Culture-derived Concepts in Scientific Discourse: Transferring Knowledge through Metaphor

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Abstract The paper focuses on metaphors with a culture specific source domain in the scientific discourse like *Rosetta stone* and *Trojan horse*, their functions and peculiarities traced from a novel metaphor to a term. Pertaining to general cultural knowledge these expressions continue to keep much of their original conceptual content and are used in special discourse metaphorically. These metaphors are predominantly used in the title of the work and then elaborated further in the ongoing process of text creation. No matter these metaphors seem to be rather specific, the conceptual analysis we are applying reveals that these complexes are particularly useful for transmitting new kinds of knowledge due to their dynamic conceptual content, heuristic potential and pragmatically aimed sphere of experience.

Our analysis has shown that although the content of these units is rather broad, one conceptual feature is usually brought to the limelight expressing the author's central idea, which becomes the most salient feature in a particular stretch of professional discourse. This conceptual dominant evokes mental representations of the cultural content acting like a key to the piece of specialized discourse through categorization and conceptualization, thus determining the transformed metaphorical meaning of phrases becoming terminological units in the framework of a particular terminological system.

Keywords Culture specific concepts, scientific discourse, ESP, academic discourse, conceptual dominant

1 Introduction

A very special type of language used in scientific communication has long been most justly defined as first and foremost informative, representing and transmitting knowledge. Indeed, there can be no doubt whatsoever that the Language for Specific Purposes (LSP) is a "concrete, well-defined register" (Akhmanova 1978: 88) or "a formalized and codified variety of language, used for special purposes with the function of communicating information of a specialist nature at any level in the most economic, precise and unambiguous terms possible" (Picht/ Draskau 1985: 3). This discourse "represents the structures of knowledge formed at a certain period" (Novodranova 2007: 139) by the scientific community and what is more important – this "particular type of rhetorical structure" (Wood 2001: 74) provides a means for knowledge advancement in a particular discipline "acceptable to peers in his scientific community" (Wood 2001: 76). A special text such as a scientific article or a monograph serves therefore as

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> a means for keeping and transmitting scientific knowledge in the verbal form from the point of view of concrete discipline and the author's knowledge, so it needs to exemplify a set of main categories, concepts and notions of this science, it has to show that it is aimed at revealing the existing types of relations and links between these notions (Manerko 2016b: 142).

"As any other form of verbal communication, academic writing shuns any definite, normative generalizations" (Duszak 1994: 191) and therefore should be studied with regard to the balance between general and well-accepted features and some novel tendencies always emerging in discourse. So, apart from the standardized and neutral norm of the language of science, special discourse nowadays also exhibits the other tendency. Special discourse should be explicated on the basis of quite a number of peculiarities influenced by socio-cultural mechanisms represented by language means in the speech of language personality, individual choices in style and creative patterns of knowledge-making that apparently go beyond the traditional vision of scientific lingua franca as a standardized language. This new tendency could be roughly defined as popularization or individualization. Individualization of modern scientific discourse includes functions of popularization that are aimed at presenting useful information for the reader or listener, widen the horizon of the receiver and satisfy the recipient's curiosity (cf. Engberg 2017). The growth of the knowledge volume in academic discourse has to reflect novel tendencies of creating new conceptions and revealing new notions in definite fields of human activity that make the language personality use vivid language means suiting not only the nominative process, but also the existing system of terminological relations. Not only the content of the scientific paper itself accounts for its potential validity, but also the way this content is presented. Thus, it has been demonstrated "that the hard disciplines tend to have highly evaluative language that results in strong highlights" (Yang 2016: 89), a rise of evaluative language (e. g. *unprecedented, unique, novel*) in biomedical abstracts in the last few decades (cf. Vinkers/Tijdink/Otte 2015). These tendencies underlying the linguistics change are perfectly consistent with the growing interest not only in conceptual metaphor, but in a novel one with a heuristic potential fitting into the preestablished field. Here we aim to address the development of novel and creative metaphors in academic discourse focusing on biological and medical writings.

The vital role of conceptual metaphor in science is largely undisputed nowadays (cf. Alexeeva 1998, Johnson 2010, Herrmann 2013) for it offers insight on how new scientific ideas emerge, how they are transformed with advances in a knowledge field and how they are thus explained and disseminated through papers and monographs. What is more, the emergence of new creative metaphors seems not to contradict the information-driven or knowledge-based view, but to work within the already established rhetorical paradigm.

Metaphor in contemporary scholarly writing appears to be essential not only in explaining and thus fulfilling the generally assumed function of academic discourse as transmitting information, but also in demonstrating the emotional content or evoking the emotional response in the readers aligning the domains. Since "the essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff/Johnson 1980: 5), it amounts to a tool for clarifying, elucidating and simplifying the complicated abstract concepts of science. In other words, metaphors in science are tools for categorizing human experience and scientific evidence. Within this framework a metaphor is not only "a fundamental scheme by which people conceptualize the world and their own activities" (Gibbs 2008: 3), but also a vehicle

for transferring new knowledge in an emotional and engaging manner as "there are no emotion-specific metaphors" (Kövecses 2008: 380).

The major objective of this paper is to reveal how a metaphor with a cultural historical basis as a source domain works in scientific discourse as it is a more complicated case of transmitting knowledge through metaphor. Recent works in cognitive linguistics argue the significant role of broad cultural knowledge being stored and structured in various culturally specific concepts (cf. Komova 2005, 2013, Kövecses 2010). Quite unpredictably and seemingly contradictory to the type of the text aimed at informing the potential reader about the new knowledge in the studied area is the emergence of creative metaphors based on cultural and historic concepts. Therefore, the concepts like *Rosetta stone* and *Trojan horse,* pertaining to the general cultural knowledge still retain much of their original conceptual content used intentionally metaphorically in academic discourse. They are proved to be useful in transmitting some novel ideas in the particular field of knowledge.

The potential of these metaphors is investigated through the notion of a culture specific concept that allows revealing the broad cognitive content, which is ready to outline the central element in categorization as well the elements at the periphery of the entity serving the source domain.

2 Knowledge transfer and metaphor in ESP discourse

The most natural preconception to be applied to the form and content of an ESP text and its rhetoric is the rule of finite energy of the reader of scientific literature. Suffice it to say, the volume of scientific literature is growing at an astonishing pace: 7000 scientific journal articles were published every day according to Naisbett (1982) and since then the number should have doubled if not tripled with 2000 publishers and 17500 research/higher education institutions taking part in scientific process (cf. Lillis/Curry 2010). Therefore, the energy and attention of the reader, pushed into an environment with astounding information load, would be spared on two things simultaneously: the form of the linguistic expression and the complicated scientific content – the phenomena and ideas being presented, explained and discussed. Providing a highly complicated scientific content the form should be as concise and crystal clear as possible. The thought should depart from a well-grounded abode and come to a no less grounded destination point without any loops or derisions and leaving a reader with an unclouded picture in his head. However, the assumption of a fully standardized discourse should not be taken for granted, and the representation of LSP domain as primarily driven by information pure and simple is not uncontroversial. With the growing marketization of higher education (cf. Furedi 2010) and increasingly competitive environment as well as pressure for visibility of publications, the question of how to promote publications becomes "a major concern for institutions of higher education, researchers and journal publishers" (Yang 2016: 90). The language of science turns out to develop and to be susceptible to modifications, it starts assimilating some features of other genres and types of discourse, and this process becomes manifested in high-impact journals first going down to lower-impact ones. Therefore, the role of metaphor in the contemporary scientific discourse is twofold: cognitive and marketing or advertising.

As far as the first function is concerned, Hofstadter/Sander offer an explanation on the importance of *analogy* being the core of cognition and thus central for scientific thinking: "[…] without concepts there can be no thought, and without analogies there can be no concepts" (Hofstadter/Sander 2013: 3). The information stored in a specialized text is not only processed

and decoded as any linguistic utterance in the linear manner, but also categorized into a number of classes and organized into various types of models[1]. Building the argumentation on the notion of a mental model, Miller develops this idea even further: "Models are metaphors which function like analogies and that non-propositional modes of thought are essential in scientific creativity" (Miller 2000: 163).

The fundamental design feature of the human verbal behavior is that the two main systems interrelate in discourse processing: the linguistic system and the conceptual system. Two corresponding levels are usually outlined for metaphor identification procedure. Evans pinpoints that the conceptual structure "relates to the non-linguistic knowledge representations that words tap into and can draw upon in situated language use" (Evans 2009: 4). He also emphasizes that the first one interacts with the latter "in order to facilitate access to conceptual knowledge" and its representation (Evans 2009: 25). The conceptual side of a metaphor may be of various complexity: Kövecses (2017) singles our four levels of schematicity starting with the level of image schemas, the level of domains, the level of frames, and ending with the most schematized one – the level of mental spaces.

Van Dijk (1999) postulated two criteria the conceptual models should meet: effectiveness (of searching, processing and representing the necessary information) and come-at-able for updating. A metaphor in this respect fulfills these criteria and turns out to be a viable tool for transmitting knowledge of varying complexity and abstractness, as Black noticed: "every metaphor is the tip of a submerged model" (Black 1993: 30), echoing the notion of the conceptual model introduced by van Dijk.

Nowadays, metaphors in science are used in theory-building, theory-explaining and 'theory-labeling or naming' and considerable attention is paid to conceptual metaphors in science (cf. Gibbs 2008).

> Scientific metaphors are central to the construction of models and to the constitution of new scientific theories and that specially when they are at the beginning of their formulation, theories should resort to metaphors in order to provide understanding and to allow to extract inferences by using knowledge available from other domains. (Rodriguez 2011: 84)

Still, regardless of the conceptual metaphor's universality and omnipresence, many metaphors are culture specific and these culture specific metaphors seem to contradict the prerequisites of language used for scientific communication. Therefore, we arrive at a paradox connected with the notion of finite energy of the reader we introduced before: metaphors facilitate cognitive processing and shorten the time of reading, while once requiring novel alignment between the domains they prolong it. The paradox is solved taking into account the type of metaphor: conventional metaphors are processed faster, whereas the novel metaphors asking for new alignment account for a longer time and effort on the side of the reader. This effort itself should serve as a semiotic marker signaling that this information in the passage is important and should be remembered. The attention of the reader may be kept through exploiting other conceptual structures grounded in culture. Yet, within the paradigm of promoting research and raising the impact factors of the journals, the original metaphors based on cultural and historical concepts appear exceptionally useful and particularly interesting.

[1] Since 1985 van Dijk has claimed that construing models in memory, connected with the contextual representation of a situation is important for discourse studies as "models are typically richer in information than the discourses that express them" (van Dijk 1999: 126).

The source domains for metaphors in science are many, but when we deal with more complex ideas serving the basis for the source domain associated with cultural-historical knowledge, the fully-fledged conceptual analysis becomes essential. This analysis is based on the concept description. The concept is traditionally defined as "an element of thinking" (Picht 1997: 336), as "an operational meaningful unit of memory, mental lexicon, conceptual system, brain language, and the whole picture of the world reflected in the human mind" (Koubriakova 1996: 90).

The metaphor identifying procedure traditionally works on two main levels: the linguistic and the conceptual one, where source and target domains are distinguished. It has long been acknowledged that a distinction occurs between at least three major processes going hand in hand: the identification procedure, which is a merely linguistic process based on language expressions and human interpretation, understanding metaphors that deals with conceptual structures and cross-domain mappings extinguishing the source and target domains, and finally the most influential one – the understanding of the stretch of discourse: its communicative and pragmatic value.

The culturally-derived word groups are very interesting material for the research, because they store a highly complex and at the same time holistically uniformed cognitive content, being a trigger for new words and prolonged utterances – stretches of discourse. The concepts representing such expressions are used as metaphors with source and target domains. Concepts used as a source domain for cross-domain mapping verbalized by the iconized set of words represent a category complex in itself. It is featured by a set of notable peculiarities in actual use and being deliberate "intentionally constructed mapping across two semantic and conceptual domains" (Steen 2013: 11). Moreover, the general conceptual content is wider for culture-derived concepts compared to those of ordinary language.

3 Beyond metaphor and genre in special discourse

In this part of the article we would like to illustrate these theoretical assumptions on examples taken from scientific and popular scientific writing on the basis of the nominal expressions *Rosetta stone* and *Trojan horse* and concepts representing them. Both are associated with a social and historical background going back in ages and accounting for different weight of conceptual elements within their structure thus bringing together semantics and pragmatics (cf. Geeraerts 2006: 75) in modern academic discourse.

3.1 The Rosetta stone: from the concept appearance to its structure in academic discourse

The cultural-historical content of the expression *Rosetta stone* is connected with the Napoleonic wars. This content is represented by the encyclopedic meaning of the nominal phrase – Rosetta stone.

The famous Rosetta stone was discovered in mid-July 1799 in the village of Rosetta by a group of archeologists brought by Napoleon to Egypt. This stone was covered by inscriptions in three sign systems: at the top there were early Egyptian hieroglyphs, then Demotic writing, also of unknown Egyptian origin, and at the very bottom – Greek letters, that could be read. For centuries scientists had made attempts to understand the mysterious code of the ancient Egypt as the lost civilization, but in vain, and only the discovery of the texts written in three languages and the correspondence between them made it possible for scientists to translate

hieroglyphics for the first time in 1822. Two main scholars rivaled to understand the code – Thomas Young from the UK and Jean François Champollion from France. Nowadays the stone is a valuable possession of the British Museum. It is a very important cultural artifact of British culture as well as the European one. Rosetta stone once deciphered became a turning point for studies of the ancient Egyptian times and its written remains were made to tell their faraway history. The mystery at the very origin of something once unraveled was able to explain all other mysteries or problems became the conceptual dominant of the *Rosetta stone* in modern culture and it is the basis of the metaphoric transfer in scientific discourse.

The frequency of occurrence provided by Google Ngram viewer exhibits the frequency peaks of this expression use in the English language in the 19th century (cf. Figure 1). However, there is a steady rise at the end of the 20th century indicating a revival of interest to the topic.

Figure 1: The use of the expression Rosetta stone starting from 1800

There is a possible misconception to be discarded here. "Frequency of occurrence is not the only factor determining prototypicality, but next to conceptual coherence, it is certainly an important one" (Geeraerts 2006: 75). And it goes without saying that context-based study reveals many other nuances of the metaphor in use. The first peaks correspond to non-metaphoric use, while steady growing after 70s of the 20th century is likely to point at metaphoric use. The latter is proved by corpus data to be extremely fruitful from that period up to now (cf. Figure 2).

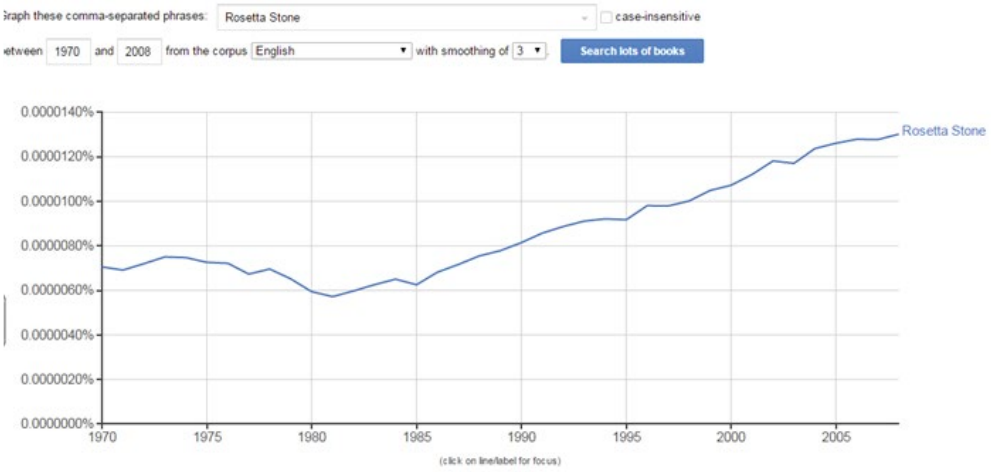


Figure 2: Google Ngram viewer data for the frequency of Rosetta stone in the second half of the 20th century

Since we are mostly interested in scientific discourse, and Google Ngram Viewer provides only general tendencies in language use, we looked up for *Rosetta stone* in PubMed database. PubMed is a search engine as well as a database accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. Apart from bull titles and abstracts allowing to be searched, it contains links to the full texts on the journal sites. 170 examples from which 144 cases of metaphoric use were studied starting from the end of the 70s. Based on the number of tokens we see in Figure 3 that the interest in this metaphor has been steadily rising since the middle of the 20th century up to now and the general tendency outlined is supported.

Figure 3: The number of papers and books with at least one usage of the Rosetta stone concept in the second half of the 20th century

Let us turn to the first example taken from a well-known book: *The Double Helix*. It is an autobiographical account of the discovery of the double helix structure of DNA written by James D. Watson, one of the Nobel Prize winners for it. The book presents a very personal and detective-like picture of the world-known events combined with purely scientific explanations. The book as well as the authority of the author played a very significant role in Biology of the 20th century, therefore a metaphor of Rosetta stone being introduced in this type of writing spread to a purely scientific discourse as well. This is a prime example where the metaphor is supported by a number of words in the context facilitating the alignment between the domains. At the very beginning of the book the author writes:

> Given the fact that DNA was known to occur in the chromosomes of all cells, Avery's experiments strongly suggested that future experiments would show that all genes were composed of DNA. *If true, this meant to Francis that proteins would not be the* ***Rosetta stone*** *for* ***unraveling the true secret of life****. Instead, DNA would have to provide* ***the key to enable us*** *to find out how the genes determined*, among other characteristics, the color of our hair, our eyes, most likely our comparative intelligence, and maybe even our potential to amuse others. (Watson 2012: 2)[2]

The main idea of the passage is explained with the help of a reference to the Rosetta stone concept. This idea of searching for something explanatory in itself is addressed in the context of Watson's experiments. Moreover, the quest for the solution to the code of DNA and not proteins is similar to the search of Champollion: the one who unraveled the secret of the Rosetta stone with the help of Coptic language. Both researchers (Champollion and Francis) were trying to find out the origins of life, reveal the secret of human civilization. More than that, those things that were once discovered should explain everything remaining to be solved within the discipline. Within the concept that contains the stored information about that historical event there is one feature brought to the limelight in natural science discourse. The main idea is the *heuristic potential of something* to be intellectually mastered. This idea lies beneath the whole book; it makes the author's creative unsettled mind strive for an elegant explanation to the abundant accumulated data on the subject. The discovery of the double helix structure of the DNA and a clear correspondence between its nucleotides was the event of no less importance and its heuristic potential for further studies was unprecedented too.

In the context taken from a piece of autobiographical writing, the metaphor of *Rosetta stone* determines the stretch of discourse, forming it in terms of knowledge expressed and linguistic signs and chosen for further developing the idea. We observe such expressions to support the main idea: *unraveling the true secret, the key* to human beings' life and gene invention. They all belong to the semantic field of something mysterious, difficult to solve and ancient, of course.

Metaphors with a culturally specific concept as a source domain are not common for scientific writing as contrasted with conceptual metaphors facilitating the mode of reasoning like the metaphor of *genetic code, gene library* or *translation process* nowadays. The first one was introduced in Schrödinger's *What is life?* (1944) in the form of *code-script* and used further to understand protein synthesis. Arising in mid-50s of the 20th century it gave birth to a consistent metaphor set connected with codes and languages in Molecular Biology. After the Second World War with huge attention paid to codes and their deciphering this idea was introduced

[2] Here and further in the examples the emphasis is ours.

into the discourse of many areas (cf. Knudsen 2005). Yet, it was most influential in Biology as it underwent a discursive shift:

> Through the introduction of terms such as information, feedback, messages, codes, alphabet, words, instructions, texts, and programs, molecular biologists came to view organisms and molecules as information storage and retrieval systems. Heredity came to be conceptualized as contemporary systems of communication, guidance, and control. This linguistic repertoire was absent from molecular biology before the 1950s. (Kay 1997: 25)

James Watson was impressed by this book and marks reading it in the preface to his *Double Helix*. In the light of this socio-cultural context the metaphor of the *Rosetta stone* seems only natural to appear and get disseminated.

Since culture specific metaphors carry quite an extensive load of cultural and historical information that may or may not be actualized in discourse, they are present only in a fraction of papers and monographs not allowing for distributing between the disciplines, yet we mostly focused on sciences and not humanities.

A very interesting case with the whole concept being actualized is found in the foreword for a book titled "The Rosetta stone of the Human Mind: *Three Languages to Integrate Neurobiology and Psychology (Art, Science and Music)* most clearly explaining the choice of this metaphor in a long introductory passage:

> Whether it takes the form of diagrams, graphs, models, images, illustrations or labels, metaphor always plays a function in the revelation of the self. This practice finds its most happy example in the choice of ***the Rosetta stone*** *itself as the metaphor* for the way *different languages cohabit* the same investigative space of *the quest for understanding who or what we are*.
> Yet, even this usage leads to even more questions. The history of the reception of the Rosetta stone required that *the three languages be read for what they had in common*. They were ***clues*** to each other, allowing *obscure* ***symbols*** to *reveal their* ***unknown significance***. Yet, anyone who has experienced the liminal space where one language meets another is aware of the untranslatable dimension that divides one *symbolic order* from another. *The three languages* on the Rosetta stone cannot be reduced to a single meaning, because this *meaning* will be at the cost of the minute but inescapable differences in tone, emphasis and timber that separate individual languages. (Sanguineti 2006: xiv)

The most important thing in this passage is the idea of metaphor, which reveals the unknown significance in three semiotic systems – art, science, and music together. The author stresses the idea that obscure symbols allow revealing their relevant importance in deciphering ***clues*** *to each other* and *symbolic* ***order***, while the unity of three symbolic arts is underlined by the phrases *different languages cohabit, the quest for understanding,* and at last their meaning can be reached *at the cost of the minute but inescapable differences* displayed by peculiarities of separate languages.

Another example is even closer to hard sciences when the analogy between the massive data sets of the sequenced genomes and their evolution, and the Rosetta stone and the deciphering by Champollion is fully drawn. The linguistic representation of human languages is put forward, when the aim of the author is to provide some *insights about the language of proteins*.

> Proteins, the main cell machinery which play a major role in nearly every cellular process, have always been a central focus in biology. We live in the post-genomic era, and inferring information from massive data sets is a steadily growing universal challenge. The increasing availability of fully sequenced genomes *can be regarded as* the ***'Rosetta stone' of the protein universe***, allowing the understanding of genomes and their evolution, just as the original Rosetta stone allowed Champollion *to decipher* the ancient Egyptian hieroglyphics. In this review, we consider aspects of the protein domain architectures repertoire that are closely related to those *of human languages* and aim to provide some *insights about the language of proteins.* (Scaiewicz/Levitt 2015: 50)

The general conceptual field of the metaphor fits into the linguistic sphere that has become rather common for the sphere of biology: first as a fresh suitable analogy and then as a linguistically grounded methodological tool coinciding with the time nucleic acids were "recognized as strings of nucleotide bases comprising the famous four-letter alphabet" (Searls 1997: 333). Numerous examples of metaphorical expressions becoming terms include: *library of genomes, reading the code, DNA-RNA-proteins translation process, gene editing, etc.* These appeared in the 50s of the 20th century and determined the development of Molecular Biology ever since. Interestingly, since many linguistic expressions got conventionalized the metaphor turned out to be in constant quest for novel ways and novel expressions. This is especially vivid in peripheral genres of lay abstracts, popular scientific reports and interviews with scientists. Here we find that *bacteriophages can listen in to bacteria, DNA is a blueprint of life,* and *we need a translation service for genes.* These do not allow the underlying metaphor to be ultimately fossilized in academic discourse.

Metaphors with the culturally specific concept as a source domain are not that frequent in scientific writing as contrasted with conceptual metaphors facilitating the way of thinking, such as *nature as a code or life as a memory/information system* (cf. Emmeche/Hoffmeyer 1991). Nevertheless, they most naturally incorporate into this global mode of reasoning. These metaphors carry quite an extensive load of cultural and historical information that are actualized in discourse.

In the majority of examples extracted from a number of scientific journals, a single reference to *Rosetta stone* is enough and we rarely find such a detailed explanation. In these cases only a fragment of conceptual knowledge is evoked and made use for creating a metaphor.

The analysis of the corpus data shows that although this conceptual content is quite broad, it is structured according to the zones of core and periphery. These areas lend themselves to identification. Their use in shortened and prolonged linguistic units inside the stretches of discourse are typologically characterized by bringing to the limelight a very special feature, which turns out to fit together everything: the whole concept, the linguistic content and the expression in the stretch of discourse.

One of the conceptual features is usually brought to the limelight in a particular stretch of special discourse. To the core we can ascribe the *linguistic sphere* with the codes, meaning, symbols, languages profiled (in Table 1 the core is represented by number one). The mid-zone comprises the necessity to solve the *mystery* itself or crack of the code itself or the *historical reference*. To the periphery – creating the common conceptual space for at least three notions necessary to solve the problem since Rosetta's unique character was determined by the correspondence between three major parts constituting it: three types of alphabets. The conceptual dominant central for the use of this metaphor in scientific discourse is – the heuristic potential of the idea of a 'key'.

Now let us give more examples of the major conceptual zones actualized by this metaphor in academic and popular scientific discourse. The zones of the concept as well as the conceptual dominant evoke mental representations of the cultural content acting like a key to a major vehicle for the metaphor to be worked on to the piece of academic discourse. This dominant determines the meaning of the set of phrases in the text. The linguistic units with a metaphorical load are presented in italics (cf. Table 1).

Table 1: The layers of the concept structure of the Rosetta stone *starting from the conceptual dominant of the category*[3]

1) The linguistic sphere (codes and languages deciphering and their sequence)	The Rosetta stone of Human Mind: three *Languages* to Integrate Neurobiology and Psychology *(Art, Science and Music)* (Sanguineti 2006); **Digital Rosetta stone**: A Conceptual Model for Maintaining Long-Term Access to *Digital Documents* (Heminger/Robertson 1998); A ceRNA hypothesis: **the Rosetta stone** of a hidden *RNA language* (Cell 2011); We found 6809 pairs of nonhomologous sequences, both members of the pair having significant similarity to a single protein in some other genome that **we term a Rosetta stone sequence** because *it deciphers the interaction* between the protein pairs (Science 1999).
2) Universal heuristic potential within a certain system ('like a key')	The Lawyer's **Rosetta stone**: How Frank Shepard's Invention Transformed Legal Research and Remains "Indispensable" Today (LexisNexis 2001); Arabidopsis, **the Rosetta stone** of flowering time? (Science 2002) (*Arabidopsis is a model object for abundant plant research); The long QT interval syndrome. A Rosetta stone for sympathetic related ventricular tachyarrhythmias (Circulation 1991); Evaluation of diastolic filling of left ventricle in health and disease: Doppler echocardiography is the clinician's **Rosetta stone** (Journal of the American College of Cardiology 1997).
3) A common conceptual space for three notions/ objects (unifying)	**The Rosetta stone** of Human Mind: three Languages to *Integrate (Art, Science and Music)* (Sanguineti 2006).
4) The necessity to get solved itself (a mystery, a quest for new knowledge, revelation)	The Earth as a distant planet: **A Rosetta stone** for *the search of* Earth-like words (Vázquez/Pallé/Rodríguez 2010); Metabolic profiling: **a Rosetta stone** for genomics? (Current opinion in plant biology 1999).
5) Historical reference	The Rosetta stone, *key to the original deciphering of Egyptian hieroglyphs*, has probably been the most famous language inscription on the planet. This massive piece of polished black stone, discovered in 1799, contains parallel messages in old Greek, hieroglyphs, and demotic, a cursive form of hieroglyphics, chiseled into its surface. Twenty-four years after its discovery linguists finally completed the *decoding* which permitted the people of the *world to understand* the writings and culture of ancient Egypt (Yong 2006); *Unlocking the mysteries* of diastolic function: deciphering **the Rosetta stone** 10 years later (Journal of the American College of Cardiology 2007).

[3] Here we include the titles of the books and extracts from the journals. For the books and monographs we provide the author and the date of publication, yet for the journals we put the year of publication and the journal name as we focus of the large trends rather than the individuality of particular authors. The necessary details are given in the references.

The uneven distribution between the use of this metaphor in various types of the text – namely the title of a book or a scientific paper and the text itself, usually starting with the introductory part, also account for the deliberateness of this kind of metaphor. We found that this expression is used in the title (98 cases), abstract (82), introduction (60), body (24), conclusion (49). Yet the sole uses turned out quite rare: only 25 times it was used only in the title, while for the abstract 18, and only once in the introduction. It is usually repeated in two or three parts of the paper mostly being title + abstract, or abstract + introduction or title + abstract + introduction (Figure 4).

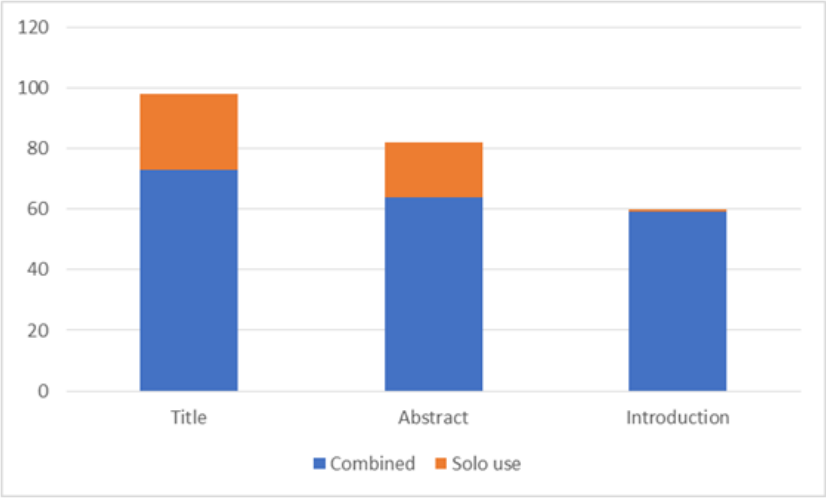


Figure 4: The distribution of the Rosetta stone metaphor in the parts of a scientific paper

The deliberate type of metaphor is generally considered less frequent in academic discourse than the conceptual metaphor. Another argument for the deliberateness of it and the attractiveness is the range of journals it is found in. Rosetta stone in its evolution has generally proceeded from higher impact journals to the lower ones – the process accompanied with the growing frequency (Figure 5).

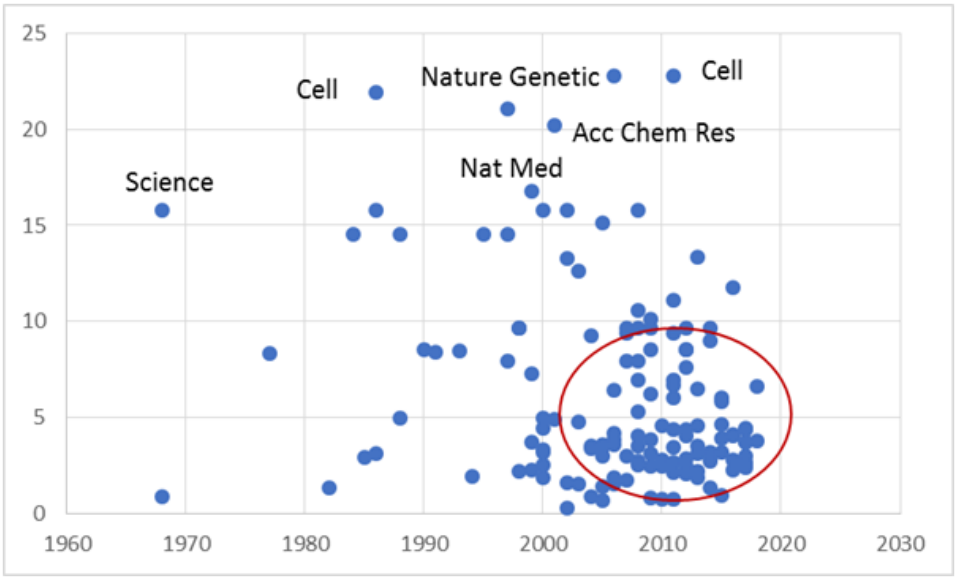


Figure 5: The impact factors of the journals using the metaphor Rosetta stone

It is specially used to attract attention thus brought to the initial position supported by an explanation further evoking all the parts of the conceptual content, useful for not only understanding a metaphor in general, but making it transfer knowledge from one area to another. The latter becomes especially important for interdisciplinary models being worked out in the last few decades.

3.2 The conceptual metaphor of the Rosetta stone *in the interdisciplinary perspective*

The analysis of the contexts proved that the metaphor based on culturally specific concept is used deliberately and most consciously. The authors recognize that Rosetta stone may be interpreted in a number of ways, thus provide an explanation of what they mean by this metaphor in the context of their special topic:

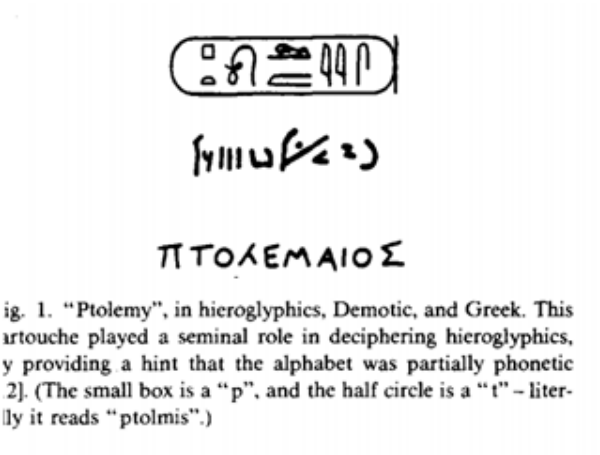
> A decade ago we described the role of echocardiography in the "Evaluation of Diastolic Filling of Left Ventricle in Health and Disease: Doppler Echocardiography Is the Clinician's **Rosetta stone**". (Lester et al. 2008: 679)

The *Rosetta stone* here being used as a metaphor to refer to anything that is a critical key to a process of decryption or translation of a difficult problem.

> Will the model developed for *Arabidopsis unlock* the complexities of flowering time control in all plants, as the **Rosetta stone** did for Egyptian hieroglyphics? (Simpson 2002: 285)

What is more notable, a multimodal dimension including the figures may be evoked to serve an explanation, thus giving the metaphor an opportunity to go beyond the semiotic medium into the sphere of the conceptual stage of the meaning construal, which precedes the verbal realization. Besides that, the ancient Egyptian writing system combining logographic, syllabic

and alphabetical characters contained 'the sacred letters' or 'god's words' (the first line) (see the material on hieroglyphs: https://en.wikipedia.org/wiki/Egyptian_hieroglyphs), the later Demotic scripts derived from the Egyptian writing (the second line) and at last the Greek phonographic reading of the same cartouche correspond to the "general semiotic system of meaning" (Manerko 2016a: 722). The *integration* of the metafunctional principle provides the basis for semiotic resources and a mechanism of its creation in discourse, where three writing systems on the Rosetta Stone serve the source domain explaining the necessity to be united together to bring forth the idea of 'connectionism' in the target domain, at which it is aimed at (cf. Figure 6).



ig. 1. "Ptolemy", in hieroglyphics, Demotic, and Greek. This artouche played a seminal role in deciphering hieroglyphics, y providing a hint that the alphabet was partially phonetic 2]. (The small box is a "p", and the half circle is a "t" – liter-lly it reads "ptolmis".)

Figure 6: An illustration provided for a paper "A Rosetta stone for connectionism" (Farmer 1990) explaining the title and the major idea

The next image (cf. Figure 7) is supported by an extended explanation abound in manifesting the heuristic potential for further studies and treatment through the metafunctional principle of *analogy* between the known languages (Ancient Greek and Demotic) and mysterious hieroglyphic inscriptions on the Rosetta stone and their decoding, on the one hand, and the similar processes going on in isogenic (normal) cells and other ones that need deciphering. They were called *cellular Rosetta stones.* The *Rosetta stone* metaphor brings forth not only the basic semiotic and cultural information, but the mechanism of treatment represented in the attributive component of the substantive construction, revealing the biological sphere of activity. The mechanism is based on the explanation and understanding of currently unknown biological phenomena.

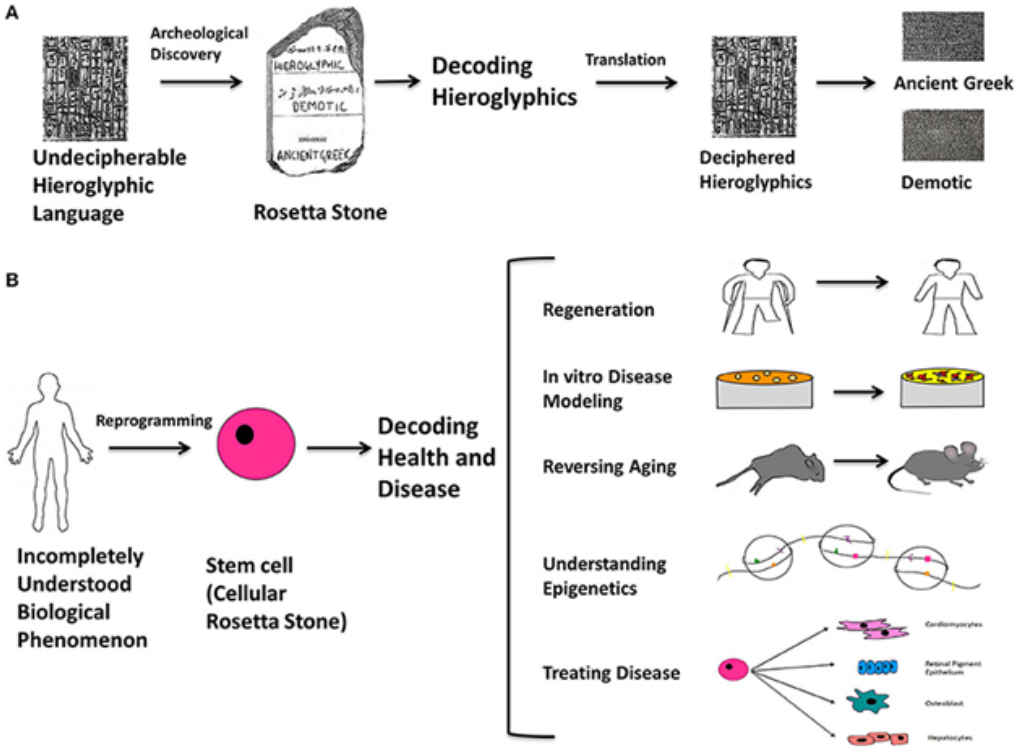


Figure 7: An illustration provided for a paper "Cellular Reprogramming for Understanding and Treating Human Disease" (Kanherkar et al. 2014)

"*The Rosetta stone* analogy" is explained consecutively in the following way:

> ***The Rosetta stone*** is an archaeological slab with the same text in three different languages; Hieroglyphics, Demotic, and Ancient Greek, and its discovery proved to be *a turning point* in understanding the Hieroglyphic language. By direct comparison of the three languages, it was possible to *decipher previously unintelligible* Hieroglyphics from the other two known languages. *An analogy can be made* with respect to stem cells: they can be thought of as "cellular Rosetta stones" because they are *key to understanding* the multifaceted mysteries underlying human health and disease. Stem cells can be *conceptualized* as *"cellular Rosetta stones"* because they are enabling us to create and compare cells with diseases or cellular phenomena that are *poorly understood (non-deciphered Hieroglyphics),* with isogenic cells that are completely normal (well-understood, Ancient Greek or Demotic). This is the contribution of stem cells toward *modeling* and treating diseases and *generating* functional cell types. In addition, they are becoming *quintessential* for studying epigenetics, aging, cancer and regeneration. It won't be long before they emerge as the ultimate practical tool and make their mark on the conceptualization of biological science in terms of understanding molecular and cellular events and treating debilitating diseases. By using reprogramming as the means *to make cellular Rosetta stones,* it will be possible to form a *universal understanding of currently unknown biological phenomena* and develop an accurate philosophy for cellular processes, disease and therapy. (A) Illustrates the

> rationale behind the way the Rosetta stone was used to decode hieroglyphics. (B) Illustrates the analogously unexplained biological phenomena to which stem cells can be made with various characteristics on an isogenic background and used to understand them; for example (1) limb-regeneration (2) disease modeling at the cellular level (3) treating organismal aging (4) understanding epigenetic mechanisms underlying diseases (5) generating lineage specific cell types to treat degenerative and chronic diseases, or acute injuries. (Kanherkar et al. 2014: 2)

Drawing a preliminary conclusion, it should be noted, that culturally important concepts are charged with an unprecedented potential for adaptation and change in the course of evolution within the semiotic systems – language and culture. The content of the concept may fluctuate depending on the genre of special kind of discourse: a book, a monograph, a popular scientific text, a review paper, an experimental paper with narrowing down the conceptual content from the first to the latter. It may also depend on the discourse field. Finally, all the characteristics of the concept may vanish leaving only the conceptual dominant meaning. Moreover, outlining the conceptual dominant within the concept structure helps to explicate the development of metaphor and semantics in late 19th and 20th centuries.

Particularly, this conceptual dominant becomes a common meaning for numerous contexts. Once it is well-established and unambiguously perceived it might be combined with other abstract concepts or idioms. Here are some examples of the kind:

> *Animal Models in Translational Research: Rosetta stone or Stumbling Block?* (Bioessays 2017) actually suggesting that the unit under scrutiny is approaching the dead metaphor stage and is very close to an idiom – *stumbling block*;
>
> *Pollen Tube Growth and Guidance: Occam's Razor Sharpened on a Molecular Arabinogalactan Glycoprotein Rosetta stone* (New Phytologist 2018) bringing two concepts with a long history together;
>
> *A Sword in the Rosetta stone* (Journal of Biosciences 2005) that is naturally an allusion to the famous *The Sword in the Stone* – T.H.J. White novel and the animated story of King Arthur of 1963;
>
> *Tamoxifen: the Rosetta stone or Hope Diamond?* (Jordan 2003: 338) where an attempt to create the stone-based opposition was made. The Hope Diamond was rumored to carry a curse thus not carrying the promise to solve the scientific mysteries (the heuristic potential), but to exacerbate them. The conceptual dominant is extracted and even played upon.

The name of Rosetta had come a long way from a small unknown village in Egypt to a personal name of the stone and then to a culturally specific concept, "an unrolled text with a very deep conceptual content" (Garagulja 2009: 20) and then to a metaphor in various kinds of texts and finally back to a personal name – *Rosetta* (comet chaser). The photographs taken by Rosetta in the open space aimed at unraveling the secrets of a mysterious 'mini' ice world – a comet. The NASA site also explains this choice, referring to the original story:

> Just as the **Rosetta stone** provided *the key to an ancient civilisation*, so ESA's Rosetta spacecraft *will unlock* the *mysteries* of the *oldest* building blocks of our Solar System – the comets. As the worthy successor of Champollion and Young, Rosetta will allow scientists

> *to look back* 4600 million years to an epoch when no planets existed and only a vast swarm of asteroids and comets surrounded the Sun.
> (http://www.esa.int/Our_Activities/Space_Science/Rosetta/Why_Rosetta)

The culturally-derived concept used for the domain appeared to be rather consistent to the conceptual metaphor existing in contemporary biology – the linguistic view of the processes (cf. Searls 1997) becoming more and more popular and reflected in a number of linguistic units (cf. Emmeche/Hoffmeyer 1991). Due to the broad knowledge packed in this metaphor and its heuristic potential the concept was gradually accepted, neutralized and gave rise to a set of terms within the sphere of Biology: *Rosetta Stone protein, Rosetta Stone hypothesis, Rosetta Stone method* and *Rosetta stone sequences of the domain fusion.* Terms serve as designations of specific concepts of science and technology. The appearance of the term may be regarded as a terminal stage of metaphor evolution as they appear "as a result of knowledge accumulation and appearance of special notions and concepts" (Shelov 2003: 180–181). As the word combination is used both with and without inverted commas, it may still preserve its metaphorical meaning. By a term *Rosetta Stone* "a protein chain composed of two fused proteins" is meant.

> Crystal structure of the worm NitFhit **Rosetta stone protein** *reveals* a Nit tetramer binding *two* Fhit dimmers.
> **According to the Rosetta stone hypothesis,** if the separate Nit and Fhit genes could be shown to occur in the same subset of genomes (that is, to share a phylogenetic profile), then the existence of a fusion protein in invertebrates and the coordinated *expression* of separate mRNAs in mouse suggest that Nit and Fhit function in the same pathway and that the structure of invertebrate NitFhit may reflect the nature of Nit–Fhit interactions.
> Recently, a general method was proposed to identify *interacting proteins* by *identifying a* ***'Rosetta stone' protein*** *consisting of two unrelated proteins fused in one organism but expressed as separate polypeptides in other organisms*. With few exceptions, experimental evidence and bioinformatic inference suggest that the existence of a fusion protein in one genome *powerfully predicts* that the separate polypeptides function in the same cellular or biochemical pathway in other organisms 36 and 37. *The strongest case that* ***Rosetta stone proteins*** *decode real* interactions can be made when the separate genes have similar gene expression patterns and are found in the same subset of genomes (that is, share a phylogenetic profile). (Pace et al. 2000)

It seems that in coining out this term a parallel interaction of several notions as a conceptual feature and the conceptual dominant being a driving force for naming process were employed. A similar way was undergone by another culture specific concept – *a Trojan horse*, being of no lesser popularity to the scientific discourse and even giving two terms in distinct areas: biology and computer science (for a detailed discussion on the latter cf. Isaeva 2013).

3.3 A Trojan horse in the sphere of Biology

As far as Biology is concerned, the expression *A Trojan horse* started to act as a deliberate metaphor, as a tool for clarifying and communicating a complex novel idea or theory to scientific community. The general number of tokens according to PubMed is over 500, starting with editorials as early as 1958 and ending with dozens of papers already in 2018. As it follows from the context analysis, the evaluation of the concept changed leaving the negative connotations

aside and focusing on the intricate type of action. Possibly, the war metaphor needs not to be stressed as it is already pervasive in medical discourse and has the net of metaphorical expressions: *fight cancer, arms race between phages and bacteria, outflank the defense of bacteria, spy on quorum-censing mechanism*. However, the type of secret action gave the opportunity to use it in medical papers working on the novel drugs and their delivery systems.

> After ten years of fighting the Trojans, the Greeks played the most famous trick in *military history* – building a wooden horse. Once taken within the walls of Troy, Greek soldiers hidden inside the Trojan horse slipped out in the middle of the night and opened the city gates. The Greek army thus entered and destroyed the city. As this *strategy* worked for the Greeks, so it can work for *transporting* molecules across the blood-brain barrier (BBB). ***Molecular Trojan horses*** *are brain transport vectors that include endogenous peptides*, modified proteins and PEPTIDOMIMETIC monoclonal antibodies. These vectors *target* specific receptor/transport systems of the brain capillary ENDOTHELIUM and undergo receptor mediated TRANSCYTOSIS through the BBB. This technology has allowed the brain targeting of recombinant proteins for neuroprotection, antisense radiopharmaceuticals for *in vivo* imaging of brain gene expression, and non-viral gene. (Pardridge 2002: 131)

The author of the paper does not only give it a title with the iconic expression, but explicitly entwines it into an introduction allowing for a successful cross domain mapping between a piece of cultural information about Greek history and brain transport vectors. The negative connotation is completely absent in this case, and the ability to penetrate something extremely difficult to be gone through – here the blood-brain barrier – is profiled.

This profiling feature puts forth a conceptual dominant addressed in various contexts. The predominant number of examples come from high impact journals on most vibrantly developing fields of research. This metaphor is rather consistent with the general conceptual metaphoric discourse of war and struggle used in the field of Biology and Medicine (cf. Larson 2005, Periyakoil 2008). Since the *Trojan horse* metaphor belongs to a very common knowledge of historical character known to all educated men irrespective of their specialization, it is used in the title only, and rarely it is supported by other phrases from the paper itself. The most common linguistic units, supporting the metaphor are verbs with a meaning of crossing the border, penetrating or making war: *spread, transport, deliver, combat,* and *target*. Several examples with a *Trojan Horse* point at various spheres of biological sciences:

> *Brucella abortus* Traverses Brain Microvascular Endothelial Cells Using Infected Monocytes as **a Trojan horse** (Frontiers in Cellular and Infection Microbiology 2018);
>
> A **Trojan horse mechanism** for the *spread* of visna virus in monocytes (Virology 1985);
>
> Protein phosphatase 2A: **the Trojan horse** of cellular *signaling* (Cellular Signalling 2001);
>
> **The Trojan horse:** *survival tactics* of pathogenic mycobacteria in macrophages (Trends in Cell Biology 2005);
>
> *Delivery* of bioactive molecules into the cell: **the Trojan horse approach** (Molecular and Cellular Neuroscience 2004);
>
> Glutamine: **a Trojan horse** in ammonia neurotoxicity (Hepatology 2006);

Intracellular photodynamic therapy with photosensitizer-nanoparticle conjugates: cancer therapy using a **'Trojan horse'** (*Photochemical & …* 2006);

A cellular **Trojan horse** for *delivery* of therapeutic nanoparticles into tumors (Nano 2007);

Trojan horse strategy in Agrobacterium transformation: abusing MAPK *defense signaling* (Science 2007);

Autophagy, **the Trojan horse** to *combat* glioblastoma (Neurosurgical Focus 2006);

A Trojan horse for Human Immunodeficiency Virus (Chemistry & Biology 2015);

The Trojan horse of the Plant Kingdom (Cell Host & Microbe 2018).

The conceptual dominant still allows the general historical content to revive and get used in the contexts beyond the medical investigations. The latest article on cross-kingdom RNA interference led to the discovery of plant extracellular vesicles acting as "Trojan horses to deliver small RNAs into fungi to *fight* infection". The major idea of the paper is illustrated in Figure 8.

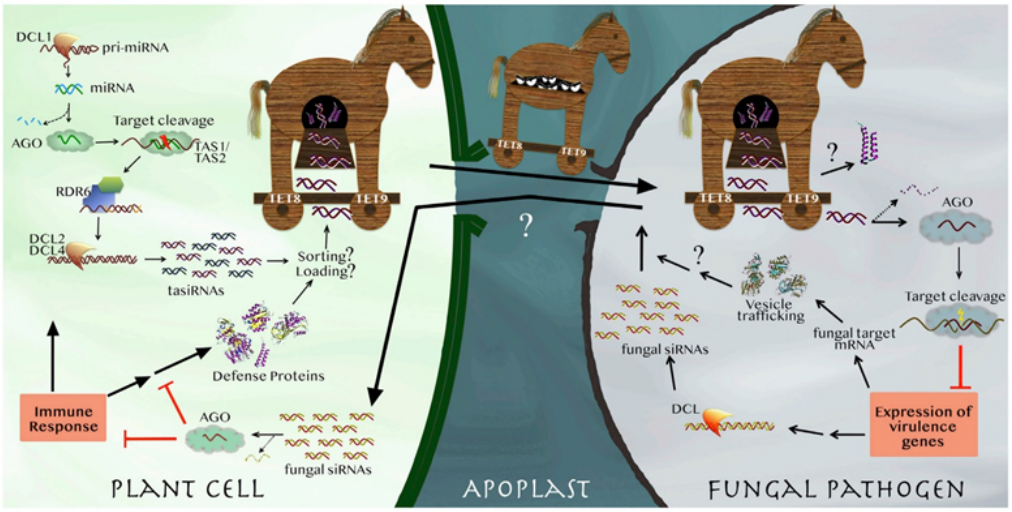


Figure 8: An illustration for "The Trojan horse of the Plant Kingdom" (2018)

4 Conclusion

Two major tendencies are outlined in the development of scientific discourse: standardization and individualization. If the first tendency corresponds to a centripetal force, the other one to a centrifugal one. As it happens in nature these two forces are ontologically unified and cannot be, by any means, traced apart. Indeed, the writers in sciences "rely heavily on conventional practices to encode ideas, to employ warrants and to construct arguments" (Hyland 2008: 3). What is more, the use of English in scientific communication is increasingly standardized and thus neutral keeping in mind the number of non-native speakers as well as collaborative works using English as their medium. However, despite the growing neutralization and standardization of scientific discourse provided by the universal character of English as a *lingua*

franca, another tendency could be revealed. High impact journals are gradually becoming more and more oriented towards a wide audience of specialists: they make the material published increasingly more attractive combining the use of metaphor along with other boosting techniques and useful tools to transfer new knowledge more efficiently. Publications in these journals might be compared to some kind of currency as they ensure further citations.

It has been recently revealed, that abstracts in higher impact journals are featured by a higher narrativity factor (Freeling et al. 2019). We can state that metaphors work for enhancing the narrativity of the paper as well and possibly much better than using simple linguistic techniques such as linking words. Deliberate metaphors basically open up another dimension of intertextual connections. Metaphors with the target domain situated in science are usually regarded to be a complicated mental entity, their source domain seems to be no less complicated that brings about the rise of metaphors based on culturally specific concepts. These concepts represented by nominal phrases, such as *Rosetta stone* and *Trojan horse* pertaining to general cultural knowledge still retain much of their original conceptual content that could be actualized and profiled in scientific discourse.

The conceptual analysis of the complicated metaphors in science with the source domains of the kind reveal the identified categorization represented by the core and periphery zones, which open up new possibilities for a more detailed investigation of the target domains. The feature getting profiled in academic discourse and relevant in the concept organization is a conceptual dominant. This dominant is a form of salience effect abundant in language that is ready to present the idea that plays as the focus in scholar's minds creating the new data bringing together semantics and pragmatics.

This dominant evokes mental representations of the cultural content acting like a key to a piece of special discourse and determining the meaning for the set of phrases in the text. The examples studied prove that the stored and conceptualized information of a very philological and semiotic character *(Rosetta stone)* and historical character *(Trojan horse)* by nature become especially relevant in other spheres of knowledge, construing patterns of discourse in academic writing. The complicated conceptual content becomes not a potential obstacle for understanding, but a viable conceptual tool for explaining something new. It is also necessary to mention, that scientific discourse provides the future generations not only with information structured and processed, classified and dried, but with a conglomerate of emotionally evaluated knowledge, structured according to other than but pure logical principles. The metaphorical language in light of contemporary scientific Pragmatics of being visible seems to be paradoxically more direct than literary language.

In case of the *Rosetta stone*, the search of meaning behind the signs and structures of language, collecting one puzzle from various parts is very similar to the work of any scientist, interpreting, uniting and seeking for analogies. The *Trojan horse* metaphor in Biology is recognized for its potential to get through various barriers that had long been struggled for. This paper has attempted to outline a distinct class of metaphors in scientific discourse and their functions that seem to be twofold: cognitive (inward aimed) and pragmatic (outward aimed). Both metaphors are united by a dynamic character semantics in discourse. Otherwise stated, this inexhaustible curiosity lying beneath the scientific quest and the dynamic heuristic potential made these concepts powerful metaphors so popular across the disciplines and genres. The rich conceptual and emotional content makes these metaphors meaningful, effectively potent of knowledge transfer. Arguing the vital importance of the notion of meaning, Ray Jackendoff compared it to the "Holy Grail" (Jackendoff 2002: 267) for the disciplines making up

the cognitive framework such as Linguistics, Philosophy, and Psychology, again using a highly culture specific metaphor.

Last but by no means least, the issues of scientific register and its uniformity arise. The representation of what is acceptable and what is beyond the limits of the generally acknowledged norm needs to be studied further and revisited for practical implications such as training in Academic Writing for non-native writes of ESP. A successful academic writer should, therefore, be able not only to identify a stretch of discourse as metaphorical but also to decipher and map the source domain to the target domain of his professional sphere of interest and thus interpret the stretch of discourse unambiguously: on-line comparison between two distinct domain-specific knowledge representations (cf. Gentner et al. 2001). A certain cultural and so-to say "metaphoric competence" in similar culture specific concepts becomes essential both in terms of passive and active knowledge and given the growing role of metaphor in science the cultural component in teaching ESP should not be dismissed as having no practical value or importance.

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