrowed" into other languages; for example software in the field of technology and funk in culture. English also borrows numerous words from other languages; abbatoire, café, passé and résumé from French; hamburger and kindergarten from German; bandana, musk and sugar from Sanskrit.

Borrowed words are often printed in italics when they are considered to be "foreign".

Calque

A calque or loan translation (itself a calque of German Lehnübersetzung) is a phrase borrowed from another language and translated literally word-for-word. You often see them in specialized or internationalized fields such as quality assurance (aseguramiento de calidad, assurance qualité taken from English). Examples that have been absorbed into English include standpoint and beer garden from German Standpunkt and Biergarten; breakfast from French déjeuner (which now means lunch in Europe, but maintains the same meaning of breakfast in Québec). Some calques can become widely accepted in the target language (such as standpoint, beer garden and breakfast and Spanish peso mosca and Casa Blanca from English flyweight and White House). The meaning other calques can be rather obscure for most people, especially when they relate to specific vocations or subjects such as science and law. Solución de compromiso is a Spanish legal term taken from the English compromise solution and although Spanish attorneys understand it, the meaning is not readily understood by the layman. An unsuccessful calque can be extremely unnatural, and can cause unwanted humor, often interpreted as indicating the lack of expertise of the translator in the target language.

Literal Translation

A word-for-word translation can be used in some languages and not others dependent on the sentence structure: El equipo está trabajando para terminar el informe would translate into English as The team is working to finish the report. Sometimes it works and sometimes it does not. For example, the Spanish sentence above could not be translated into French or German using this technique because the French and German sentence structures are different. And because one sentence can be translated literally across languages does not mean that all sentences can be translated literally. El equipo experimentado está trabajando para terminar el informe translates into English as The experienced team is working to finish the report ("experienced" and "team" are reversed).

Oblique Translation Techniques

Oblique Translation Techniques are used when the structural or conceptual elements of the source language cannot be directly translated without altering meaning or upsetting the grammatical and stylistics elements of the target language.

Oblique translation techniques include:

- Transposition
- Modulation
- Reformulation or Equivalence
- Adaptation
- Compensation

Transposition

This is the process where parts of speech change their sequence when they are translated (blue ball becomes boule bleue in French). It is in a sense a shift of word class. Grammatical structures are often different in different languages. He likes swimming translates as Er schwimmt gern in German. Transposition is often used between English and Spanish because of the preferred position of the verb in the sentence: English often has the verb near the beginning of a sentence; Spanish can have it closer to the end. This requires that the translator knows that it is possible to replace a word category in the target language without altering the meaning of the source text, for example: English Hand knitted (noun + participle) becomes Spanish Tejido a mano (participle + adverbial phrase).

Modulation

Modulation consists of using a phrase that is different in the source and target languages to convey the same idea: Te lo dejo means literally I leave it to you but translates better as You can have it. It changes the semantics and shifts the point of view of the source language. Through modulation, the translator generates a change in the point of view of the message without altering meaning and without generating a sense of awkwardness in the reader of the target text. It is often used within the same language. The expressions es fácil de entender (it is easy to understand) and no es complicado de entender (it is not complicated to understand) are examples of modulation. Although both convey the same meaning, it is easy to understand simply conveys "easiness" whereas it is not complicated to understand implies a previous assumption of difficulty that we are denying by asserting it is not complicated to understand. This type of change of point of view in a message is what makes a reader say: "Yes, this is exactly how we say it in our language".

Reformulation or Equivalence

Here you have to express something in a completely different way, for example when translating idioms or advertising slogans. The process is creative, but not always easy. Would you have translated the movie The Sound of Music into

Spanish as La novicia rebelde (The Rebellious Novice in Latin America) or Sonrisas y lágrimas (Smiles and Tears in Spain)?

Adaptation

Adaptation occurs when something specific to one language culture is expressed in a totally different way that is familiar or appropriate to another language culture. It is a shift in cultural environment. Should pincho (a Spanish restaurant menu dish) be translated as kebab in English? It involves changing the cultural reference when a situation in the source culture does not exist in the target culture (for example France has Belgian jokes and England has Irish jokes).

Compensation

In general terms compensation can be used when something cannot be translated, and the meaning that is lost is expressed somewhere else in the translated text. Peter Fawcett defines it as: "...making good in one part of the text something that could not be translated in another". One example given by Fawcett is the problem of translating nuances of formality from languages that use forms such as Spanish informal tú and formal usted, French tu and vous, and German du and sie into English which only has 'you', and expresses degrees of formality in different ways.

As Louise M. Haywood from the University of Cambridge puts it, "we have to remember that translation is not just a movement between two languages but also between two cultures. Cultural transposition is present in all translation as degrees of free textual adaptation departing from maximally literal translation, and involves replacing items whose roots are in the source language culture with elements that are indigenous to the target language. The translator exercises a degree of choice in his or her use of indigenous features, and, as a consequence, successful translation may depend on the translator's command of cultural assumptions in each language in which he or she works".

If you are interested in reading further on the subject, please refer to Peter Fawcett, Translation and Language, St. Jerome, Manchester, 1997 (especially Chapter 4 on Translation Techniques).

COMPREHENSION QUESTIONS:

1. What are the main translation techniques? Give their definitions.
2. Which method do you prefer to use during the translation of foreign literature? Why?

ТЕМА 18. НАУКОВА СТАТТЯ (RESEARCH PAPER)

How to write a scientific article

"The whole of science is nothing more than a refinement of everyday thinking"

Albert Einstein

Conducting scientific and clinical research is only the beginning of the scholarship of discovery. In order for the results of research to be accessible to other professionals and have a potential effect on the greater scientific community, it must be written and published. Most clinical and scientific discovery is published in peer-reviewed journals, which are those that utilize a process by which an author's peers, or experts in the content area, evaluate the manuscript. Following this review the manuscript is recommended for publication, revision or rejection. It is the rigor of this review process that makes scientific journals the primary source of new information that impacts clinical decision-making and practice.

The task of writing a scientific paper and submitting it to a journal for publication is a time-consuming and often daunting task. Barriers to effective writing include lack of experience, poor writing habits, writing anxiety, unfamiliarity with the requirements of scholarly writing, lack of confidence in writing ability, fear of failure, and resistance to feedback. However, the very process of writing can be a helpful tool for promoting the process of scientific thinking, and effective writing skills allow professionals to participate in broader scientific conversations. Furthermore, peer review manuscript publication systems requiring these technical writing skills can be developed and improved with practice. Having an understanding of the process and structure used to produce a peer-reviewed publication will surely improve the likelihood that a submitted manuscript will result in a successful publication.

Clear communication of the findings of research is essential to the growth and development of science and professional practice. The culmination of the publication process provides not only satisfaction for the researcher and protection of intellectual property, but also the important function of dissemination of research results, new ideas, and alternate thought; which ultimately facilitates scholarly discourse. In short, publication of scientific papers is one way to advance evidence-based practice in many disciplines, including sports physical therapy. Failure to publish important findings significantly diminishes the potential impact that those findings may have on clinical practice.

BASICS OF MANUSCRIPT PREPARATION & GENERAL WRITING TIPS

To begin it might be interesting to learn why reviewers accept manuscripts! Reviewers consider the following five criteria to be the most important in decisions about whether to accept manuscripts for publication: 1) the importance, timeliness, relevance, and prevalence of the problem addressed; 2) the quality of the writing style (i.e., that it is well-written, clear, straightforward, easy to follow, and logical); 3) the study design applied (i.e., that the design was appropriate, rigorous, and comprehensive); 4) the degree to which the literature review was thoughtful, focused, and up-to-date; and 5) the use of a sufficiently large sample. For these statements to be true there are also reasons that reviewers reject manuscripts. The following are the top five reasons for rejecting papers: 1) inappropriate, incomplete, or insufficiently described statistics; 2) over-interpretation of results; 3) use of inappropriate, suboptimal, or insufficiently described populations or instruments; 4) small or biased samples; and 5) text that is poorly written or difficult to follow. With these reasons for acceptance or rejection in mind, it is time to review basics and general writing tips to be used when performing manuscript preparation.

Write with a measure of formality, using scientific language and avoiding conjunctions, slang, and discipline or regionally specific nomenclature or terms (e.g. exercise nicknames). For example, replace the term “Monster walks” with “closed-chain hip abduction with elastic resistance around the thighs”. You may later refer to the exercise as “also known as Monster walks” if you desire.

Avoid first person language and instead write using third person language. Some journals do not ascribe to this requirement, and allow first person references, however, IJSPT prefers use of third person. For example, replace “We determined that…” with “The authors determined that….”.

***Use figures and graphics to your advantage*. -**Consider the use of graphic/figure representation of data and important procedures or exercises. Tables should be able to stand alone and be completely understandable at a quick glance. Understanding a table should not require careful review of the manuscript! Figures dramatically enhance the graphic appeal of a scientific paper. Many formats for graphic presentation are acceptable, including graphs, charts, tables, and pictures or videos. Photographs should be clear, free of clutter or extraneous background distractions and be taken with models wearing simple clothing. Color photographs are preferred. Digital figures (Scans or existing files as well as new photographs) must be at least 300dpi. All photographs should be provided as separate files (jpeg or tif preferred) and not be embedded in the paper. Quality and clarity of figures are essential for reproduction purposes and should be considered before taking images for the manuscript.

Avoid Plagiarism and inadvertent lack of citations. Finally, use citations to your benefit. Cite frequently in order to avoid any plagiarism. The bottom line: *If it is not your original idea, give credit where credit is due*. When using direct quotations, provide not only the number of the citation, but the page where the quote was found. All citations should appear in text as a superscripted number followed by punctuation. It is the authors' responsibility to fully ensure all references are cited in completed form, in an accurate location. Please carefully follow the instructions for citations and check that all references in your reference list are cited in the paper and that all citations in the paper appear correctly in the reference list. Please go to IJSPT submission guidelines for full information on the format for citations.

CONTENT

Abstract

Sometimes written as an afterthought, the abstract is of extreme importance as in many instances this section is what is initially previewed by readership to determine if the remainder of the article is worth reading. This is the authors opportunity to draw the reader into the study and entice them to read the rest of the article. The abstract is a summary of the article or study written in 3rd person allowing the readers to get a quick glance of what the contents of the article include. Writing an abstract is rather challenging as being brief, accurate and concise are requisite. The headings and structure for an abstract are usually provided in the instructions for authors. In some instances, the abstract may change slightly pending content revisions required during the peer review process. Therefore it often works well to complete this portion of the manuscript last. Remember the abstract should be able to stand alone and should be as succinct as possible.

Introduction and Review of Literature

The introduction is one of the more difficult portions of the manuscript to write. Past studies are used to set the stage or provide the reader with information regarding the necessity of the represented project. For an introduction to work properly, the reader must feel that the research question is clear, concise, and worthy of study.

A competent introduction should include at least four key concepts: 1) significance of the topic, 2) the information gap in the available literature associated with the topic, 3) a literature review in support of the key questions, 4) subsequently developed purposes/objectives and hypotheses.

When constructing a review of the literature, be attentive to “sticking” or “staying true” to your topic at hand. Don't reach or include too broad of a literature review. For example, do not include extraneous information about performance or prevention if your research does not actually address those things. The literature review of a scientific paper is not an exhaustive review of all available knowledge in a given field of study. That type of thorough review should be left to review articles or textbook chapters. Throughout the introduction (and later in the discussion!) remind yourself that a paper, existing evidence, or results of a paper cannot draw conclusions, demonstrate, describe, or make judgments, only PEOPLE (authors) can. “The evidence demonstrates that” should be stated, “Smith and Jones, demonstrated that….”

Conclude your introduction with a solid statement of your purpose(s) and your hypothesis(es), as appropriate. The purpose and objectives should clearly relate to the information gap associated with the given manuscript topic discussed earlier in the introduction section. This may seem repetitive, but it actually is helpful to ensure the reader clearly sees the evolution, importance, and critical aspects of the study at hand See Table 1 for examples of well-stated purposes.

Table 1.

Examples of well-stated purposes by submission type.

Type of Submission	Example purpose
Original Research	Therefore, the purpose of this study was to describe the volume of pitching for pitchers from multiple college teams at the Division I level.
Systematic Review of the Literature	Therefore, the purpose of this systematic review was to investigate the association between training characteristics and running related injuries.
Clinical Commentary/Current Concepts Report	The purpose of this clinical commentary is to examine the risk factors contributing to the high recurrence rate of hamstring injuries, and propose a unique rehabilitation strategy addressing these factors in order to decrease the rate of reinjury.
Case Report	The purpose of this case report is to describe the non-surgical management of a professional athlete with the characteristic signs and symptoms of a sports hernia.
Clinical Suggestion	The purpose of this clinical commentary is to review types of integumentary wounds that may occur in sport, and their acute management.

Methods

The methods section should clearly describe the specific design of the study and provide clear and concise description of the procedures that were performed. The purpose of sufficient detail in the methods section is so that an appropriately trained person would be able to replicate your experiments. There should be complete transparency when describing the study. To assist in writing and manuscript preparation there are several checklists or guidelines that are available on the IJSPT website. The CONSORT guidelines can be used when developing and reporting a randomized controlled trial. The STARD checklist was developed for designing a diagnostic accuracy study. The PRISMA checklist was developed for use when performing a meta-analyses or systematic review. A clear methods section should contain the following information: 1) the population and equipment used in the study, 2) how the population and equipment were prepared and what was done during the study, 3) the protocol used, 4) the outcomes and how they were measured, 5) the methods used for data analysis. Initially a brief paragraph should explain the overall procedures and study design. Within this first paragraph there is generally a description of inclusion and exclusion criteria which help the reader understand the population used. Paragraphs that follow should describe in more detail the procedures followed for the study. A clear description of how data was gathered is also helpful. For example were data gathered prospectively or retrospectively? Who if anyone was blinded, and where and when was the actual data collected?

Although it is a good idea for the authors to have justification and a rationale for their procedures, these should be saved for inclusion into the discussion section, not to be discussed in the methods section. However, occasionally studies supporting components of the methods section such as reliability of tests, or validation of outcome measures may be included in the methods section.

The final portion of the methods section will include the statistical methods used to analyze the data. This does not mean that the actual results should be discussed in the methods section, as they have an entire section of their own!

Most scientific journals support the need for all projects involving humans or animals to have up-to-date documentation of ethical approval. The methods section should include a clear statement that the researchers have obtained approval from an appropriate institutional review board.

Results, Discussion, and Conclusions

In most journals the results section is separate from the discussion section. It is important that you clearly distinguish your results from your discussion. The results section should describe the results only. The discussion section should put those results into a broader context. Report your results neutrally, as you "found them". Again, be thoughtful about content and structure. Think carefully about where content is placed in the overall structure of your paper. It is not appropriate to bring up additional results, not discussed in the results section, in the discussion. All results must first be described/presented and then discussed. Thus, the discussion should not simply be a repeat of the results section. Carefully discuss where your information is similar or different from other published evidence and why this might be so. What was different in methods or analysis, what was similar?

As previously stated, stick to your topic at hand, and do not overstretch your discussion! One of the major pitfalls in writing the discussion section is overstating the significance of your findings or making very strong statements. For example, it is better to say: "Findings of the current study support…." or "these findings suggest…" than, "Findings of the current study prove that…" or "this means that….". Maintain a sense of humbleness, as nothing is without question in the outcomes of any type of research, in any discipline! Use words like "possibly", "likely" or "suggests" to soften findings.

Do not discuss extraneous ideas, concepts, or information not covered by your topic/paper/commentary. Be sure to carefully address all relevant results, not just the statistically significant ones or the ones that support your hypotheses. When you must resort to speculation or opinion, be certain to state that up front using phrases such as "we therefore speculate" or "in the authors' opinion".

Remember, just as in the introduction and literature review, evidence or results cannot draw conclusions, just as previously stated, only people, scientists, researchers, and authors can!

Finish with a concise, 3-5 sentence conclusion paragraph. This is not just a restatement of your results, rather is comprised of some final, summative statements that reflect the flow and outcomes of the entire paper. Do not include speculative statements or additional material; however, based upon your findings a statement about potential changes in clinical practice or future research opportunities can be provided here.

Conclusions

Writing for publication can be a challenging yet satisfying endeavor. The ability to examine, relate, and interlink evidence, as well as to provide a peer-reviewed, disseminated product of your research labors can be rewarding. A few suggestions have been offered in this commentary that may assist the novice or the developing writer to attempt, polish, and perfect their approach to scholarly writing.

COMPREHENSION QUESTIONS:

1. What are the main principles of scientific article writing?
2. How must the figures and graphics be used in writing scientific article?
3. What are the rules of writing Introduction and Review of Literature?
4. What information should a clear methods section contain?
5. Why is the section Results, Discussion, and Conclusions so important in writing scientific article.
6. What is the purpose of conclusions?

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НАВЧАЛЬНЕ ВИДАННЯ

Методичні вказівки до практичної роботи з дисципліни «Англійська мова» для здобувачів вищої освіти освітньо-наукової програми третього рівня (підготовка докторів філософії) для усіх спеціальностей (1 курс)

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старший викладач

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