

ФИЛОЛОГИЧЕСКИЕ НАУКИ

УДК 81

О.С. Муранова

Университет штата Оклахома, Стилуотер, США

О ЛИНГВИСТИЧЕСКИХ ФОРМАХ ВВЕДЕНИЯ НАУЧНЫХ ТЕРМИНОВ В ЗАГОЛОВКИ И ТЕКСТЫ

Аннотация. Среди научно-популярных изданий наиболее распространенным типом является научно-популярная статья (НПС). Изображения, включенные в НПС, обычно сопровождаются подписями, содержащими авторские объяснения некоторых особенностей процессов или объектов, изображенных в них и описанных в основном тексте статей. Основной целью данного исследования является изучение различных языковых форм введения научных терминов в подписи к изображениям и основной текст НПС, публикуемых в журналах *National Geographic* и *Discover*. Результаты показывают, что поскольку статьи, публикуемые в этих журналах, адресованы различным категориям читателей, они характеризуются использованием нескольких общих и различных форм введения научных терминов (например, дача авторской оценки конкретного явления с помощью персонификации в НПС из *National Geographic* и представление истории, связанной с конкретным явлением в СРП из *Discover*). Это говорит о том, что использование НПС на занятиях по английскому языку для специальных целей может помочь учащимся обогатить собственный спектр языковых средств, применимых в различных коммуникативных ситуациях (например, при попытке убедить кого-либо в том, что их точка зрения обоснована, или при представлении необходимой фактической информации в связанном виде и т. д.).

Ключевые слова: научно-популярные статьи; научные термины; подписи.

O.S. Muranova

Oklahoma State University, Stillwater, USA

ON THE LINGUISTIC FORMS OF INTRODUCING SCIENTIFIC TERMS INTO THE CAPTIONS AND TEXT

Abstract. Among popular science publications, the most common type is the Popular Science Article (PSA). Images included in PSAs are typically accompanied by captions containing the author's explanations of certain features of processes or objects depicted in them and described in the main

text of the articles. The main purpose of this study is to investigate various linguistic forms of introducing scientific terms into captions of the images and the main text of the PSAs published in the *National Geographic* and *Discover* magazines. Results show that, since the articles published in these magazines are addressed to different categories of readers, they are characterized by the use of several common and varying form of introducing scientific terms (e. g. giving the author's evaluation of a specific phenomenon with the help of personification in the PSAs from *National Geographic* and presenting a story connected with a particular phenomenon in the PSAs from *Discover*). This suggests that using PSAs at ESP lessons can help learners enrich their own range of the linguistic means applicable in different communicative situations (for example, when trying to convince somebody that their point of view is well-justified, or when presenting the necessary factual information in a coherent way, etc.).

Keywords: popular science articles; scientific terms; captions.

1 Introduction

The growing importance of popular science publications led to the necessity of conducting research on various language and pragmatic features that make communication between specialists and laymen more effective. Among popular science publications, the most common type is the Popular Science Article (PSA), both in printed and electronic formats [5; 17; 25]. Several studies have focused on specific individual features of this kind of popular science writing, including the use of hedging [16; 29] and reporting verbs [8]. Several recent studies also compared some individual language and pragmatic features typical of research and PSAs with their source texts, – that is, the research articles published in specialized journals [4; 8; 16; 19; 20; 24; 25; 30]. For example, in their study, Parkinson and Adendorff [25] compared the sources of information, degree of objectivity, reader-writer interrelations, and interpersonal differences between PSAs and academic texts, including research articles and textbooks. Based on the general qualitative analysis of these three types of publications, the researchers concluded that PSAs differ significantly from academic texts at the level of register. This difference influences the choice and use of different linguistic means in both types of texts.

One of the differences between PSAs (and popular science texts in general) and academic texts is connected with the frequency and ways of using scientific terms. Although the number of scientific terms used in PSAs is smaller than in purely scientific texts, terms remain as one of the main linguistic features used to convey factual information in both types of texts. In fact, the use of terms allows the authors of PSAs to communicate new ideas and associations to the readers as they become familiar with the subject-matter [1].

The choice of certain forms of introducing new terms into PSAs depends on the ways writers *frame* information for their target readers. According to Hyland [16], framing is achieved by tailoring information to the assumed knowledge base of potential readers, creating proximity for different audiences through language choices which are most likely to meet their readers' expectations. Since the writers of PSAs do not expect readers to be specialists, they tend to use fewer technical terms and provide meanings of the technical terms they do use [1]. Therefore, writers need to choose only the most central terms; besides, they should consider whether those terms need to be explained and illustrated so that their narration would be interesting and accessible to the general public [17; 26]. This need determines the choice of certain forms of introducing and using new terms in the text of PSAs. For instance, writers may need to explain the etymology or origin of a new term, emphasize the most important features of the object or phenomenon, mention a new term in parentheses, provide a definition, mention some individual characteristics, and/or present examples [17].

Along with textual information, PSAs published in printed magazines usually include some photos, graphics, schemas, and other kinds of images illustrating the scientific phenomena discussed in the text. Images are widely used for presenting highly specialized scientific or ecological research to different categories of non-specialists [10]. The main function of the images used in PSAs is to represent scientific processes and phenomena that may not be familiar to the layperson. When combined with texts, images can also be used for defining and conveying essential meanings, demonstrating ideas, persuading the reader, or proposing action [10]. Thus, it means that in PSAs and in many other types of texts, images can *perform not only the informative but also* argumentative, illustrative, substitutive, and persuasive functions. However, as PSAs are aimed, first of all, to make research accessible to the general public, images are mainly used for conveying factual information in a more engaging way.

Images included in PSAs are usually accompanied by captions in which the authors provide their descriptions or explanations of certain features of processes or objects depicted in those images. In many cases, the authors of PSAs introduce new terms into the text of captions. Some studies have contributed much to our understanding of some linguistic forms of introducing new terms into PSAs [1; 16; 17; 25; 26]. However, very a little research has been done into the ways of presenting scientific information in the captions accompanying images.

Therefore, more in-depth studies need to be conducted for revealing and describing the linguistic devices used in captions to convey factual information in a more compact and illustrative way. The present study is aimed at investigating various forms of representing scientific information in the images and

captions included in the text of PSAs. It addresses the following research questions:

1 What linguistic forms introduce scientific terms into captions in PSAs and to what extent does the source of publication determine the use of these linguistic forms?

2 What differences can be observed in the methods of introducing the same terms into the captions and text of the same articles from two different popular science magazines (*National Geographic* and *Discover*)?

Thus, the main purpose of this study is to determine and analyze the major methods of introducing scientific terms into the captions and text of PSAs published in two magazines intended for different categories of non-specialist audiences. With the help of the results obtained in this study, I hope to be able to identify and provide more or less systematic description of the most important linguistic forms of introducing new terms into this kind of popular science texts.

2 Research Design

This study used qualitative descriptive analysis to inquire into the major ways of using terms in PSAs. It was based on the analysis of the captions accompanying the images included in a sample of articles from two popular science magazines. I define PSAs as texts which are initially published in magazines or on Web-sites intended for non-specialist target audiences and which are written for the purposes of conveying some scientific content. At the same time, PSAs may also contain their authors' personal evaluations, opinions and interpretations of the things discussed in those articles [1; 17]. Thus, it is logical to conclude that PSAs may include both factual and emotional or evaluative information.

The evidence presented in this paper was collected from 12 popular science articles about ocean life (see Appendix). All articles investigated in this study were written by the experts in the fields related to the subject of the articles. Originally they were published in different issues of the US printed magazines *National Geographic* and *Discover*. These two magazines were chosen because they are intended for different categories of readers. According to the information provided on the website of *National Geographic*, the materials published in this magazine are intended for non-specialist target audiences, which means that the readers of these articles can be people of different age, having different educational background and different degree of familiarity with the subject-matter of the article. As this magazine contains not only scientific articles, but also some materials on other topics, some readers may not be interested and/or not familiar with certain areas of science discussed in some of the articles.

The *Discover* website [9] indicates that the materials of this magazine are intended for people interested in biology, astronomy, physics, chemistry, and a wide range of areas of the natural sciences in

general (e. g. anatomy, physiology, ecology, geography, geology, among others). Compared to *National Geographic*, the potential readers of this magazine should be already familiar with certain areas of science (and with science in general) by the time they start reading *Discover*. Using this material for the purposes of the study should help us understand whether the target audience of the articles determines the choice and actual methods of introducing scientific terms into the captions and text of PSAs.

3 Data Analysis and Findings

3.1 Common Forms of Introducing Scientific Terms into the Captions Accompanying the Images in PSAs in *National Geographic* and *Discover*

Most of the terms used in the captions in *National Geographic* and *Discover* denote biological species as well as biological families, classes and types. The analysis suggests that several linguistic forms of introducing scientific terms into captions are used in both magazines. All these forms are summarized in Table 1.

Table 1 – Common Methods of Introducing Scientific Terms into the Captions in the Popular Science Articles Published in *National Geographic* and *Discover*

Linguistic forms revealed in the captions in <i>National Geographic</i> and <i>Discover</i>	The number of occurrences in the corpus of the study
Mentioning one or two important features or details about a certain biological species	25
Providing a more detailed description of a certain phenomenon or biological species	13
Mentioning only the term itself	10
Providing a common name for several kinds of closely related biological species	6
Total	54

As shown in Table 1, in both magazines, mentioning one or two important features or details about a certain kind of organism is the most popular method of introducing new terms into captions. For example, in his article published in *Discover*, Bosweld (2009) describes the mechanism of bioluminescence used by different kinds of marine animals as an adaptation to life in dim-light environments. To make his explanations more accessible to the general public, the author includes several photos of the marine organisms using bioluminescence for attracting mates, luring prey, startling predators, protecting themselves during the day, among other purposes. All these images are accompanied with short captions introducing certain species to the readers, for example¹ (see figure 1):

¹ With a few exceptions, italics on scientific terms in all captions and examples from the text of PSAs cited in this paper are mine.



A hatchetfish showing off its glow

Figure 1 – Taken from Bosweld (2009), published in *Discover*

In this example, the author gives the name of the fish presented in the picture (*hatchetfish*); at the same time, he mentions one of its characteristics (“showing off its glow”) which is relevant to the content of the article. In this case the author does not need to provide a detailed description of hatchetfish, since the article is intended for non-specialist audiences and since the author mentions this particular kind of fish to illustrate his explanations about the phenomenon of bioluminescence described in the text of the article.

In some cases, the authors of some PSAs analyzed in this study used the Latin names of certain species when mentioning them in the captions. For example, when introducing a bioluminescent jellyfish, Bosweld (2009) provides its Latin name (see figure 2).



The light-emitting jellyfish *Atolla wyvillei*

Figure 2 – Taken from Bosweld (2009), published in *Discover*

In this case, the author does not mention the English name of the species presented in this photo; this is explained by the fact that the English name for this kind of jellyfish has not been suggested yet. At the same time, to let the reader infer the necessary scientific information, the author gives the name of the superordinate taxonomic rank to which this species belongs (jellyfish) and indicates its physiological characteristic related to the topic of the article (“light-emitting”). To make it easier for the reader to understand that *Atolla wyvillei* is the Latin name of the species presented in this picture, the author also used italics when mentioning it in the caption. Combining these linguistic and visual devices helps the author introduce a new term and the necessary factual information in a more compact and clearer form.

In some captions analyzed in this study, it was possible to find more detailed descriptions of the features of certain biological species. When writing about the use of spines by sea urchins in an article published in *Discover*, Rabinovich (2005) uses a series of electron micrographs illustrating different stages of the process of crystallization taking place when these organisms begin to regenerate their spines, for example in figure 3.

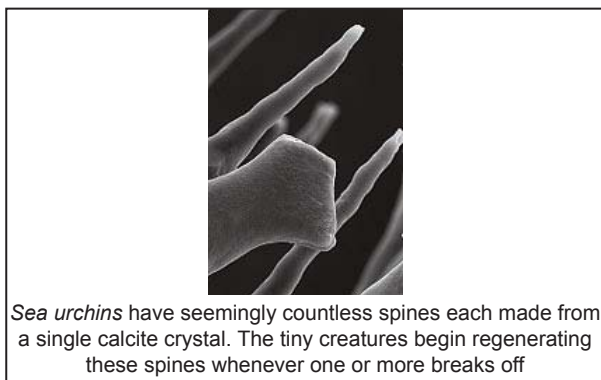


Figure 3 – Taken from Rabinovich (2005), published in *Discover*

In this caption, the author writes about several characteristics of sea urchins, including the number of the spines they have (“seemingly countless spines”), the materials their spines are made of (“made from a single calcite crystal”), and the ability of sea urchins to regenerate their spines (“The tiny creatures begin regenerating these spines whenever one or more breaks off”). However, when the author introduces the term *sea urchins* (or its shortened variant – *urchins*) into the text of the article, he mentions only individual features of these marine organisms:

- “Sea urchins may not have brains, but they’ve managed to outsmart the scientists studying them by growing their sharp spines in ways that seem to defy the laws of nature”;
- “Sea urchins use spines for protection from predators and for locomotion”; or
- “More extraordinary is how urchins go about regenerating spines that have broken off”.

Describing several features of sea urchins in the caption mentioned above allows the author to convey the necessary scientific information in a denser and more compact form than in the text. For instance, combining the use of images and verbal explanations enables Rabinovich (2005) to mention several characteristics of sea urchins while still making the scientific content accessible to non-specialist audiences. At the same time, the differences observed in the presentation of the same terms in the captions and in the text suggest that the ways of using these linguistic forms is determined by different contextual factors (e.g. communicative and pragmatic purposes of the author of a concrete article, its subject, target audience, among other factors).

Along with mentioning and describing some typical features of certain biological species, some other linguistic forms of introducing new scientific terms into captions are commonly used in the articles published in *Discover* and *National Geographic* as well. For example, in those cases when a term is widely used by non-specialists or when its meaning can be easily inferred by the lay reader from the context and from the images, authors may just mention the necessary terms in the captions accompanying the images, without providing any additional information. In an article published in *National Geographic*, Lee (2014) discusses some long-term effects of a newly identified virus killing millions of starfish up and down the West Coast of North America. The article also includes several illustrations showing some examples of starfish species being killed by that virus. In the captions accompanying some of those illustrations, the author mentions different kinds of marine animals affected by the virus described in the article (see figure 4):

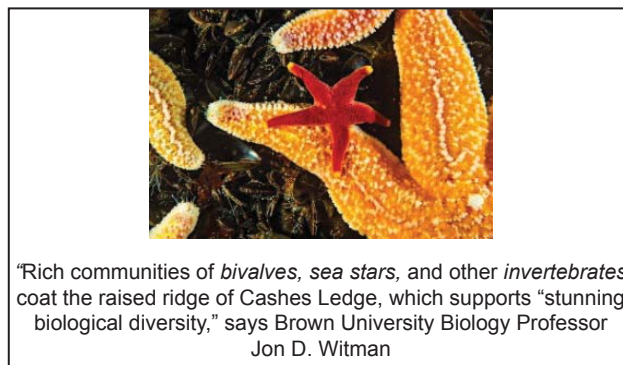


Figure 4 – Taken from Lee (2014), published in *National Geographic*

In this caption, the author uses several terms at the same time (*bivalves*, *sea stars*, and *invertebrates*). The terms *bivalves* and *sea stars* are widely used in everyday language. Moreover, it can be easily inferred from the context and from the picture that the term *invertebrates* denotes the superordinate taxonomic rank which *bivalves* and *sea stars* belong to. For these reasons the author does not provide any additional descriptions. Later she also introduces these terms into the text of the article.

Sea stars are linchpins in the ecology of habitats like tide pools, said Robert Paine, a retired marine ecologist at the University of Washington in Seattle, in an interview earlier this year. Without them around to control mussels, the *bivalves* can take over an area, greatly reducing the kinds of algae and sea anemones present (Lee, 2014).

Since the terms *bivalves* and *sea stars* were already mentioned in one of the captions and since they should be familiar to the lay reader, when introducing them into the text of the article, the author does not provide any definitions or additional details.

In many other articles analyzed in this study,

the above-mentioned terms are introduced into the caption within a direct quotation conveying the words of one of the author's colleagues. Previous studies [8; 11] suggest that introducing explicit and implicit markers of intertextuality (including direct quotations) into the text of PSAs allows authors to convince the reader that their assumptions about the questions discussed in those articles are true-to-life and well-justified. It is also possible to assume that introducing new terms into captions with the help of direct quotations serves, at least, two purposes. On the one hand, it increases the credibility of the text. *On the other hand, terms and quotations may help readers become familiar with different approaches and opinions related to the subject of the PSAs.*

Providing a common name for several kinds of closely related biological species is another linguistic form of introducing new terms which was revealed in the captions in the articles published in *National Geographic* and *Discover*. For instance, in an article published in *National Geographic*, Howard (2014) uses the following illustration (see figure 5):

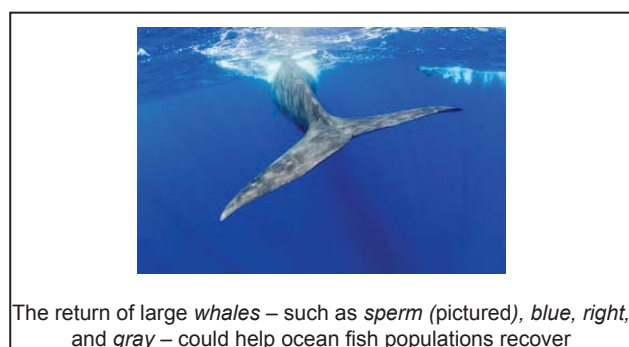


Figure 5 – Taken from Howard (2014), published in *National Geographic*

Mentioning a common name (*large whales*) for several closely related biological species enlisted in this caption allows the author to introduce the necessary terms in a more compact way. Later he resorts to the same technique of introducing those terms in the text of the article as well:

An increase in the number of large *whales* – like *blue*, *sperm*, *right*, and *gray* – around the world could lead to a healthier ocean and more fish, a team of scientists report in a review study published this month in the journal *Frontiers in Ecology and the Environment* (Howard, 2014).

The use of the same technique of introducing the necessary terms both into the caption and into the text can be explained by the fact that these terms denoting different kinds of whales should be pretty familiar to the general public. The author preferred to introduce these terms with the help of a common name encompassing different species mentioned in the caption and in the text, without the use of explicit definitions, detailed descriptions, or synonyms.

In some cases, the use of the adverb *particularly* and the subordinating conjunctions *like*, *such as* and *including* makes it easier for the reader to see the connections between more general and more specific terms introduced into captions, for example in figure 6:

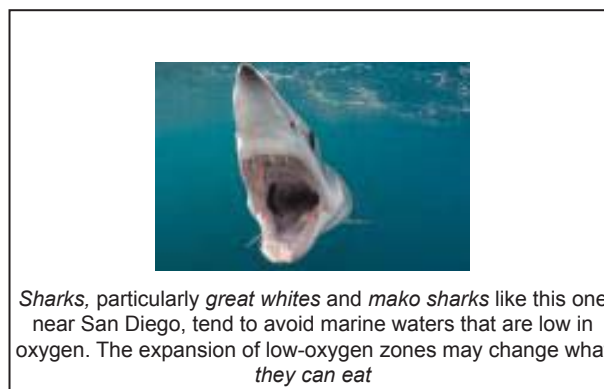


Figure 6 – Taken from Welch (2015), published in *National Geographic*

In this example taken from *National Geographic*, Welch (2015) introduces the terms *great whites* and *mako sharks* preceded by the common name for both of those species (*sharks*). The use of the adverb *particularly* makes it clear for the reader that both terms used in this caption denote different kinds of sharks (even if the word “shark” is not mentioned in the term itself). At the same time, the subordinating conjunction *like* in the phrase “like this one”, which is used after one of these new terms, signals the reader that the image accompanied by this caption depicts a mako shark. Thus, *using adverbs and subordinating conjunctions together with new scientific terms helped the author of this and some other articles analyzed in this study convey the necessary factual information in a coherent way. At the same time, conjunctions helped establishing explicit connections between the images and the captions accompanying them in the text of PSAs.*

3.2 Specific Forms of Introducing Scientific Terms into the Captions Accompanying the Images in the Text of PSAs Published in *National Geographic*

The data analysis suggests that, along with different methods of introducing new terms described above, the captions included in the text of the articles published in *National Geographic* are characterized by the use of some other linguistic forms as well. Table 2 outlines specific forms of introducing new terms into captions found in the articles from *National Geographic*.

As shown in Table 2, in some cases the authors of the articles from *National Geographic* resort to the use of the synonyms which should be already familiar to the general public (see figure 7).

Table 2 – Specific Methods of Introducing Scientific Terms into the Captions in the Popular Science Articles Published in *National Geographic*

Linguistic forms revealed in the captions in <i>National Geographic</i>	The number of occurrences in the corpus of the study
Providing a synonym of a scientific term which should be familiar to the general public	5

Continuation of table 2

Using the word “called” when introducing a new term	4
Giving different variants of the same term	3
Giving the author’s evaluation of the species or phenomenon denoted by a new term with the help of personification	3
Providing a real-life example before introducing a new term	2
Total	17

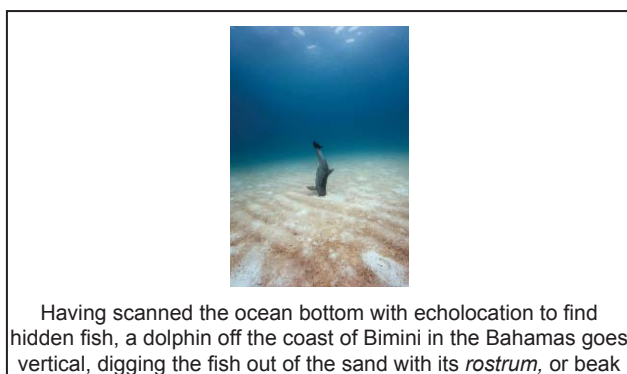


Figure 7 – Taken from Foer (2015), published in *National Geographic*

When introducing the term *rostrum* into the caption, Foer (2015) uses the word “beak”, which has a more general meaning and is often employed in different kinds of texts and discourses, but not only in scientific communication. Later the author also provides this synonym when introducing the same term into the caption accompanying one of the images presenting some examples of dolphin behaviors (see figure 8).

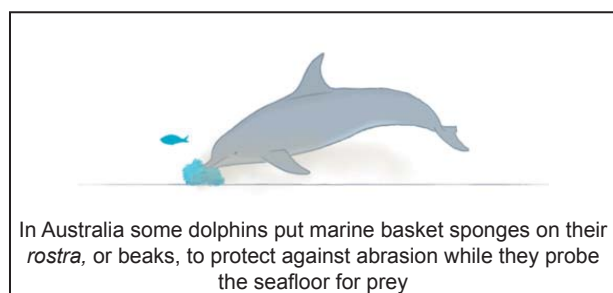


Figure 8 – Taken from Foer (2015), published in *National Geographic*

It is interesting that in this caption, Foer (2015) uses the same term (*rostrum*) in plural (*rostra*). The fact that the plural form of the word *rostrum* is irregularly inflected was probably the main reason for introducing the same term with the help of the same synonym into another caption too. When mentioning this term in the text of the article, the author resorted to the use of the same synonym (*beaks*) as well: “Head trainer Teri Turner Bolton looks out at two young adult male dolphins, Hector and Han, whose beaks, or rostra, are poking above the water as they eagerly await a command” (Foer, 2015). While in this case the words “beak” and “rostrum” are used in plural, a little bit later the singular form of the term “rostrum” appears in the text of this article as well: “One of the dolphins swims over, grabs the piece of fabric, and moves it back and forth from its rostrum to its pectoral fin”. However, since both the singular and plural forms of this term have already been introduced into the captions, in the text the author does not give the synonym of this term but just mentions it. This example suggests that it is possible to speak about the existence of a close interconnection between the images, the captions accompanying them, and the text of PSAs.

It is also necessary to note here that, unlike the captions in which the synonym “beak” (or “beaks”) follows the term *rostrum* (or *rostra*), in the text of the article, the same synonym is used before the new term. This seems to be quite reasonable, since the word “beak” should be already familiar to the lay reader before he/she starts reading the article. Mentioning the synonym (“beak” or “beaks”) after the term (“rostrum” or “rostra”) in the captions cited above can be probably explained by the fact that these captions are accompanied by photographs. The images help the intended readers of the article to adequately understand the scientific information which is presented in those captions. These differences in the methods of introducing a new term into the captions and text can be probably connected with the necessity to make the content of different parts of the article *clearer and more accessible to its potential readers*.

The results of this analysis suggest that several other linguistic forms of introducing new terms into captions can also be observed in the articles published in *National Geographic*. For example, the use of the word “called” before mentioning a new term signals the reader that the author is going to introduce a new scientific term connected with the subject of the article as in figure 9.

In this caption, Kaufman (2005) mentions the term *chromatophores* in his description of some physiological features peculiar to the crescent-tailed bigeye fish. As this example shows, the use of the word *called* enables the author of the article to introduce the term itself and its short explanation in the caption without additional sentences. This makes the text of the caption more compact and more informative at the same time. Also, the use of the word

called in the caption allows the author to introduce the term chromatophores into the text in a more compact way too: “Controlled by both neurons and hormones, *chromatophores* create the appearance of color or pattern through pigments and light manipulation” (Kaufmann, 2005). Moreover, in this case, the author does not need to provide an explicit definition or detailed explanation of the term, since its meaning has already been explained in the caption. Therefore, when introducing the term into the text for the first time, the author just mentions two details about chromatophores and their functions (“controlled by both neurons and hormones”; “create the appearance of color or pattern through pigments and light manipulation”). This textual evidence points to the existence of clear connections between the methods of introducing the same terms into the captions and text of the same article.



A crescent-tailed bigeye (*Priacanthus hamrur*) seems to wear its emotions on its sleeve—or on its whole body. This sequence of three frames of the same fish shows how it can change from largely silver to striped to solid orange-red, a transformation that occurs in a matter of seconds. Pigment cells in its skin, called *chromatophores*, allow it to change color, but scientists don't yet know what each color pattern signifies. Sometimes a sudden shift in color can be used to startle potential predators or threaten intruders. Red light dissipates beyond about 30 feet (10 meters), so the reddish hue of this fish would appear black in deeper waters, allowing some degree of invisibility for this nocturnal hunter

Figure 9 – Taken from Kaufman (2005), published in *National Geographic*

It is also important to mention here that, unlike some other captions analyzed in this study, in this particular caption (Figure 9), the Latin name of the species (*Priacanthus hamrur*) was not italicized in the original. However, the term was given in parentheses after the English name (crescent-tailed bigeye). This can be probably explained by the fact that this caption does not only contains the Latin, but also the English name of the species presented in the picture. The use of parentheses in such cases enables their authors to separate the Latin and English names of the same species in the text of the captions, which makes it easier for the reader to perceive and understand their content properly.

Along with the use of the word “called”, some other forms of introducing the necessary terms in a compact way could be observed in other PSAs as well. In some cases, Foer (2015) introduces two variants of the same term as in figure 10.

After using a longer and more official variant of a new scientific term (*spinner dolphins*) at the beginning of the caption, the author then provides its shorter and more colloquial variant (*spinners*). The use of evaluative adjectives “garrulous” and “gregarious” enables the author to convey the necessary factual and emotional/evaluative information in a more illustrative and expressive way. The adjectives *garrulous* and *gregarious* also contain the elements of personification, as the characteristics denoted by them are typically associated with some certain forms of human behavior. In the context of this article, interpreting spinner dolphins' behavior with the help of “human terms” enables the author to achieve clarity and memorability of its factual content while making his scientific narration more attractive and accessible to the general public.



Spinner dolphins return from foraging to a bay off Oahu, Hawaii. Garrulous and gregarious, *spinners* gather in groups that can number in the thousands

Figure 10 – Taken from Foer (2015), published in *National Geographic*

The use of evaluative adjectives accompanying new terms and containing the elements of personification could also be observed in the captions used in some other articles from *National Geographic* (see figure 11).



A voracious predator, the *bluefin* feeds mainly on small fish, crustaceans, and squid

Figure 11 – Taken from Brower (2014), published in *National Geographic*

As shown in Figure 11, Brower (2014) uses the evaluative adjective *voracious* before introducing a new fish species (*bluefin*), which makes his description of this species more vivid and dynamic. At the same time, the caption cited above also includes some information about the usual ration of this kind of fish. This information is conveyed via the use of

stylistically neutral vocabulary (feeds, mainly, small, etc.) and the terms which should be already familiar to the general public (fish, crustaceans, squid). The simultaneous use of terms, stylistically neutral and evaluative lexical units suggests close connection of the factual and emotional-evaluative information conveyed in the text of PSAs dedicated to the questions of ocean life.

Mentioning a specific characteristic of some species and providing an example of some particular species possessing that same characteristic enables the authors of PSAs to make their narration more informative and interesting for non-specialist audiences. In his article, Foer (2015) makes his explanations about dolphin behavior more illustrative and clearer to the layman audience by providing examples of behavior typical of certain kinds of dolphins (see figure 12).

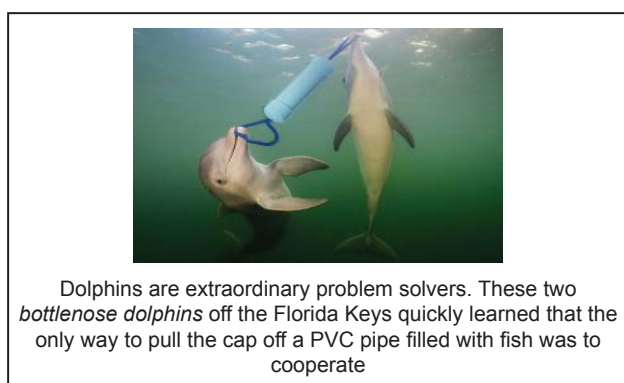


Figure 12 – Taken from Foer (2015), published in *National Geographic*

Since the author mentions *bottlenose dolphins* just for illustrating his statement that dolphins are particularly good at solving problems, he does not need to provide a detailed description of one or more features or characteristics of these dolphins. The sentence “Dolphins are extraordinary problem solvers” and an example of bottlenose dolphins’ behavior allow the author to foster **in the reader’s mind some new ideas, thoughts, and associations connected with this particular kind of dolphins.**

At the same time, when describing the cognitive abilities of some kinds of dolphins, Foer (2015) provides a real-life example before introducing a new term.

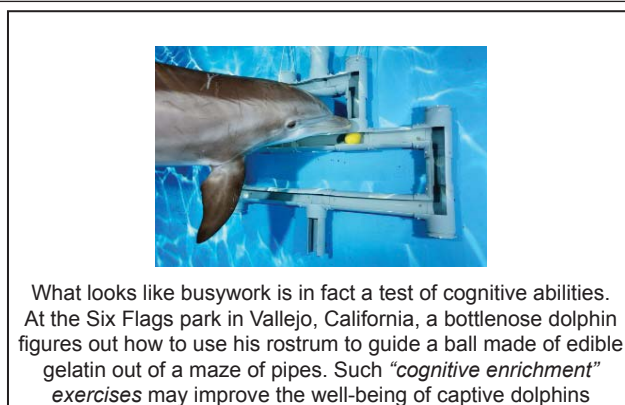


Figure 13 – Taken from Foer (2015), published in *National Geographic*

In this caption, Foer (2015) mentions the term *cognitive enrichment exercises* only after referring to a real-life example of dolphin behavior in captivity. Providing such an example before mentioning the term itself helps the author avoid the necessity to use explicit definitions and long scientific explanations. Furthermore, including a real-life example in the caption containing a new term enables him to convey the necessary scientific content to the layperson in a more engaging way. *In its turn, this example should motivate the readers to explore the subject of the article in more detail after they finish reading it.*

3.3 Specific Forms of Introducing Scientific Terms into the Captions Accompanying the Images in the Text of Popular Science Articles Published in *Discover*

As it was mentioned earlier, the materials published in *Discover* are intended, first of all, for those readers who are already familiar with some areas of science and who are already interested in exploring some questions connected with certain areas of science in more detail. Nevertheless, the results of this analysis suggest that the authors of those materials resort to the use of some specific forms of introducing new terms into captions too, as it helps them make their narration clearer and more accessible or interesting for non-specialist audiences as well. These forms are presented in Table 3.

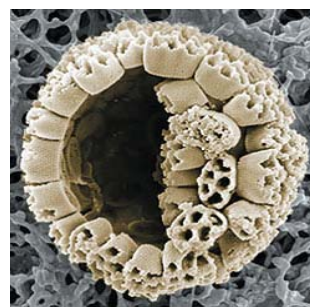
Table 3 – Specific Methods of Introducing Scientific Terms into the Captions in the Popular Science Articles Published in *Discover*

Linguistic forms revealed in the captions in <i>Discover</i>	The number of occurrences in the corpus of the study
Providing a brief explicit definition of a new term	5
Presenting a story of some certain specimen of a biological species	3
Total	8

As shown in Table 3, providing a brief explicit definition of a new term can be regarded as one of such specific ways of introducing new terms into the captions in *Discover*.

In this caption (see figure 14), Amato (2004) introduces several terms at the same time. Although in most cases the author mentions only some typical characteristics of the organisms mentioned in the article, which are relevant to the content of the article, he still provides the explicit definitions of two more general terms. At the beginning of the caption, the first term (*plankton*) is defined as “waterborne animals or plants that cannot swim against an ambient current”, while the second term (*phytoplankton*) is presented as a group of “single-celled plants”. Later Amato (2004) also gives a brief definition of *marine plants* (“meaning they live in salt water”) when speaking about two different types of plankton (*coccolithophorids* and *dinoflagellates*). It is possible to assume that providing definitions of those terms which are superordinate of the other terms mentioned in this caption (*coccolithophorids*, *diatoms*, *dinoflagellates*, *Syracolithus quadriperforatus*, and *Cyclotella pseudostelligera*) lets the author make his explanations more structured and coherent. Besides, this way the author can facilitate the reader’s ability to make the necessary connections between the concepts introduced into this caption with the help of several scientific terms mentioned above more efficiently.

It is also important to mention here that when introducing the term “plankton” into the text, the author mentions only one detail about this group of marine organisms: “*Plankton* are literally at the bottom of the food chain, a source of nourishment for virtually every animal in the sea”. It is possible to assume that, as in some previous examples, the information density of many captions analyzed in this study tends to be higher than that of their texts. Perhaps this tendency can be explained by the fact that presence of images makes it easier for the readers to perceive and understand the necessary scientific information conveyed in the captions accompanying those images. This enables the authors of those articles to make captions more concise and more informatively dense at the same time.

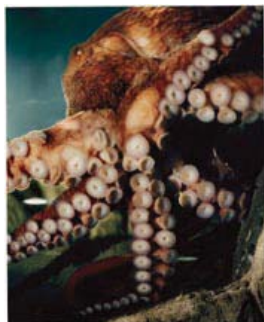


By definition, *plankton* are waterborne animals or plants that cannot swim against an ambient current. For the most part they float, although some can maneuver as long as they “go with the flow.” *Phytoplankton* are single-celled plants. The largest can be divided into three groups: *coccolithophorids*, *diatoms*, and *dinoflagellates*. The exterior of the *coccolithophorid* at right, a *Syracolithus quadriperforatus*, is made of calcium carbonate, the stuff of chalk. By contrast, the shell of the diatom *Cyclotella pseudostelligera* is silica, the material that makes up sand, glass, and quartz. *Coccolithophorids* and *dinoflagellates* are largely *marine plants*, meaning they live in salt water. *Diatoms* exist in both fresh and brackish environments. The oldest diatom fossils are about 140 million years old, leading some scientists to speculate that they evolved along with the ascent of terrestrial grasses, which released silica into the sea after separating it from minerals

Figure 14 – Taken from Amato (2004), published in *Discover*

Presenting a story of some concrete specimen of a certain biological species is another specific form of introducing new terms into the captions in PSAs in *Discover*. For example, in their article, Tsar & Scigliano (2003) speak about different signs of intelligence which have been noticed in octopuses. These signs are not typical of many other invertebrates with short life spans. To illustrate their explanations and to reinforce the credibility of *the factual information presented in this article*, the authors include in the article several images accompanied by the stories about two octopuses whose level of intelligence has been studied by scientists (see figure 15).

As Figure 15 shows, to make his narration more vivid, the author mentions some facts about a giant Pacific octopus using its organs in an unusual way. The use of the direct quotation included in this caption enables the author, on the one hand, to provide additional information about the species. On the other hand, the quotation helps to make the ideas expressed in the text more compelling for the general public. Furthermore, introducing new terms with the help of direct quotations allows the author to preserve the style of speech and terminology used by scientists, which increases the credibility of the narrative.



Three-year-old Pandora, a giant *Pacific octopus* at the Seattle Aquarium, weighs about 45 pounds. Each of her eight arms is about five feet long and lined with 200 suckers, which she uses not only to feel but to taste. "This octopus prefers native littleneck clams to Manila clams [a variety that was introduced into Puget Sound]," says Roland Anderson, a biologist at the aquarium. An octopus also has sharp eyesight

Figure 15 – Taken from Tsar & Scigliano (2003), published in *Discover*

Including in this and some other captions descriptions of the octopuses whose level of intelligence has been investigated by scientists before makes it easier for the reader to perceive and understand some related information provided in the text of the article. For example, in its introductory part, the author mentions some unusual characteristics of octopuses: "Octopuses and their cephalopod cousins – the cuttlefish and the squid – are evolutionary oxymorons: big-brained invertebrates that display many cognitive, behavioral, and affective traits once considered exclusive to the higher vertebrates" (Tsar & Scigliano, 2003). Including real-life stories about octopuses in the captions helps readers understand more precisely what the author means by the "cognitive, behavioral, and affective traits" that can be displayed by these organisms.

4 Discussion and Conclusions

In the present study, a descriptive analysis was conducted to identify the linguistic forms used to introduce terms into the captions of the illustrations and into the text of a sample of PSAs from *National Geographic* and *Discover*. The analysis showed that the writers used some common methods to introduce terms. However, it was also found that some linguistic features that were used for the same purpose were specific of each magazine. The lack of uniformity in the ways of introducing scientific terms into the texts of PSAs can be explained by numerous variations which, as it was shown earlier in Nwogu's study [22], often exist in the discourse structure of popularized texts (including some variations in the ways of combining factual and emotional or evaluative information presented in such texts).

As mentioned earlier, the articles from *National Geographic* and *Discover* are characterized by the use of several common form of introducing scientific terms. In particular, mentioning one or two features/details about the species or phenomenon denoted by a certain term appears to be the most popular meth-

od to introduce new terms in both magazines. This tendency is probably connected with the fact that, by mentioning only those characteristics of the species or phenomena denoted by a term, the authors may make their narration clearer and more accessible to the layman audience. Besides, as shown by Hyland [16], indicating certain characteristics of the entities denoted by scientific terms which relate complex processes to everyday events allows the authors of PSAs and other popular science texts to make the unfamiliar clearer and more intelligible.

Some other common forms of introducing new scientific terms into captions were observed in the two magazines. When a term is widely used by non-specialists and when the meaning can be easily inferred by the lay reader from either context or images, authors often mention those terms in the captions without providing any additional details. On the contrary, in those cases when the readers may not know the terms, writers sometimes provide a more detailed description of the features or characteristics typical of certain biological species. At the same time, including in captions a common name for several kinds of closely related biological species (very often with the help of the adverb "particularly" and the subordinating conjunctions "like", "such as" and "including") allows PSA writers to introduce the necessary terms in a more logical and coherent way. These observations match the findings of Parkinson and Adendorff's study [25] which suggest that providing meanings of scientific terms and making connections between different notions and concepts allow the authors of PSAs to present scientific content in the terms of the commonplace and unexceptional. In addition, as noted by Goncharova and Shishkina [13], providing the explicit connections between different terms and concepts which are mentioned in popular science texts enables their authors to convey the necessary scientific information in a more accessible and precise way.

The use of the Latin names of those species which are mentioned in captions is another common tendency observed in the articles published in *National Geographic* and *Discover*. In some captions accompanying the images in the articles published in these magazines, only the Latin names of certain species are provided. This method may be connected with the absence of appropriate or well-known English names for those species. When introducing Latin names of the species depicted in those images, PSA authors often use italics so that the readers could easily infer that these are the Latin names of the species displayed in those pictures. Additionally, when the English names of certain species are provided in captions too, their Latin equivalents are usually given there in parentheses. With these methods, the writers separate the Latin and English names in the text of the captions, which makes it easier for the readers to perceive and understand the scientific content presented in those captions. As well as in the texts of journal editorials, science blogs, and some other

kinds of popularized texts [12; 17; 18; 19], the use of this and other forms of introducing scientific terms into the captions and text of PSAs discussed above stimulates their readers to find logical connections between different elements of one and the same text, which eventually makes one's understanding of the factual information presented in them deeper and more effective. In this connection, it is possible to assume that PSAs could be effectively applied for teaching ESP (English for Specific Purposes) learners how to identify new terms and their explanations provided by writers in their texts using the markers *like, such as, including, for example*, etc., as well as the Latin names of biological species described in PSAs.

The evidence found also showed that, in some cases, some specific forms of introducing new terms were specifically used in *National Geographic* but not in *Discovery* and vice versa. For example, in the captions accompanying the images presented in the articles published in *National Geographic*, several other linguistic forms of introducing new terms were revealed as well, including:

- mentioning a feature or characteristic of some group of species and providing an;
- example of some particular species having that feature or characteristic;
- providing a synonym of a scientific term which should be familiar to the general public;
- giving different variants of the same term;
- using the word "called" when introducing a new term;
- giving the author's evaluation of the species or phenomenon denoted by a new;
- term with the help of personification;
- providing a real-life example before introducing a new term.

As shown in previous research into the language of popular science texts [16; 17; 31], some of these forms of introducing new terms (namely, providing a real-life example before introducing a new term and mentioning a feature or characteristic of some group of species denoted by a certain term) are widely used in different kinds of popular science and popularized texts. At the same time, some other linguistic forms of introducing scientific terms (such as providing a synonym of a scientific term or giving the author's evaluation of the species or phenomenon denoted by a new term with the help of personification) are more peculiar to the texts of PSAs where their use helps their authors convey the necessary scientific content in a more compact and illustrative way. By using these and the other methods enlisted above, writers can suggest new associations, thoughts, and ideas related to the concepts denoted by those terms. Therefore, it is logical to assume that PSAs can be used by ESP teachers for showing their learners how to infer the meaning of new terms, based on different clues provided in PSAs (for example, the presence of synonymous terms, real-life examples, the lexical marker "called", the author's evaluations combined

with the use of personification, etc.).

The results of this analysis also showed that, compared to the captions used in the *National Geographic* articles, the captions in *Discover* are characterized by a smaller range of the linguistic forms of introducing new terms. Articles published in *National Geographic* are addressed to different categories of readers (including those ones who may not be interested in the questions of science before they become familiar with the content of those articles). This fact may motivate authors to make the content of those articles *more engaging for the general public*. Nevertheless, in some cases, the authors of the articles published in *Discover* resort to the use of some additional forms of introducing new terms as well. In particular, providing definitions of those terms which are superordinate of other terms mentioned in the same caption enables writers to make their explanations more coherent and hence more accessible to non-specialist audiences [12; 15; 18; 19; 20]. At the same time, presenting a story of a certain specimen of a biological species may help authors *make their texts more illustrative and present the questions discussed as interesting and up-to-date*. This corresponds with the findings of some studies [2; 7; 14] which suggest that stories are easier to comprehend and that readers typically find them more engaging than traditional logical-scientific communication. Furthermore, the use of stories in PSAs and other kinds of popular science texts makes scientific explanations less abstract and more concrete [23]. Thus, it is possible to conclude providing a story of a certain specimen of a biological species allows the authors of PSAs to balance their dual goals of reporting objective and accurate factual and scientific information in a more dynamic and engaging way. This tendency can be used by ESP practitioners for teaching their students different strategies of presenting scientific information in such a way that it could be clear for non-specialist audiences as well. These strategies may include the use of related terms familiar to the general public, showing the connections between different terms introduced into one's writing, as well as making scientific narration more vivid and expressive with the help of stories and real-life examples.

It was also found that, in many cases, the same terms which are introduced into captions are later used in the text of the same articles as well. However, sometimes the same terms are introduced in different ways into the captions and text of the same articles. For example, in some captions scientific terms are accompanied with a brief definition. On the contrary, as the findings of this and some previous [16; 17; 27; 28] studies demonstrate, in the text of the same articles, the concepts denoted by the same terms may be introduced by mentioning one or several characteristics typical of the object or phenomenon. Also, while in the captions authors introduce the term followed by a synonym, in the text of the same articles a widely-used synonym was introduced before the term.

Perhaps these and some other possible variations in the methods of introducing new terms are connected to the presence of the images to which captions are attached. As demonstrated by Odintsov [23] and Parkinson and Adendorff [25], compared to purely scientific texts, illustrations in popularisations are less abstract and more likely to supplement explanations provided in the text. In this connection, it is possible to assume that images simplify understanding of terms and of scientific information in general, which makes it possible to use scientific terms more actively in the captions than in the text of the same article. Focusing on the differences observed in the forms of introducing the same terms into the captions and main text of the same article should enable ESP teachers to emphasize the necessity to consider various contextual factors which may influence the ways of using new terms in PSAs, including the presence of images and their connection with the author's explanations, the author's assumptions about the degree of the reader's familiarity with topic of his/her article and with the meaning of the terms introduced into it, the author's communicative and pragmatic purposes, etc.

Finally, as shown earlier, occasionally it was possible to find in the corpus of the study some examples of captions where two different forms of introducing new terms are used simultaneously. For instance, PSA authors sometimes provide a synonym of a scientific term and mention some distinctive feature of a certain object or species in the text of the same caption. According to Lazarevich [17] and Moshtaghi [19], combining different forms of introducing one and the same term or concept into popular science texts allows their authors to make their explanations more detailed and informative. It also allows them to adopt their writing to the potential readers of these articles who can be people of different age, having different educational background as well as different level of interest and current knowledge related to the subject of these articles. Thus, we can conclude that using two different forms of introducing new terms simultaneously may be intended to make the scientific narration more accessible to the audience and more informative at the same time.

The use of linguistic devices together with new scientific terms in the captions and text of the articles analyzed in this study (including evaluative adjectives, direct quotations, more colloquial variants of the same terms, metaphorical expressions, personification, etc.) contributes to present scientific content in a more convincing and expressive form. This corresponds with the findings of some previous related studies [15; 20; 27], according to which the use of clichés, phraseological units, colloquial and evaluative vocabulary as well as different stylistic devices in the text of PSAs enables writers to make their narration more vivid, persuasive and engaging to non-specialist audiences. All these findings suggest that reading and analyzing the texts of PSAs at ESP lessons can help learners enrich their own

range of different linguistic means and devices which they can use in different communicative situations (for example, when trying to convince somebody that their point of view is well-justified and true-to-life, or when presenting the necessary factual information in a logical and coherent way, and so on).

Variations in the forms of introducing new scientific terms into the captions and text of the articles analyzed in this study point to the fact that the target audience of the articles and their authors' assumptions about the degree of readers' familiarity with the subject of the articles need to be regarded as the contextual factors affecting the use of various linguistic forms in the captions and text of PSAs. However, as it was shown earlier, in spite of some variations observed in the methods of introducing new terms into the captions and text of the articles analyzed in this study, some other linguistic forms of introducing new terms are commonly applied in the articles published in both magazines which were used in this study. The existence of these invariant forms lets us make sure that, despite some differences in the ways of using new terms observed in the articles from different magazines, all these texts belong to the genre of popular science article.

List of the data sources used in the present study.

- Amato, I. (2004, August). Plankton planet. Discover, 8. Retrieved from <http://discovermagazine.com/2004/aug/plankton-planet>
- Berglund, J. (2014, July/August). Searching for life in Mexico's underwater caves. Discover, 6. Retrieved from <http://discovermagazine.com/2014/julyaug/16-cave-man>
- Bosweld, J. (2009, July/August). Earth's own aliens: They light up & live in the deep. Discover, 6. Retrieved from <http://discovermagazine.com/2009/jul-aug/05-earths-aliens-light-up-live-deep>
- Brower, K. (2014, March). High-tech tuna researcher uncovers marvels of the big fish? National Geographic, 3. Retrieved from <http://news.nationalgeographic.com/news/2014/03/140301-bluefin-tuna-barbara-block-ocean-fisheries-marine-science/>
- Foer, J. (2015, May). It's time for a conversation. Breaking the communication barrier between dolphins and humans. National Geographic, 5. Retrieved from <http://ngm.nationalgeographic.com/2015/05/dolphin-intelligence/foer-text>
- Howard, B. C. (2014, July). More big whales in ocean could mean more fish, scientists find. National Geographic, 7. Retrieved from <http://news.nationalgeographic.com/news/2014/07/140710-whales-ecosystem-engineers-fish-conservation-science/>
- Kaufman, L. (2005, May). One fish, two fish, red fish, blue fish: Why are coral reefs so colorful?

National Geographic, 5. Retrieved from <http://ngm.nationalgeographic.com/2005/05/coral-reefs/kaufman-text>

Kunzig, R. (2007, June). Sweeping the ocean floor. *Discover*, 5. Retrieved from <http://discovermagazine.com/2007/jun/sweeping-the-ocean-floor/>

Lee, J. J. (2014, November). Why are millions of starfish 'melting'? *National Geographic*, 11. Retrieved from <http://news.nationalgeographic.com/news/2014/11/141117-starfish-dying-epidemic-virus-animal-ocean-science/>

Rabinovich, A. (2005, May). Secret of the spines. *Discover*, 4. Retrieved from <http://discovermagazine.com/2005/may/secret-of-the-spines>

Tsar, J., & Scigliano, E. (2003, October). Through the eye of an octopus. *Discover*, 8. Retrieved from <http://discovermagazine.com/2003/oct/feateye>

Welch, C. (2015, March). Oceans are losing oxygen – and becoming more hostile to life. *National Geographic*, 3. Retrieved from <http://news.nationalgeographic.com/2015/03/150313-oceans-marine-life-climate-change-acidification-oxygen-fish/>

Библиографический список

- 1 Алексеева И. С. Профессиональное обучение переводчиков / И. С. Алексеева. – Санкт-Петербург : Институт иностранных языков, 2000.
- 2 Гончарова Е. А. Интерпретация текста / Е. А. Гончарова, И. П. Шишкина. – Москва : Высшая школа, 2005.
- 3 Лазаревич Е. А. Искусство популяризации науки / Е. А. Лазаревич. – Москва : Наука, 1978.
- 4 Одинцов В. В. Речевые формы популяризации / В. В. Одинцов. – Москва : Знание, 1982.
- 5 Разинкина Н. М. Функциональная стилистика / Н. М. Разинкина. – Москва : Высшая школа, 1989.
- 6 Чернявская В. Е. Интерпретация научного текста / В. Е. Чернявская. – Санкт-Петербург : Наука, 2004.
- 7 Bruner J. *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press. 1986.
- 8 Bucchi M. *Science and the Media. Alternative Routes in Scientific Communication*. New York, NY: Routledge. 1998.
- 9 Calsamiglia H., Ferrero C. *Polifonía en Textos Periodísticos con Información Científica*. Lengua, Discurso, Texto. Madrid, Spain: Visor Libros. 2001.
- 10 Corbett J. *Popularizations*. In K. Brown (ed.), *Encyclopedia of Language and Linguistics (second ed.)*. Amsterdam. The Netherlands: Elsevier. 2006, pp. 755–759.
- 11 Dahlstrom M. *Using narratives and storytelling to communicate science with non-expert audiences*. *Proceedings of the National Academy of Sciences of the United States of America*, 111. 2014, pp. 13614–13620.
- 12 De Oliveira J. M., Pagano A. S. *The research article and the science popularization article: a probabilistic functional grammar perspective on direct discourse representation*. *Discourse Studies*, 8. 2006, pp. 627–646.
- 13 *Discover Science for the Curious*. *Discover. Media Guide*. 2014. Retrieved January 31, 2017 from <http://discovermagazine.com/-/media/Files/PDF/Advertising/2013/DSC-MediaGuide2014v5.pdf>.
- 14 Dobrin S. I., Morey, S. *Ecosee. Image, Rhetoric, Nature*. Albany, NY: SUNY Press. 2009.
- 15 Gallardo G. *Pragmatic support of medical recommendations in popularized texts*. *Journal of Pragmatics*, 37.

2005, pp. 813–835.

- 16 Giannoni D. S. *Popularizing features in English journal editorials*. *English for Specific Purposes*, 27. 2008, pp. 212–232.
- 17 Green M. C. *Narratives and cancer communication*. *Journal of Communication*, 56. 2006, pp. 163–183.
- 18 Hempel S., Degand, L. *Sequencers in different text genres: Academic writing, journalistic and fiction*. *Journal of Pragmatics*, 40. 2008, pp. 676–693.
- 19 Hyland K. *Constructing proximity: Relating to readers in popular and professional science*. *Journal of English for Academic Purposes*, 9. 2010, pp. 116–127.
- 20 Luzón M. J. *Public communication of science in blogs: Recontextualizing scientific discourse for a diversified audience*. *Written Communication*, 30. 2013, pp. 428–457.
- 21 Moshtaghi P. *The comparative genre analysis of psychology journal articles and popularized psychology texts in e-magazines and e-journals*. *Procedia Social and Behavioral Sciences*, 5. 2010, pp. 2067–2071.
- 22 Myers G. *Discourse studies of scientific popularization: Questioning the boundaries*. *Discourse Studies*, 5. 2003, pp. 265–279.
- 23 *National Geographic. National Geographic Shows 30.9 Million Worldwide Audience via Consolidated Media Report*. Retrieved January 31, 2017 from <http://press.nationalgeographic.com/2012/09/24/national-geographic-shows-30-9-million-worldwide-audience-via-consolidated-media-report/>
- 24 Nwogu K. N. *Structure of science popularizations: A genre-analysis approach to the schema of popularized medical texts*. *English for Specific Purposes*, 10. 1991, pp. 111–123.
- 25 Parkinson J., Adendorff R. *The use of popular science articles in teaching scientific literacy*. *English for Specific Purposes*, 23. 2004, pp. 379–396.
- 26 Rowan K. *Moving beyond the what to the why: Differences in professional and popular science writing*. *Technical Writing and Communication*, 19. 1989, pp. 161–179.
- 27 Taylor D. E. *The Transfer of Information from Journal to the Mass Media*. London, UK: City University. 1975.
- 28 Varttala T. *Remarks on the communicative functions of hedging in popular scientific and specialist research articles on medicine*. *English for Specific Purposes*, 18. 1999, pp. 177–200.
- 29 Zamboni L. M. S. *Cientistas, jornalistas e divulgação científica: subjetividade e heterogeneidade no discurso da divulgação científica*. São Paulo, Brazil: Autores Associados. 2001.
- 30 Zhang G. *It is suggested that... or it is better to...? Forms and meanings of subject it-extraposition in academic and popular writing*. *Journal of English for Academic Purposes*, 20. 2015, pp. 1–13.

References

- 1 Alekseeva I. S. *Professional'noe obuchenie perevodchikov*. Sankt-Peterburg. Institut inostrannyh yazykov. 2000.
- 2 Goncharova E. A., Shishkina I. P. *Interpretaciya teksta*. Moscow. Vysshaya shkola. 2005.
- 3 Lazarevich E. A. *Iskusstvo populyarizacii nauki*. Moscow. Nauka. 1978.
- 4 Odincov V. V. *Rechevye formy populyarizacii*. Moscow. Znanie. 1982.
- 5 Razinkina N. M. *Funkcional'naya stilistika*. Moscow. Vysshaya shkola. 1989.
- 6 Chernyavskaya V. E. *Interpretaciya nauchnogo teksta*. Sankt-Peterburg. Nauka. 2004.
- 7 Bruner J. *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press. 1986.
- 8 Bucchi M. *Science and the Media. Alternative Routes in Scientific Communication*. New York, NY: Routledge. 1998.
- 9 Calsamiglia H., Ferrero C. *Polifonía en Textos Periodísticos con Información Científica*. Lengua, Discurso, Texto. Madrid, Spain: Visor Libros. 2001.
- 10 Corbett J. *Popularizations*. In K. Brown (ed.), *Encyclopedia of Language and Linguistics (second ed.)*. Amsterdam. The Netherlands: Elsevier. 2006, pp. 755–759.
- 11 Dahlstrom M. *Using narratives and storytelling to communicate science with non-expert audiences*. *Proceedings of the National Academy of Sciences of the United States of America*, 111. 2014, pp. 13614–13620.
- 12 De Oliveira J. M., Pagano A. S. *The research article and the science popularization article: a probabilistic functional*

grammar perspective on direct discourse representation.

Discourse Studies, 8. 2006, pp. 627–646

13 Discover Science for the Curious. *Discover. Media Guide*. 2014. Retrieved January 31, 2017 from <http://discovermagazine.com/~media/Files/PDF/Advertising/2013/DSC-MediaGuide2014v5.pdf>.

14 Dobrin S. I., Morey, S. *Ecosee. Image, Rhetoric, Nature*. Albany, NY: SUNY Press. 2009.

15 Gallardo G. Pragmatic support of medical recommendations in popularized texts. *Journal of Pragmatics*, 37. 2005, pp. 813–835.

16 Giannoni D. S. Popularizing features in English journal editorials. *English for Specific Purposes*, 27. 2008, pp. 212–232.

17 Green M. C. Narratives and cancer communication. *Journal of Communication*, 56. 2006, pp. 163–183.

18 Hempel S., Degand, L. Sequencers in different text genres: Academic writing, *journalese* and fiction. *Journal of Pragmatics*, 40. 2008, pp. 676–693.

19 Hyland K. Constructing proximity: Relating to readers in popular and professional science. *Journal of English for Academic Purposes*, 9. 2010, pp. 116–127.

20 Luzón M. J. Public communication of science in blogs: Recontextualizing scientific discourse for a diversified audience. *Written Communication*, 30. 2013, pp. 428–457.

21 Moshtaghi P. The comparative genre analysis of psychology journal articles and popularized psychology texts in e-magazines and e-journals. *Procedia Social and Behavioral Sciences*, 5. 2010, pp. 2067–2071.

22 Myers G. Discourse studies of scientific popularization: Questioning the boundaries. *Discourse Studies*, 5. 2003, pp. 265–279.

23 National Geographic. *National Geographic Shows 30.9 Million Worldwide Audience via Consolidated Media Report*. Retrieved January 31, 2017 from <http://press.nationalgeographic.com/2012/09/24/national-geographic-shows-30-9-million-worldwide-audience-via-consolidated-media-report/>.

24 Nwogu K. N. Structure of science popularizations: A genre-analysis approach to the schema of popularized medical texts. *English for Specific Purposes*, 10. 1991, pp. 111–123.

25 Parkinson J., Adendorff R. The use of popular science articles in teaching scientific literacy. *English for Specific Purposes*, 23. 2004, pp. 379–396.

26 Rowan K. Moving beyond the what to the why: Differences in professional and popular science writing. *Technical Writing and Communication*, 19. 1989, pp. 161–179.

27 Taylor D. E. *The Transfer of Information from Journal to the Mass Media*. London, UK: City University. 1975.

28 Varttala T. Remarks on the communicative functions of hedging in popular scientific and specialist research articles on medicine. *English for Specific Purposes*, 18. 1999, pp. 177–200.

29 Zamboni L. M. S. *Cientistas, jornalistas e divulgação científica: subjetividade e heterogenidade no discurso da divulgação científica*. São Paulo, Brazil: Autores Associados. 2001.

30 Zhang G. It is suggested that... or it is better to...? Forms and meanings of subject *it*-extraposition in academic and popular writing. *Journal of English for Academic Purposes*, 20. 2015, pp. 1–13.