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## MACROSTRUCTURE OF ENGLISH RESEARCH ARTICLES IN LIFE SCIENCES WRITTEN BY UKRAINIAN AUTHORS

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The study addresses macrostructure patterns of research articles in the life sciences published by Ukrainian journals by analyzing section and subsection heading designation and ordering. The study corpus comprised 60 original research articles (RAs) written in English and published in five scientific journals in the field of biology and environmental sciences in Ukraine in 2023–2024. The headings recorded were classified according to their type. Functional headings were processed quantitatively; content headings were subjected to a key word analysis. Based on section labelling, composition and ordering, their structural patterns were constructed and compared. The study revealed that the examined articles followed the conventional structuring standards based on the Introduction-Methods-Results-Discussion (IMRD) pattern. Most section headings were of the standard functional type, while subsection headings were mostly of content type. The dominant macrostructure patterns were I\_Mat & M\_R & D\_C and I\_Mat & M\_R\_D\_C with subheadings included in the Mat & M or R&D sections. No major deviations from the international standards of research article structuring were found.

*Key words:* research article, macrostructure pattern, section heading, sub-heading, IMRD structure.

**Introduction.** In recent decades, the number of original research article (RA) submissions to scientific journals in the life sciences by non-English-speaking authors has increased. This trend is no exception for Ukrainian authors, who are becoming more active participants in the global academic communities in these fields. In addition, new journals are appearing in Ukraine itself that aim to publish research in English, which is undoubtedly the lingua franca of modern science. In this regard, mastery of general academic English, as well as of its discipline-specific variations, is an essential prerequisite for both individual scholars and journals to gain recognition in the global research communities.

**Previous Research in the Area.** Conventions of research writing manifest themselves at macro and micro levels, the former being represented by the overall organization of the main text elements, the global coherence, logical flow of ideas and connectivity between different sections, while the latter concerns the arrangement of smaller chunks of text, such as paragraphs, or sentences, word and grammatical choices, etc. [3; 22]. A wealth of scholarship has accumulated on the problem of scientific text structure analysis addressing the phenomenon from multiple perspectives: from micro-level cohesion to macro-level organization, including lexical and grammatical analysis, genre/move analysis, scientometric analysis, etc. [2; 10; 12; 23; 24].

One of the best-known approaches is based on the so-called IMRD pattern which is associated with the typical Introduction-Method-Results-and-Discussion format of article division into functional sections. This pattern was further elaborated and supplemented by Swale's CARS (Create a Research Space) model that serves as a framework for understanding the rhetorical structure of introductions in research papers [8; 21]. Although these models have proven to be quite effective and traceable in the majority of modern RAs, cross-cultural and cross-disciplinary studies of academic writing suggest that their application may vary across fields, academic levels, and cultures [1; 11].

Studies show that the IMRD structure is not universally adopted, with variations observed in different contexts. For example, a comprehensive corpus-based study by Moskovitz *et al.* distinguishes several categories of IMRD structure: "IMRAD, IMRAD+ (IMRAD with additional sections and/or different order), Nested IMRAD (multi-part studies), and Non-IMRAD" [14, p. 265] across STEM disciplines. A study by A. Esimaje addresses cultural-specific academic practices within Nigerian research communities and claims that in this cultural context the traditional 4-part IMRD pattern is redefined into a 5–7 element model that differs in both structure and content [7]. Cross-linguistic studies also reveal differences in the frequency and sequence of IMRD moves highlighting inconsistencies in rhetorical structure and linguistic features between RAs written by native and non-native English authors [5; 17]. These findings emphasize the importance of recognizing and accommodating cultural practices in academic writing within the global publishing landscape.

The macrostructure of an RA is revealed through its sections and subsections. The former are defined by Nathan *et al.* as "any segment of text that has been set apart from the main text with a label", while the latter are described as "any segment of text that falls within a section and has been set apart from that section with its own label" [16, p. 644]. The notion of "label" concerns words or phrases that function as names of sections/ subsections and are commonly referred to as headings.

Headings contribute to more effective text comprehension, by promoting the reader's selective attention and guiding the structured reading process with potential implications for cognitive processes and educational practices [4]. Researchers also claim that the ability to effectively manage and arrange the content of a paper through specific organizational units simplifies the writing process, enhances the reception of a manuscript and raises the chances for its publication [15]. Harati & Mobashshernia argue that “headings of sections and subsections of RAs seem to be convenient signposts to identify the structural patterns” [9, p. 50]. At the same time, Ruiying & Allison caution against potential misinterpretation of RA structure due to the fact that headings are “not always explicit about the rhetorical function of a section” as well as varying individual uses of headings by authors [19, p. 265].

Commonly, section headings are divided into several types: conventional (standard) functional, varied functional, and content headings [8; 9; 19]. The first group comprises the most traditional and universal headings, such as *Introduction, Methods, Results*, etc., and, as the name suggests, reveals the rhetorical function of a section. The second group includes alternative variants of conventional headings, such as *Methodology, Findings*, etc. The third type is represented by headings that highlight specific research content, for example *Body glucose and glycogen assay*. Literature analysis suggests that although the IMRD pattern is fundamental to the structuring of RAs across disciplines, there are numerous variations of this model that reveal disciplinary discourse conventions, as well as patterns of knowledge production and exchange which are characteristic of specific cultural and linguistic backgrounds, and which can potentially be transferred to the English-language academic environment via non-native contributors.

Recently, a great deal of scholarly attention has been paid to various aspects of research writing in diverse national, cultural, disciplinary and other settings. Despite this, there is a dearth of studies on academic texts written in English by Ukrainian authors. The majority of studies address the challenges experienced by non-native authors resulting from first language interference, which leads to multiple cases of language misuse at various levels (mainly syntactic, grammatical and lexical), such as verbosity, redundancy, loan translations, incorrect word order, inappropriate vocabulary choices, etc. [12; 20; 23]. Only a few studies address peculiarities of Ukrainian authors' research writing at levels above linguistic. T. Yakhontova [25] discusses and classifies problems revealed at the level of paragraph construction and gives practical recommendations on avoiding them. The researcher also draws attention to the issues of rhetorical organization and argument development in RAs written by non-Anglophone (predominantly Ukrainian) authors [24]. By and large, present scholarship on structural, organizational and rhetorical features of RAs written by Ukrainian authors does not go much beyond the above-mentioned research. Obviously, the topic needs further development and elaboration with regard to specific fields, disciplines and journals.

Ukraine has a strong scientific background in biology and environmental sciences with a long publishing tradition. However, until recently, the bulk of research was written in the Ukrainian, occasionally Russian, languages, and thus adhered to the local academic writing conventions. Today, many well-established journals are reformatting to meet

the global requirements. At the same time, many new academic journals are emerging, aiming for the highest international quality standards and global recognition. In this period of transition, it is of particular interest to trace and document how the old and new traditions of research writing and publishing merge and evolve. It seems quite logical to start observations at the level of the structural organization of research papers of Ukrainian authorship.

The purpose of this article is to gain an insight into the macrostructure patterns (MSPs) of RA content arrangement into textual and rhetorical units through the analysis of section and subsection headings, specifically their type and ordering. Furthermore, a comparison was sought between the observed patterns and those presented in the literature, in particular by Gong & Barlow, Harati & Mobashshernia, Lin & Evans, Moskovitz et al., and Nathan et al. [8; 9; 13; 14; 16].

**Methodology.** *Sampling procedure.* The corpus for this study comprises 60 original RAs written in the English language and published in five scientific journals in the field of biology and environmental sciences in Ukraine in 2023–2024. We employed the convenience sampling method [6] for the selection of both journals and papers, taking into account a few criteria. Thus, to be selected, a journal had to meet the following requirements: (a) be readily available on the Internet (support open access policy), (b) be published by a university or another institution registered in Ukraine, and (c) be on the list of “category A” journals.

The selection criteria for RAs were as follows: (a) the paper had to report an original empirical study, (b) the full text of the article had to be written in English, (c) the team of authors was not supposed to include native English speakers. To ensure the fulfillment of condition (a) for RAs, we checked in which journal section they appeared (e.g.: Experimental Works); if this was not possible, we identified empirical RAs by the presence of a *Method(s)* section with a corresponding heading, following Harati & Mobashshernia [9]. Authors’ non-native English background was inferred from their names and affiliations (we did not select papers for analysis unless all their authors were affiliated with Ukrainian institutions).

After reviewing the list of Ukrainian scientific journals in the field of biology and environmental sciences, we selected five journals that meet the above criteria and whose scientific scope covers a variety of branches within the fields of our interest, namely: *Biolozhnyi Studii/Studia Biologica (SB)*, published by Ivan Franko National University of Lviv, *Biosystems Diversity (BD)*, published by Oles Honchar Dnipro National University, *The Ukrainian Biochemical Journal (UBJ)*, published by the National Academy of Sciences of Ukraine (NASU) and Palladin Institute of Biochemistry of the NASU, *Biopolymers and Cell (B&C)*, published by the Institute of Molecular Biology and Genetics of the NASU, and *Fiziologichnyi Zhurnal (FZh)*, (The Journal of Physiology), published by Bogomoletz Institute of Physiology of the NASU. The four most recent issues of each journal were taken and three RAs were selected from each issue that met the above requirements, making a total of n=60.

*Data collection and processing.* The first step of data collection was to scan the texts of the selected papers, identify and list all the section and subsection headings that are

visually distinguishable by any differences in print style (**bold type**, *italics*, CAPITAL LETTERS, etc.) and that serve as “labels” for different parts of the paper content. Once all headings were recorded, the next step was to identify their type as conventional functional, varied functional or content. A comprehensive framework developed by Nathan *et al.* [16] comprising 24 common functional headings represented by 186 conventional or alternative section and/ or subsection names (labels) that occur in various types of journal articles, including RAs, across the disciplines was used for verification of the functional headings. If a heading detected did not match or closely approximate these labels, it was referred to the group of content headings.

The recorded functional section headings were further abbreviated following Gong & Barlow [8] to construct the MSPs into which they are organized in RAs. The novelty of this study was the inclusion of subsection headings in the patterns. The selected functional section and subsection headings and the patterns constructed from them, in particular their composition and frequency, were analysed quantitatively. The identified content headings were subjected to a key word analysis conducted using an AI-based language model, ChatGPT [18].

**Results and Discussion.** *Section and subsection headings: types, composition, arrangement and frequency.* The study revealed the presence of all three types of headings – conventional functional, varied functional and content – in the RAs of the Ukrainian journals analysed. Table 1 shows the complete list of recorded functional section and subsection headings, their total number and percentage. The section headings are listed in the order of their appearance in the RAs; the subsection headings are presented in relation to their belonging to the corresponding sections and are listed in the alphabetical order.

We could observe a few trends with regard to the presence, labelling and composition of sections in the RAs under study. All articles had the **Introduction** section, but, it was labelled in only 80% of the articles; the remaining 20% were all published in one journal – UBJ – clearly illustrating a journal specific tendency. These data closely correlate with the findings reported by Nathan *et al.* [16] who detected labelled introductions in 89.2% of RAs, regardless of the field. It is also noteworthy that no alternative names were used for the introductory sections in the papers studied and that subsections (at least labelled ones) were never included in them.

The **Method(s)** section heading was recorded in 20% of the articles, all of which belonged to one journal – FZh; the other journals utilised the label **Materials and Methods** (80%). This section was distinguished by the greatest number and variety of subsection headings. The majority of functional labels denoted the subsection describing methods of statistical analysis, with the most consistently used label *Statistical analysis* (in 20% of the RAs) and a rather wide range of its alternatives, such as *Statistical data analysis*, *Statistical procedures*, *Statistical processing of results*, *Statistical tests*, etc. Most of the other functional subsection names appeared only once in our sample (see Table 1), indicating an irregularity in their use.

Table 1

**Functional section and subsection headings (according to IMRD-pattern) and their frequency**

Standard section headings, total count ( <i>n</i> =60) and percentage			Alternative section headings, total count ( <i>n</i> =60) and percentage			Subsection headings, total count ( <i>n</i> =60) and percentage		
Section name	No	%	Section name	No	%	Subsection name	No	%
Introduction (I)	48	80	Unlabeled introductory section (I)	12	20	N/A		
Method(s) (M)	12	20	Materials and Methods (Mat&M)	48	80	Descriptive statistical analysis	1	1.7
						Ethical approval	1	1.7
						Ethical statement	1	1.7
						Experimental design	1	1.7
						Experimental procedures	1	1.7
						Inclusion and exclusion criteria	1	1.7
						Materials	2	3.3
						Methods	1	1.7
						Patient selection	1	1.7
						Statistical analysis	12	20
						Statistical data analysis	1	1.7
						Statistical procedures	1	1.7
						Statistical processing of results	1	1.7
						Statistical tests	1	1.7
						Statistics	1	1.7
Study area	1	1.7						
Study design	1	1.7						
Results (R)	18	30	Results and Discussion (R & D)	38	63.3	Descriptive statistical analysis	1	1.7
Discussion (D)	21	35				Conclusion(s)	12	20
			Study limitations	1	1.7			
Conclusion(s) (C)	47	78.3				N/A		

Content subsection headings are numerous in the **Method(s)/Materials and Methods** sections (129 in total) and are represented by a wide range of words and phrases of various lengths: from *PCR*, or *Volume to Bioinformatic analysis of K. oboediens genomes on the presence of nucleolytic enzymes associated with OMVs and E-OMVs*, or *Determination of lactate dehydrogenase (LDH) and gammaglutamyltranspeptidase (GGT) activity*. The key word analysis assisted by ChatGPT, an AI-powered language tool [18], revealed the presence of both general scientific and discipline-specific lexical units in the content subheadings. Table 2(a) lists the most common general scientific words and shows examples of collocations with them recorded in the subheadings of the **Method(s)** section. Most of the discipline-specific phrases identified were used only once within the sample, with a few exceptions such as *PCR* or *Western blot*. These lexemes clearly demonstrate field relevance to various branches of life sciences, for example: *histological staining* (relevant to tissue analysis), *reverse transcription* (molecular biology and genetics), *antimicrobial activity* (microbiology and pharmacology), *X-ray diffraction* (crystallography and structural biology), *exometabolites spectra* (chemical analysis in biochemistry), etc.

The next section in the majority of the articles studied appears with a combined heading – **Results and Discussion** (63.3%). Some articles use the model with two separate sections, respectively named **Results** (30%) and **Discussion** (35%). Uniform use of one of the two models was found in only two journals: *BD* that adheres to the pattern with separate **Results** and **Discussion** sections, and *B & C* that consistently follows the combined model. Otherwise, the two models are scattered across and within journals with no discernible regularity. Our findings regarding the percentage of the combined or separated variants of the section(s) in question are not entirely consistent with those of Nathan *et al.* [16]. These authors report only 15% occurrence of the combined variant (**Results and Discussion**), whereas the separated model shows much higher indicators: **Results** (98%) and **Discussion** (92%). This discrepancy could be attributed to the fact that their study was conducted on the material of RAs from all fields, while ours may represent the discipline-specific arrangement of research papers in the life sciences.

The **Results** and **Discussion** sections often contain subsections, mostly with content headings. The functional subsection headings identified for these sections were *Descriptive statistical analysis*, which appeared in the **Results**, *Study limitations* in the **Discussion**, and *Conclusion(s)*. The latter was only the case for *UBJ*, whose structure does not include the **Conclusion(s)** section, instead presenting it as a subsection in the **Results and Discussion** or **Discussion**. The number of content headings in these sections is smaller (64) compared to the **Materials and Methods**. These headings tend to be composed of longer phrases, such as *Investigation of the Ge citrate effect on the functional and metabolic activity of neutrophils in aging mice subjected to experimental endotoxemia*, most of which are unique – no exact matches of the wording of content subheadings in the **Results** and **Discussion** were recorded across the articles under study. Occasionally, subheadings in the **Results** and **Discussion** sections echoed those in the **Materials and Methods** within the same paper showing a correlation with each other, for example *Antimicrobial activity*, *Descriptive statistical analysis*, etc. However, such cases were infrequent.

The key word analysis of the content subheadings in the **Results** and **Discussion** sections, carried out in part with the support of an AI-based language model, ChatGPT [18], revealed that the dominant general scientific lexemes partly coincided with those in the **Materials and**

**Methods** (see Table 2(b)). These were the words *analysis, activity, study(ies)*. At the same time, a number of general scientific words were identified that were specific to the headings of the content subsections within the **Results** and **Discussion** sections: *characteristics, properties, role, effect, influence, evaluation, content, structure*. Used in collocations, the above lexical units produce highly discipline-specific meanings, e.g. *cytomorphological studies, concentration-dependent cytotoxic effect, content of indole alkaloids*, etc.

Table 2

**Key word analysis of content subsection headings**

<b>(a) The most frequent general scientific key words occurring in the content subsection headings (n=129) of the Method(s)/ Materials and Methods section</b>		
<i>Key word</i>	<i>Number of occurrences</i>	<i>Examples of collocations</i>
Analysis	10	statistical analysis, biochemical analysis, bioinformatic analysis
Isolation	10	isolation of DNA, isolation of cells, lymphocytes isolation
Determination	10	determination of glucose, determination of fatty acid composition, determination of wet body mass
Activity	9	antibacterial activity, antimicrobial activity, protein activity
Study(ies)	8	cytomorphological studies, study of biochemical indicators, immunohistochemical study
Assay	6	enzyme assay, cytotoxicity assay, RNA degradation assay
Preparation	6	preparation of solutions, preparation of extracts
Synthesis	5	synthesis of nanoparticles, synthesis of primers
Data	4	crystal data, surveillance data, analysis of data
Measurement	3	measurement of antibacterial activity, measurement of erythrocyte size
<b>(b) The most frequent general scientific key words occurring in the content subsection headings (n=64) of the Results and Discussion sections</b>		
<i>Key word</i>	<i>Number of occurrences</i>	<i>Examples of collocations</i>
Analysis	8	cluster analysis, cytological analysis, factor analysis
Activity	7	antagonistic activity, antimicrobial activity, metabolic activity
Study(ies)	5	study of the influence, cytomorphological studies, fluorescence microscopy study
Characteristics	5	culture characteristics, morphometric characteristics, characteristics of clutches
Role	5	role of prostaglandins in acetylcholineinduced relaxation, role of KIR channels in ...
Effect	5	phodynamic effect of dyes, concentration-dependent cytotoxic effect
Influence	4	under the influence of, study of the influence
Content	3	content of indole alkaloids, content of photosynthetic pigments
Evaluation	3	evaluation of hybrid composition, evaluation of the population
Properties	3	morphological properties, soil properties
Structure	3	porous structure, vegetation structure

With the exception of the *UBJ* mentioned above, the **Conclusion(s)** section was present in all other journals examined (80%). Similarly to the **Introduction**, this section was never given an alternative name or included subsections. **References** were present and uniformly labelled in 100% of the RAs analysed.

*Patterns of RA macrostructure.* Once all the section headings had been recorded, they were abbreviated (see Table 1) and patterns were constructed based on their presence and ordering in the RAs. Two types of patterns were ultimately constructed: generic patterns, which did not take subsections into account, and specific patterns, which considered subsections and also indicated their location within the pattern. Table 3 lists all the generic and specific patterns that were identified, presented in descending order of frequency, and shows their distribution across the journals that were in the focus of this study.

The **I\_Mat & M\_R & D\_C** and **I\_Mat & M\_R\_D\_C** patterns were prevailing, with frequencies of 33.3% and 25%, respectively, within the sample examined. These were the only two MSPs that appeared in more than one journal, indicating their more universal use. Most of the patterns recorded occur both *with* and without subsections. Subsections are usually part of Mat & M / M or R & D sections, or both. The most complex MSP recorded was of the **I\_Mat & M\_R\_D\_C** type with subsections incorporated in three sections: **I\_Mat & M (sub\_h)\_R (sub\_h)\_D (sub\_h)\_C**.

At the level of generic MSPs, our findings are partly consistent with data presented by Gong & Barlow [8] for RAs in the life sciences, according to which the top three positions by frequency belong to such patterns: **I\_Mat & M\_R\_D** (51.42%), **I\_Mat & M\_R\_D\_C** (48.12%), and **I\_Mat & M\_R&D\_C** (26.32%). As can be seen, the top two patterns in our study correlate relatively closely with the second and third patterns in their study, whereas we did not detect the **I\_Mat & M\_R\_D** pattern at all. Instead, we found an **[I]\_Mat & M\_R\_D** pattern with a 5% occurrence, where the **Introduction** section was present, but unlabelled. The differences between the results can be attributed to the small size of our sample, which cannot be representative. Unfortunately, we were unable to find any studies of RA macrostructure in the field of life sciences that took into account subsections to compare with our results.

*Universal, national and journal-specific trends in RA macrostructure.* No significant deviations from the common RA macrostructure patterns presented in the literature [8; 13; 14; 19] were detected in the papers published in Ukrainian journals in the fields of biology and environmental sciences. This indicates that Ukrainian journals and authors comply with the international conventions and standards of RA section labelling and ordering. All section headings were of the conventional functional type, except for one found in *UBJ*, where the phrase *Analysis of fauna change* was used to denote the **Results** section. This finding is in line with Gong & Barlow and Moskovitz et al. [8; 14], who claim that functional section headings are more common for RAs in the life sciences than content ones.

However, the situation is quite the opposite at the subheading level, where there is a much greater variety of headings. Here, the ratio between functional and content subheadings was approximately 1:10. Content subheadings were present in a wide variety of forms, usually as phrases that revealed the discipline-specific character of the texts and thus corresponded to the specialization of the journal. Even functional subheadings were more diverse with a number of alternative options being used in place of the standard ones, for example, we

recorded several substitutes for the standard subheading *Statistical analysis*, such as *Statistics*, *Statistical tests* or *Statistical processing of results*. This suggests that the journals examined have a less strict policy regarding the labelling of sub-headings.

Table 3

MSP distribution across journals

Pattern	Journal											
	Total (60)		SB		FZh		B&C		BD		UBJ	
	No	%	No	%	No	%	No	%	No	%	No	%
<b>I_Mat &amp; M_R &amp; D_C</b>	<b>20</b>	<b>33.3</b>	<b>9</b>	<b>75</b>			<b>11</b>	<b>91.6</b>				
I_Mat & M_R & D_C	4	6.7	2	16.7			2	16.7				
I_Mat & M(sub_h)_R & D_C	8	13.3	4	33.3			4	33.3				
I_Mat & M_R & D(sub_h)_C	2	3.3	1	8.3			1	8.3				
I_Mat & M(sub_h)_R & D(sub_h)_C	6	10	2	16.7			4	33.3				
<b>I_Mat&amp;M_R_D_C</b>	<b>15</b>	<b>25</b>	<b>2</b>	<b>16.7</b>			<b>1</b>	<b>8.3</b>	<b>12</b>	<b>100</b>		
I_Mat & M_R_D_C	6	10							6	50		
I_Mat & M(sub_h)_R_D_C	1	1.7					1	8.3				
I_Mat & M_R(sub_h)_D_C	1	1.7	1	8.35								
I_Mat & M_R_D(sub_h)_C	1	1.7							1	8.3		
I_Mat & M(sub_h)_R(sub_h)_D_C	4	6.7							4	33.4		
I_Mat & M(sub_h)_R_D(sub_h)_C	1	1.7							1	8.3		
I_Mat & M(sub_h)_R (sub_h)_D (sub_h)_C	1	1.7	1	8.35								
<b>[I]_Mat &amp; M_R &amp; D</b>	<b>9</b>	<b>15</b>									<b>9</b>	<b>75</b>
[I]_Mat & M_R & D	1	1.7									1	8.3
[I]_Mat & M_R & D (sub_h)	2	3.3									2	16.7
[I]_Mat & M (sub_h)_R & D (sub_h)	6	10									6	50
<b>I_M_R &amp; D_C</b>	<b>8</b>	<b>13.3</b>			<b>8</b>	<b>66.6</b>						
I_M_R & D_C	6	10			6	50						
I_M (sub_h)_R & D_C	1	1.65			1	8.3						
I_M (sub_h)_R & D(sub_h)_C	1	1.65			1	8.3						
<b>I_M_R_D_C</b>	<b>3</b>	<b>5</b>			<b>3</b>	<b>25</b>						
I_M_R_D_C	2	3.35			2	16.7						
I_M_R_D (sub_h)_C	1	1.65			1	8.3						
<b>[I]_Mat &amp; M_R_D</b>	<b>3</b>	<b>5</b>									<b>3</b>	<b>25</b>
[I]_Mat & M_R_D	1	1.7									1	8.3
[I]_Mat & M_R_D (sub_h)	1	1.7									1	8.3
[I]_Mat & M (sub_h)_R_D (sub_h)	1	1.7									1	8.3
<b>I_Mat &amp; M_R_C</b>	<b>1</b>	<b>1.7</b>	<b>1</b>	<b>8.3</b>								
I_Mat & M(sub_h)_R_C	1	1.7	1	8.3								
<b>I_M_R &amp; D</b>	<b>1</b>	<b>1.7</b>			<b>1</b>	<b>8.3</b>						
I_M_R & D (sub_h)	1	1.7			1	8.3						

Overall, this study did not identify any national or journal specific characteristics in the labelling of sections and subsections, or in their arrangement within the body of the text of RAs published in Ukrainian scientific journals. However, RAs in four out of the five journals under study – *B & C*, *FZh*, *SB*, and *UBJ* – contained duplicates of the *title*, *abstract* and *key words* both in the English and Ukrainian languages. The Ukrainian versions of these structural RA units usually appeared after the main text in English either before (*FZh*, *UBJ*) or after (*B & C*, *SB*) the **References**. The presence of a Ukrainian translation of the *title*, *abstract* and *key words* seems to be the only national specific tendency found in the life science journals published in Ukraine.

**Conclusions.** Analysis of the structural organization of research papers written by non-native English speakers and published in Ukrainian scientific journals in biology and environmental sciences revealed the following trends:

1) all RAs examined followed the conventional structuring standards generally based on the IMRD pattern. Section headings were mostly of the standard functional type. On the contrary, subsections used a great variety of content type headings, which clearly indicated their field relevance to the life sciences;

2) a number of organizational patterns were identified based on the labelling and ordering of sections and the presence of subsection headings. The **I\_Mat & M\_R & D\_C** and **I\_Mat & M\_R\_D\_C** patterns were the most common with subheadings included in the Mat & M or R & D sections, or both. Subsections were never found in the **Introduction** or **Conclusion(s)**;

3) the only feature that differentiated the RAs in Ukrainian journals under study from their counterparts published in the English language environment was the presence of Ukrainian translations of the title, abstract, and key words, which was found in three out of five journals.

Considering the dearth of studies on research articles written by Ukrainian authors in English, particularly in life sciences, further in-depths research into the macro- and microstructure of such texts, studies on their rhetorical moves and strategies, discourse and genre analyses are necessary. For example, it seems reasonable to carry out move/step analyses of separate structural units within RAs of Ukrainian authorship, such as the **Introduction**, **Materials and Methods**, **Results**, etc., to identify any peculiarities of Ukrainian academic writing conventions within the field of life sciences. Such studies could have some pedagogical implications, particularly with regard to designing courses of English for academic purposes for Ukrainian researchers.

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## МАКРОСТРУКТУРА АНГЛОМОВНИХ НАУКОВИХ СТАТЕЙ УКРАЇНСЬКОГО АВТОРСТВА У ГАЛУЗІ НАУК ПРО ЖИТТЯ

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У статті розглянуто моделі макроструктури наукових статей у галузі наук про життя, опублікованих українськими журналами, на основі аналізу заголовків розділів і підрозділів та їхнього впорядкування. Корпус дослідження складається з 60 оригінальних наукових статей, написаних англійською мовою та опублікованих у п'яти наукових журналах у галузі біології та наук про довкілля в Україні у 2023–2024 роках. Зафіксовані заголовки були класифіковані відповідно до їхнього типу. Функціональні заголовки були опрацьовані кількісно, а змістові – за допомогою аналізу ключових слів. На основі маркування, складу та впорядкування розділів були побудовані та порівняні їхні структурні моделі. Дослідження показало, що у розглянутих статтях дотримано загальноприйнятих стандартів структурування за зразком IMRD. Більшість заголовків розділів були стандартного функціонального типу, тоді як заголовки підрозділів – переважно змістового типу. Виявлено, що домінуючими моделями макроструктури були I\_Mat & M\_R & D\_C та I\_Mat & M\_R\_D\_C з підзаголовками, включеними до розділів Mat & M або R & D. Суттєвих відхилень від міжнародних стандартів структурування наукових статей не зафіксовано.

*Ключові слова:* наукова стаття, модель макроструктури, заголовок розділу, підзаголовок, структура IMRD.