

The Enigma of Merlin in Biomedical Sciences: Image, Concept, Term

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ABSTRACT

This paper attempts to overview how a fictional character from the Arthurian myth became transferred to biomedical sciences entering complex variance relationship with other terms introduced at the same time. Applying the cognitive linguistic methodology, we first model the structures of knowledge represented by the initial concept through outlining the conceptual characteristics. Then we study the discursive features of using the term “merlin” and pinpoint those characteristics that get actualized in scientific papers. The term allows for great creativity to be unleashed exploiting those structures and transferring them to another knowledge domain. Merlin as a term is preferred in review papers and seems to serve as a marker of some yet unresolved questions of basic science.

KEYWORDS: merlin, Arthurian myth, terminological variance, concept, knowledge structures, metaphor.

ANOTACIJA

Straipsnio tikslas – apžvelgti, kaip karaliaus Artūro legendos personažas buvo perkeltas į biomedicinos mokslus, taip užsimezgant sudėtingiems, variantiškumu grindžiamiems santykiams su kitais tuo pat metu šiuose moksluose atsiradusiais terminais. Taikant kognityvinės lingvistikos metodą, pirmiausia, išskiriant sąvokos požymius, sumodeliuojamos pirminės sąvokos perteikiamos žinių struktūros. Tuomet analizuojami diskursyvieji termino *merlinas* vartojimo požymiai ir įvardijami požymiai, aktualizuojami moksliniuose darbuose. Šias struktūras panaudojant ir perkeliant jas į kitą žinių sritį, terminas teikia galimybių dideliam kūrybiškumui. Terminas *merlinas* dažniau vartojamas apžvalgoje ir yra tarsi ženklas, žymintis tam tikrus dar neišspręstus fundamentaliųjų mokslų srities klausimus.

ESMINIAI ŽODŽIAI: merlinas, Artūro legenda, terminologinis variantiškumas, sąvoka, žinių struktūros, metafora.

INTRODUCTION

Scientific writing or the type of language used in academic publications of various genres represents “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 knowledge structures formed at a certain period” (Novodranova 2007: 139) by the scientific community and, what is more important, it “provides a means for knowledge advancement” in a particular discipline (Wood et al. 2001). The cornerstones of knowledge transfer and its formation are terms, words “in its specific function” (Винокур 1939) representing the most condensed packs of processed and construed knowledge. However, the structures of knowledge are intact only to a certain extent. With the advances in science, they change, morph, and get restructured, embracing new knowledge acquired within the a discipline.

Metaphorically speaking, a term is like both a wave and a particle; it is a *linguistic unit* and a *cognitive one* at the same time, a static and a dynamic entity. The term is defined as a “verbal designation of a general concept in a specific subject field” (ISO 1087: 3.4.3) and typically is “a well delineated and clear-cut mental object with well-marked frontiers” (Leitchik, Shelov 2007: 93). Meanwhile, apart from obvious linguistic features, good and accepted terms are instruments of gaining new knowledge, i.e. they are defined by heuristic potential. Some terms could also be much more complex, fuzzy, and not fully determined (Leitchik, Shelov 2007). “The traditional terminology argument that concepts should be clearly delineated in order to ensure unambiguous and therefore efficient and effective communication is not convincing” (Temmerman 2000: 7). This might be due to the ontological opposition of living and thus the ever-changing body of knowledge and closed and thus static pieces.

The word *knowledge* was used several times in the previous paragraph on purpose. It is the most essential component, thus entailing the necessity to study not the exact words themselves, i.e. terms, but also the discourse reflecting the way this knowledge is modelled, taking into account the human factor, cultural, and social background and discourse practices at the given moment. Language is fundamentally “an intersubjective, historically and socially variable tool” (Geeraerts 2016: 527), it easily accommodates to the extra-linguistic environment. Thus, many

terms go through a long journey embracing this intersubjectivity on the way. Associations with history and culture get embedded in their structure on equal rights with a clear-cut scientific condensed thought. Rather, terms in discourse represent not the ready-made bricks of knowledge but the dynamic and communal aspects of gaining it. Particularly, “cognitive linguistics takes into account agents’ mental and communicative activities incorporating social, psychological, pragmatic and other sides of human interaction” (Manerko 2019: 52). In another insightful comment it is stressed that “we cannot study a professional language without having knowledge about ways and mechanisms of its creation and development” (Alexeeva et al. 2020: 59).

As substantial research has unveiled, the scientific discourse at large and terminology (Ahmad 2011; Petrović, Golubović 2018) in particular has never been deprived of this cultural-emotional component. Medical and psychological terminology has roots in Greek mythology, and this aspect is well-studied so far both from the traditional approach (Athanasiadis 1997) and the cognitive one (Манерко, Новодранова 2012). Moreover, the new millennium has witnessed certain changes going beyond the information-based preconception bringing the socio-cultural nature of language use to the foreground. They arise from “the situational, pragmatic and other extra-linguistic characteristics” (Schubert 2011: 29), cognitive aspects of scientific creative thinking (Temmermann 2000) construing identity through language means (Komova 2000; Hyland 2009). Although academic writing is considered to be mainly informative, numerous creative patterns have always contributed to the scientific process.

One of those features is using metaphors not only to explicate scientific concepts, i.e. the conceptual ones, but also to attract attention – the novel ones. Metaphors also serve as a rich and varied source of terminology. The vital role of conceptual metaphor in science is largely undisputed nowadays (Алексеева 1998; Johnson 2010; Herrmann 2013) for it offers insights on how new scientific ideas emerge, how they are transformed with advances in the knowledge field, and how they are disseminated through scientific papers and monographs. Many researchers explained the fact that metaphor and analogy are indispensable elements related to scientific creativity with the argument of juxtaposing old and new knowledge. “The novel entities and forms introduced by the theory become intelligible only if we interpret them in terms of the old entities

and forms already available” (Harré 2004). “Scientific metaphors are central to the construction of models and to the constitution of new scientific theories and that, especially 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” (Rodríguez, Arroyo-Santos 2011: 84). So, the ability to draw links between the known and the unknown is the vital capacity of scientific thought and a means for knowledge advancement. Metaphor amounts to “that instrument of thought, with the help of which we manage to reach the most distant parts of our conceptual field” (Ortega y Gasset 1990).

The role of metaphors in terminology formation was also acknowledged (Raad 1989; Tretjakova 2013; Temirgazina et al. 2019). A cognitive methodology was demonstrated particularly fruitful in understanding why a particular image undergoes a metaphoric transfer in a certain knowledge domain (Манерко, Новодранова 2012). The importance of culturally specific concepts being used as the source domains in science was studied for such metaphors as the Rosetta stone and the Trojan horse used in biology discourse (Sharapkova, Manerko 2019).

Searching for and making use of an appropriate metaphor in scientific discourse is fundamentally about a creative emotional insight. Here I would like to quote two scientists tackling the problem from the top-down and bottom-up approaches. First, the philosopher of language G. Kuliev underlined the role of emotional factors in scientific cognition: “The reflex to novelty in scientific activity begins ... with an emotional shock” (Кулиев 1987). The famous physicist, R. Feynman, in one of his lectures on the nature of the scientific method said: “Now I’m going to discuss how we would look for a new law. In general, we look for a new law by the following process. First, we guess it, no, don’t laugh, that’s the truth”. Both scientists in fact emphasized the importance of emotional impetus/creative insight/ holistic image at the heart of further experiment, rationalization, and categorization. This may probably be the same root for finding the metaphor.

The aims of this paper are twofold. First, I would like to show how the well-known character from the Arthurian myth possessing a high heuristic capacity underwent an interdisciplinary transfer and became a term, thus contributing to the scientific discourse of biology. Second, I touch

upon the question of terminological variance as several other terms based on different principles were introduced at the same time and merlin, after once being popular, ceased to a limited number of papers where it turned out to be creatively played upon. This piece of empirical research also aims to address the question of creativity in a purely informative scientific discourse and its role in promoting scientific ideas.

For these purposes, 2029 papers were collected from PubMed serving a corpus and a database of papers in biomedical sciences. The material comprises texts with either of these three terms: “merlin”, “schwanomin”, and “Nf2 protein”. Since the major focus of this work is Merlin becoming first a metaphor and then a term, the thorough conceptual analysis is undertaken prior to discussing the discourse use and cross-domain mappings.

MERLIN: A MYTHOLOGICAL CHARACTER AND A CONCEPT

In this part I would like to overview the literary and historical context and associations linked with the image of Merlin, the famous druid of the Arthurian myth. It will be necessary for further outlining the conceptual characteristics construing it as a concept before outlining the cross-domain mapping.

The metaphor identifying procedure traditionally works on two main levels: the linguistic and the conceptual one. It has long been acknowledged that a distinction between three major phenomena driving both the identification (merely linguistic) procedure and the understanding of metaphors is vital: linguistic expressions, conceptual structures, and the cross-domain mappings themselves. Several processes thus go hand in hand: identifying the metaphor, identifying the source and target domains, and finally understanding the stretch of discourse – its communicative and pragmatic value. However, when we are dealing with the terms originating from the field of arts and humanities including literature, history, mythology, it is especially important to carry out a thorough conceptual analysis of the source domain. The applied methodology was developed taking into account the conceptual metaphor theory (CMT) differentiating the source and target domains (Lakoff, Johnson 1980). Being a seminal work that changed the linguistic and cognitive linguistic view of metaphor for decades, it still required detalization especially when applied to the complex concepts serving the source domains.

Being initially complex images, these metaphors still preserve much of their original rich content based on all the links and associations being sometimes anything but straightforward. They could be quite complex for the analysis and ambivalent in use, especially if some of their conceptual characteristics get missed in this interdisciplinary transfer. The conceptual structure as acknowledged in the cognitive approach “relates to the non-linguistic knowledge representations that words tap into and can draw upon in situated language use” (Evans 2009: 4). Recent works in cognitive linguistics argue the significant role of broad cultural knowledge being stored and structured in various culturally specific concepts (Kotomova 2005). This structured knowledge serves as “a fundamental scheme by which people conceptualize the world and their own activities” (Gibbs 2008: 3), it provides the ready-made conceptual framework for transferring from one area to another.

The image of Merlin is the most ambivalent and enigmatic character in the Arthurian myth, an image that appeared in legends separately from the Arthurian myth, and organically merged with the Arthurian myth enriching it with Celtic magical imagery. In the oral tradition, Merlin has existed since the 7th century (Goodrich 2002). According to the first historical records, Merlin was a young magician Ambrosius, born from an incubus and a nun, thus defined by the supernatural ability to know things and no evil intentions. He could see the underground lake and fighting dragons (red and white), prevent Vortigern from erecting a fortress. However, the most popular version of the story was presented by Geoffrey of Monmouth in the 12th century “*Historia Regum Britanniae*”, where the final combination of historical, legendary, and mythological figures took place in the single image of Merlin Ambrosius – a seer, druid, wizard, and sage. Merlin became a unique character in medieval literature, an amalgam of various representations of pre-Christian beliefs and the first conceptualization of the power of knowledge.

In general, there were two main medieval traditions of Merlin’s description: a druid-magician and a visionary-politician (Jarman 1960; Thomas 2000). Throughout the history of literary incarnations, the image of King Arthur became the embodiment of royal social power, while Merlin was the embodiment of power of mystical practices, which originate from the Druids religion. An oak and a mistletoe were as symbols of the Druids (reflected in etymology of the word *dru-vid* “strength-wisdom” and as-

sociated with strength and wisdom) (Guenon 1962). This is the Indo-European type of the priest-king, the shaman or holy man, the image of the wild man, the model of the biblical prophets (Goodrich 2002). His image is a mediator between different worlds: pagan and Christian, magical and knightly, living and dead. His role as a mentor to young Arthur construes the vital component of the legend. His further fate is also important; he disappears from the Arthurian world after falling in love with his female apprentice – Nimue. Despite his visionary abilities and magical knowledge, he could not resist her charms and got trapped in a cave. Still, it is not death in the proper sense; he hangs at the borderline between the living and the dead, returning and embodying the archetype of the eternal Old Wise man “the highest and wisest resources of the unconscious” (Gollnick 1990).

In the 21st century, when science became so inconceivably complex that it is impossible to grasp many of its concepts without believing in them or assuming them as holistic entities, the image of Merlin the Scientist became the ideal material for a prototypical researcher, ironic, intelligent, and a bit mad. The latter is reflected in numerous fiction and cinema works.

Now let us turn to outlining the conceptual characteristics through seven lexicographic sources we analysed (American Heritage Dictionary of the English Language; European Myth, Legend; Collins English Dictionary; Webster’s College Dictionary; Macmillan Dictionary; Wiktionary). First of all, Merlin is inevitably associated with the legends of King Arthur as it is mentioned in six analyzed definitions, which point at the discursiveness of the image existence (Шарапкина 2014). Merlin originates and exists in old stories (*old English stories*). Besides that, there are three important functional components. Its magical nature is predominant, and he is described as *a magician* in four definitions, and as *a wizard* in three ones. The other two components of the image being less frequent usually occur in combination. This is the role of the advisor: *counselor* (2 times) and *advisor*. Only in one definition the noun *friend* is used, indicating a friendly relationship between Arthur and Merlin. And the role of the seer is reflected in *prophet* and *seer* lexical items. The definitions also contain information about his death, namely, according to one of the legends, he was imprisoned by Morgana/ Vivien/ Nimue in an oak tree: *eternally imprisoned in a tree by a woman to whom he revealed his secret craft*.

Since the explanatory dictionaries of language and culture offer only key information about the core conceptual characteristics, we turned to the dictionaries of associations, based on computer processing of big data from open Internet sources, as well as classical and modern English literature. The associations presented in the Word Association Network dictionary used in our study, make it possible to identify not only the core characteristics of the concept under scrutiny, but also its nearest periphery and periphery. It also highlights the connections with other characters of the myth (see Table 1).

Table 1. The distribution of conceptual characteristics (based on Word Associations Network dictionary)

MOST FREQUENT ASSOCIATIONS	LESS FREQUENT ASSOCIATIONS	LEAST FREQUENT ASSOCIATIONS
Core magical capabilities: <i>Magician, Druid, Prophecy, Sorcerer, Bard, Hawker, Wizard, Enchanted, Eared, Pied, Powered, Magical, Sage, Magic, Prophetic, Wizard, Sorcery, Owl</i>	Core, magic capabilities: <i>Spell, Prophet, Foretell</i>	Core, magical capabilities: <i>Witchcraft, Counsel, Stone, Alchemist</i>
Nearest periphery: <i>Cooled, Enchantment, Damsel, Engine, Wand, Vulture, Smiley, Priestess, Vivian Prophecy, Imprison</i>	Nearest periphery, other personages: <i>Morgan, Emma, Lancaster</i>	Periphery, features of the world: <i>Knighthood, Adventures, Chronicles, Downfall, Supernatural, Fairy, Celtic, Radial</i>
Nearest periphery, general characteristics: <i>Spitfire, Apprentice, Beget,</i>	Periphery, features of the world before Arthur: <i>Chaos, Sickness, King, Fantasy,</i>	Nearest periphery, general features: <i>Nemesis, Rough, Argonaut, Thrust, Prologue, Mythology, Demon, Attraction, Gods, Likeness, Prometheus, Illegitimate, Topical</i>
Nearest periphery, Space and Artifacts: <i>Grail, Quest, Avalon, Scabbard, Briton, Cauldron, Vita, Saxon, Britain, Barron, Legend</i>	Nearest periphery, authors: <i>Cornwall, Chaucer</i>	Nearest periphery, the end: <i>Dungeon, Aquarium, Madame, Prey, Destiny, Veil, Omnibus, Imprisoned, Treachery</i>
Core, other personages: <i>Lancelot, Arthur, Gwen, Lucien, Tristan, Percival</i>	Nearest periphery, artefacts: <i>Dragon, Sword, Towers</i>	Nearest periphery, artefacts: <i>Bowl, Goblet</i>
Nearest periphery, the authors: <i>Monmouth, Geoffrey, Tennyson</i>	Periphery, other: <i>Entertainment, Potion, Horsepower, Cedric, Macbeth, Cruising, Hobby, Boost, Bbc</i>	
	Nearest periphery, the end: <i>Nymph, Cave, Mermaid, Prototype, Lure, Disguise, Conjure, Slay, Tailed, Immortal</i>	
	Nearest periphery, the space: <i>Welsh, Eurasian, Brittany, Cornish</i>	
	Core, general characteristics: <i>Mystical, Perilous, Legendary, Fitted, Mythical, Sentient, Yonder, Rightful</i>	

This procedure of outlining the core and periphery characteristics of the studied concept was developed on the basis of the traditional conceptual analysis (Болдырев 2014) extended with the analysis of associations and encyclopedic knowledge. It forms a useful basis for the further cross-domain mapping procedure (Sharapkova, Manerko 2019), image-schema, and the integrated spaces analysis (Шарапкова, Яковлева 2020), especially when we are dealing with a conceptually rich content. It is clear that Merlin's core characteristics as a magician, alchemist, and druid make this image highly useful for denoting complex and illusive entities requiring conceptualization and categorization in science.

MERLIN BECOMING A TERM IN NATURAL SCIENCES

The 21st century witnessed significant advances in studying the molecular mechanisms underlying developmental processes and delineating biochemical pathways that once broken lead to various malformations. It has become crystal clear that the biology of a living organism is both extremely fragile and incredibly complex rejecting any mechanistic simplification. This swiftly developing area with the knowledge acquired at a high pace required the whole body of new terms being proposed, turned down, or accepted. The latticework of the biological pathways required some facilitating vehicles to understand and explicate the science begetting metaphors.

One of the exceptionally interesting cases is the appearance, variance, and change of the term “NF2 protein”, 595 amino acid protein encoded by Neurofibromatosis type 2 (NF2) gene that was called “schwannomin” and “merlin”. It is a cytoskeletal protein contributing to developmental processes. In humans it is involved in the pathogenesis of tumors of the human nervous system as it is inactivated or not functioning in almost all schwannomas and meningiomas.

The first works on this protein appeared as early as the 80-s and early 90-s with papers published in the most reputable journals – “Nature” and “Cell” – both explaining the choice of this specific terminological formation. Since the protein responsible for the development of tumour growing out of Schwann cells was first found in schwannomas, it was called “**schwannomin**” – “a word derived from **schwannoma**, the most prevalent tumour seen in NF2” (Rouleau et al. 1993). It was also proposed that it has tumour suppressor activity and surprisingly turned out to have the secondary structure “similar to the structures of moesin, ezrin and radixin” (Ibid).

The intrigue is that exactly in the same year another paper on the same topic was published by the other group of scientists. The authors identified the protein based on studying the families with inherited neurofibromatosis type 2 disease: “This protein, which we have named **merlin** (for **m**oesin-**e**zrin-**r**adixin-**l**ike protein), may represent a new class of tumor suppressor whose function is mediated by interaction with cytoskeleton” (Trafatter et al. 1993). The introduction of two different terms designating the same object (protein) simultaneously created the situation of terminological variance.

Both terms seem to be most reasonable and fulfilling the requirements the terms should have. “Schwannomin” is related to the type of cells primarily affected by the mutation, thus bearing the information of its discovery; it follows the morphological pathway of similar terms, and it localizes the protein product in some subarea – brain research. The second term – “merlin” is an acronym. The recurrent definition of the acronym runs as following: “an acronym is a nuance of word-group abbreviation, wherein the word group (usually a single entity or a noun, but sometimes a verb) is pronounceable” (Grange, Bloom 2000: 3). The tentative tendency is not only to make the new word pronounceable but also resembling the already existing words the tendency is called a backronym and is popular in marketing. In our case, the resulting term is not only fairly pronounceable with a vowel in the middle but maps onto the existing enigmatic character. The acronym’s structure has two crucial benefits. First, it fits into the phonetic structure of similar terms even better, as it is a two-syllable word rather than a three-syllable word. Thus, “merlin” enters the already existing terminological system. Second, as the later research has uncovered the protein was not solely related to Schwann cells but also functioned as a membrane-cytoskeleton scaffolding protein. So, it is better in the form of “merlin” thus lacking a direct link to schwannomas.

Moreover, it turned out to be quite an ancient protein: merlin was identified as an upstream regulator of the Hippo tumor suppressor pathway, a function that is conserved in mammals (Hamaratoglu 2006), thus contributing to cell proliferation, growth and apoptosis (cell death) at large. The very idea of an ancient origin and homology to the known proteins was fully explored in the following publication by the same authors supporting the metaphor by personalization. The authors use the word “pedigree” usually referring to “the parents and other past family members of an

animal or person, or an official written record of this” (LDO) in the metaphoric context. The opportunity ensured by background mapping between merlin the protein and Merlin the druid: “*DNA diagnosis of neurofibromatosis 2. Altered coding sequence of the **merlin** tumor suppressor in an **extended pedigree***” (MacCollin et al. 1993). Moreover, the 1994 paper revealed that the overexpression of this protein can nearly miraculously revert “*the malignant phenotype induced by an oncogenic Ras mutant*” or “*antagonize the oncogenic action of Ras mutants*” – the driver of most carcinomas¹ in human body (Tikoo et al. 1994). In the coming years the authors ensured personalization mapping using the words from the human domain such as *antagonize*, *fight with*, *battle off*, and *abrogate*. Interestingly, such word as *abrogate* (to officially end a legal agreement, practice LDO) starts being used in this context by possibly supporting the idea of some slightly too formal style: “*Whereas a mutation at S518 that mimics constitutive phosphorylation (S518D) **abrogates** the ability of merlin to suppress cell growth and motility...*” (Surace et al. 2004). Moreover, in many papers of this period it is still not clear whether the new term is written with the lower case as terms are supposed to be written or with the upper case, like a name, as it is preferred by some authors.

The term **merlin** embraces the already existing structure of knowledge of the other domain. First, it is the magical-mythical part related to the difficulty of obtaining scientific knowledge, the complexity of the protein functions that are yet not fully determined. The druid is old, and the protein fulfills the tumor suppressive function allowing the cells to function longer and the organism lead a full life. Second, since it contributes to the development and growth in mammals, it could be conceptualized as a wise councillor, a mentor, the role akin to the one played by Merlin in many Arthurian stories. Third, it carries all the emotional associations related to literature and culture that might make the knowledge transfer faster or easier. “Merlin” is an example of the term that is not fully determined, thus potentially open to accommodating new meanings or shades of meaning relying on the dynamic character of science. “Indeterminacy can manifest negatively as vagueness but also positively as openness, “hospitality” or ability to accommodate concurrent possibilities” (Bassey 2007: xvi).

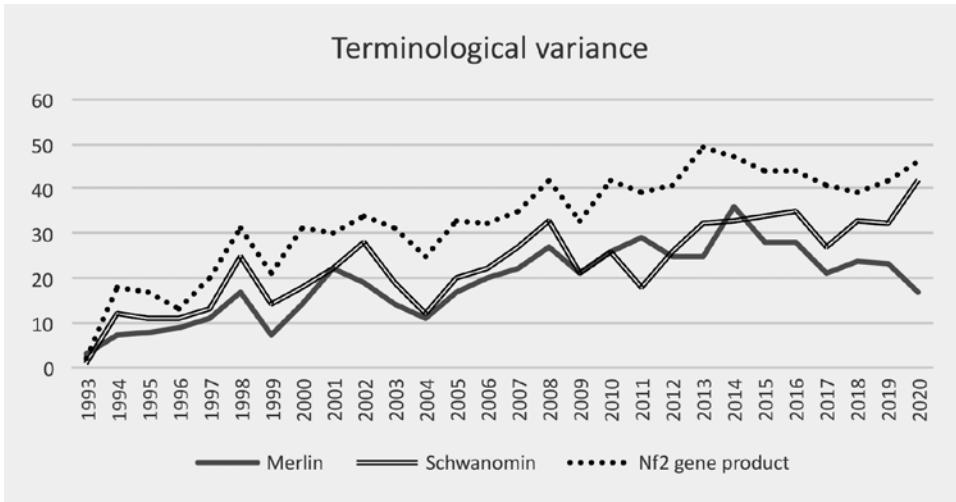
¹ Carcinoma is a malignant tumour developing from epithelial cells.

Here I would like to return to a very important idea that transformed LSP studies in the 90s. It is the understanding that the language of science is the communal effort with many contributing to it. In other words, all people working in the field contribute to the language norm through writing their own papers, preferring some words/patterns over the other. Charles Bazerman also argued that “to treat scientific style as fixed and epistemologically neutral is rhetorically naïve and historically wrong” (1987: 125). Terminology is no exception. The rich structure of knowledge provided by the image from another field allows us to realize some of its slots working as a kind of a framework to be filled. It was further adapted in education as well and formulated as following: “beyond metaphors, according to which learning is a process of knowledge acquisition by individual learners (a “monological” approach) or participation in social interaction (a “dialogical” approach), one should distinguish a “trialogical” approach, i.e., learning as a process of knowledge creation which concentrates on mediated processes where common objects of activity are developed collaboratively” (Paavlova, Hakkarainen 2005: 535). It is very much in line with the notion of “collaborative creativity” discussed in cognitive linguistics in the past years. It stresses that creativity is first and foremost a communal act and effort ensured by the preexisting knowledge structures (Заботкина 2019).

Two terms were used equally frequently as the study of 2029 papers in PubMed has shown (Fig. 1)². In many cases the authors followed the model of mentioning both in one paper: “merlin” – the other name “schwanomin” or “schwannomin” – the other name “merlin” or even the double form “merlin-schwannomin” and “merlin/schwannomin”. Some areas of knowledge though diverge. “Schwanomin” is clearly preferred in cancer studies, experimental works on human cells, medical cases, while “merlin” – in more complex biological areas and particularly in review papers. Moreover, we cannot rule out the competition of two laboratories or groups as well, thus adding a significant social factor to a case of linguistic terminological variance. In recent years, more papers with just NF2 product or NF2 protein are prevailing being probably the leading cause for a decrease of merlin in papers and reflecting the tendency towards abbreviations consistent within different domains. NF2 gene most

² Some of the researched sources we cite here in full and present in a separate list of references at the end of the paper.

Fig. 1. The use of key terms in papers of biology and medicine from 1993 till 2020

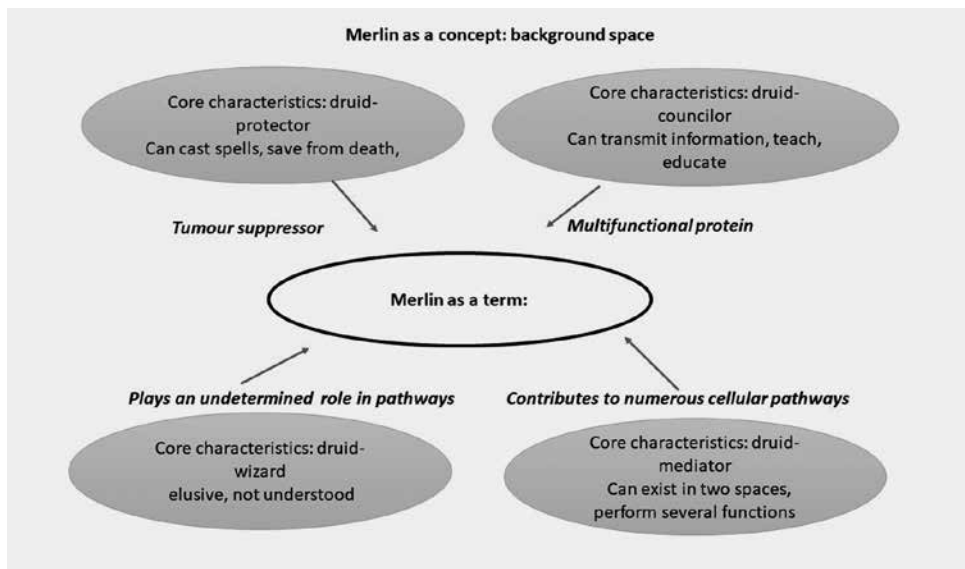


logically produces NF2 protein, not Merlin or schwannomin, no matter how useful these were at the very beginning of studying this field.

The potential of “merlin” as a term to evoke a whole range of associations connected with its literary ancestor is successfully exploited in some of the papers explaining the choice of this term over the second one. The preexisting knowledge structure or matrix allows for creativity, extending and expanding the overall interpretation of a purely scientific paper. These cases could be viewed as the simultaneous operation of two mental spaces: the space of rigid and precise science relying on rational thinking and the space of mythological imagery relying on emotional syncretism. They do not form the integrated space as it is described in the blending theory (Fauconnier 1999), but add the level of intertextuality, adding novel interpretations and gluing several thoughts into some holistic entity.

In most cases we observe only one creatively developed characteristic feature. Analyzing all the collected examples, we outline four major pathways “merlin” could take based on the core conceptual characteristics. They are as following: druid-protector, druid-councilor having access to knowledge and information, druid-wizard being elusive and enigmatic, and druid-mediator (summarized in Fig. 2). These pathways most clearly fit into the slots provided by the structure of the original concept; the core characteristics are mostly exploited, yet the peripheral ones unlock the creativity potential.

Fig. 2. The conceptual characteristics of MERLIN at the background of its metaphorization in scientific papers



The role of Merlin as a druid-protector, the magical warrantor of the Arthurian kingdom with positive connotations seems to be most popular in biomedical papers especially when dealing with yet unknown functions in the early years of exploring merlin. Let us illustrate this transfer with the following examples. The papers entitled as follows: “Neurofibromatosis 2: loss of merlin’s **protective spell**” (Gusella et al. 1996); “NF2: the **wizardry** of merlin” (Xiao et al. 2003); “Merlin: the **wizard** requires protein stability to function as a tumor suppressor” (Morrow, Shevde 2012) are based on this idea. In the first, the authors consider possible functions based on merlin’s homology to other similar proteins: *Merlin might thus play a role in the control of cell shape, movement, attachment, communication, or membrane remodeling.*

Being a mythological creature, Merlin is in line with other mythological characters with superpowers like Prometheus: “Neurofibromatosis type 2/Merlin: sharpening **the myth of Prometheus**” (Drvarov, Cubero 2011). This paper stresses the critical role of “merlin” controlling homeostasis of the liver stem cell niche, thus being much more important in various processes including liver regeneration, the exceptional capacity of which was portrayed within the lines of the Prometheus myth. Merlin serves as a guardian controlling the proliferation of hepatic oval cells. This is an

even more complex conceptualization with three input spaces merged: the myth about Prometheus, the Arthurian myth, and the science behind this protein – “merlin” endowed with outstanding powers. The correlation with life and death or cell growth and apoptosis was serendipitously shown in the angiogenesis of schwannomas, where merlin plays a role as well, thus making the blood vessel environment a potential therapeutic target for treating schwannomas.

The nearly magic function of protecting cells from tumourgenesis since not clearly understood leads to playing on contrasting the rational and irrational systems of knowledge, the irrational one serving as the background source of inspiration for the rational one. Although the authors resort to such words as *wizardry*, *spells*, *magic* for creative purposes, they delineate them creating an opposition in discourse: *Finally, a **rational understanding of Merlin’s wizardry** will enable the design of sorely needed targeted therapies for NF2, mesothelioma and, possibly, other types of cancer* (Okada et al. 2007). This is the verbalization and deconstruction of the thought mediation between two mental spaces: background literary mythological and scientific terminological. Understanding or rationalization becomes the clue. The same process occurs in the paper “**Magic but treatable?** Tumours due to loss of merlin” (Hanemann 2008) focusing on the tumors arising from the loss of function and potential approaches to treat them. The mechanism of malformation is not yet understood, but it is possible to find a treatment by inhibiting the already known pathways related to merlin. The use of the word *magic* in the title stresses that the full picture is neither known, nor understood; moreover, it is so complicated that it could metaphorically be seen as magic.

The mediator function is reflected in the following lexical items: *hanging, between, linking*, e.g.: *Merlin: **hanging** tumor suppression on the Rac* (Sherman, Gutmann 2001). “*Merlin is a “**magic**” **linker** between extracellular cues and intracellular signaling pathways that regulate cell motility, proliferation, and survival*” and “*Merlin regulates signaling events **at the nexus** of development and cancer*” (Stamenkovic, Yu 2010). *Merlin might function in a pathway designed to **convey information** between the cytoskeleton and the cell membrane, and from these to the nucleus* (Gusella et al. 1996).

The conceptualisation of a protein through druid-wizard and druid-councilor slots is especially useful in papers focusing on the plethora of functions this protein can fulfill. The paper “NF2: the **wizardry** of merlin”

(Xiao et al. 2003) is a detailed review of numerous putative functions played by this protein in tumour initiation and progression without specifically supporting the choice of wizardry introduced only in the title. Many of these functions are just supposed but not known or proved experimentally. Yet it is clear, that given the number of functions the protein can handle and the whole complexity of these processes harnessing numerous biochemical pathways, its role could be compared to wizardry. It is a well-known illness of human thought oxymoronically formulated by fiction writer Arthur Clarke: “Any sufficiently advanced technology is indistinguishable from magic”. It may be even reformulated into “any inconceivable complex science could be simplified through magic thought”.

The papers addressing the unknown or yet unproven functions of this protein clearly choose merlin as a term rather than schwannomin accompanying the text with such words as *elusive*, *unknown*, *unelucidated*, *mysterious*, etc. Even for a rational scientific thought, something not known feels like mysterious and magical, like the nature is still hiding its secrets from the human mind. It is used in the titles of the following papers: “Shedding light on Merlin’s **wizardry**” (Okada et al. 2007), where the authors work within the well-established conceptual metaphor of comparing knowledge to light. This protein as contrasted to other products of the oncogenes affects the malignant processes indirectly through contributing to different cellular pathways: 1) *other tumor suppressor genes appear to function in processes less clearly related to control of the cell cycle. One of the most **intriguing genes** of this latter class is the Neurofibromatosis type 2 (NF2)1 gene, which encodes a member of the protein 4.1 superfamily, Merlin*; 2) *The mechanism by which Merlin functions to regulate cellular proliferation **is still unclear*** (LaJeunesse et al. 1998); 3) *The mechanism underlying the tumour-suppressor activity of the neurofibromatosis type 2 (NF2) gene product, merlin, **is largely undefined*** (Neill, Crompton 2001). The protein was clearly exceptional in the list of similar tumor protectors and many papers stress it through direct comparison: *It became immediately clear **that Merlin is no ordinary tumor suppressor: it is devoid of any apparent catalytic or DNA-binding domain but displays significant homology to members of the ERM (Ezrin–Radixin–Moesin) family of cytoskeletal linker proteins*** (Okada et al. 2007).

The review article entitled “The tumour suppressor protein NF2/merlin: **the puzzle continues**” (Hovens, Kaye 2001) explicitly plays on this

part of the original conceptual characteristics making the process even more complicated through fitting “merlin” into the recurrent metaphor of gaining knowledge like assembling a puzzle. The papers that stress the lack of knowledge prefer the word *elusive*: *However, as yet, how this function translates into tumour growth suppression remains **elusive***. For a long time, the functions of this protein were not pinpointed: 1) *The Nf2 tumor suppressor gene codes for merlin, a protein whose function has been **elusive*** (Kissil et al. 2003); 2) *but the function of its encoded protein, Merlin, **remains elusive*** (McClatchey, Giovannini 2005); 3) *Although the biochemical function of Merlin has **remained elusive**...* (Okada et al. 2007). The authors clearly prefer boosting techniques and choosing stronger words: ***Unraveling** the biology of these tumors helps to clarify their growth pattern* (de Vires et al. 2015).

The role of Merlin as a counselor to young Arthur organizing the Order of the Round Table and mediating between different knights make the term exceptionally useful in describing complex biological pathways stressing the coordinating, cooperating function as it was done in the following papers: “Nf2/Merlin: a **coordinator** of receptor signalling and intercellular contact” (Curto, McClatchey 2008) and “The merlin **inter-acting** proteins reveal multiple targets for NF2 therapy” (Scoles 2008). The conceptual metaphors represented by *regulate*, a common word in biology, are accompanied by more metaphoric expressions such as *dictate, cooperating function, remodel the cell-cell communication, a microtubule stabilizer, a master organiser*. For instance: *Tumor-suppression functions of merlin are independent of its role as **an organizer** of the act in cytoskeleton in Schwann cells* (Lallemand et al. 2009); *Merlin functions as **a critical regulator** in Staphylococcus aureus-induced osteomyelitis* (Zhou et al. 2021).

The best test for the structure of knowledge is whether it is productive or not. Otherwise stated, whether any new terms appear to be formed within the existing framework. And Merlin as a term, having tied bonds with magic and wizardry, is indeed being productive. The 2000s saw the term “magicin” to appear in the paper “**Magicin**, a novel cytoskeletal protein associates with the NF2 tumor suppressor merlin and Grb2”, which is another acronym following the proposed framework and exploiting the already existing structures of knowledge: *We report a novel protein as a merlin-specific binding partner that we have named magicin (**merlin and Grb2 interacting cytoskeletal protein**)* (Wiederhold et al. 2004).

Since 2014, there have been much more papers devoted to searching for targeted therapies against the tumors associated with Nf2 gene and its product merlin or schwannomin. Interestingly, this protein was shown to contribute to other cancer types and their progression: *NF2 mutations and merlin inactivation also occur in spontaneous schwannomas and meningiomas, as well as other types of cancer including mesothelioma, glioma multiforme, breast, colorectal, skin, clear cell renal cell carcinoma, hepatic and prostate cancer* (Petrilli, Fernández-Valle 2016). Therefore, there is a slow decline in using the first term and preferring the second in biomedical papers. For clarity and uniformity some authors just prefer “Nf2 gene product” that nearly triples in the period of 2013–2020 (Fig. 1). Merlin seems to be still preferred in those works dealing with fundamental biochemical processes, developmental processes, oxidative stress. Again, in many papers two terms appear together and are introduced as complete synonyms like in the following papers: “Merlin, the NF2 gene product” (Pećina-Šlaus 2013) or “Role of Merlin/NF2 inactivation in tumor biology” (Petrilli, Fernández-Valle 2016). Meanwhile the term “merlin” started to be ousted by Neurofibromin 2, the term related to the gene causing all the malfunctions. Moreover, in 2021 there were 41 uses of the term “merlin” as compared with 34 of Nf 2 protein and only 11 of schwannomin. It seems that the final choice of the one and only term is not made, and this variance is consciously preserved not only for the sociocultural reasons of two schools or groups competing, but precisely because of the necessities connected with knowledge formation and mediation in biology. That is this complexity, fuzziness, and indeterminacy working for heuristic purposes with subtle differences still existing between the terms.

Another aspect that is usually dismissed while discussing academic writing is that it could have inclusions of creativity or some phenomena going beyond the information-centered paradigm. In our case it is both: at the cognitive level when new knowledge is being born and at the linguistic level of mediating this knowledge further on. The first level is difficult to capture through traditional linguistic methods as only very infrequent instances such as the appearance of the term “merlin” allow to get insight on how the novelties arise. Two ideas I quoted earlier about *an emotional shock* (Кулиев) and a *guess* (Feynman) at the very dawn of theory formation are in fact in good agreement with the latest neurological research on creativity: “Creative thought also has vital emotional components, includ-

ing the reaction of pleasure that accompanies novel combinations in the treasured AHA! experience. The generation of new representations involves binding together previously unconnected representations in ways that also generate new emotional bindings” (Thagart, Stewart 2011). But this moment could be traced through studying metaphors at all stages of knowledge advancement. Meanwhile, when the protein is finally understood, the metaphoric potential is exploited again mostly in review papers (Table 2). Moreover, these papers seem to be cited much more than it is common for the journal. It may be partially explained by the fact that the review papers are cited more often, but it might also be the creative title attracting attention, thus boosting the cite score even more. The data on the impact factor and citation score were retrieved from Web of Sciences. Several papers exceed the impact factor by the citation score significantly.

Table 2. The most creative titles in our corpus with the journal impact factor and cite score

TITLE	JOURNAL	IMPACT FACTOR	YEAR	TYPE	CITE SCORE
Neurofibromatosis type 2/Merlin: sharpening the myth of prometheus	Hepatology		2011	comment	3
Neurofibromatosis 2: loss of merlin’s protective spell.	CurrOpin Genet Dev	5.9	1996	review	44
Magic but treatable? Tumours due to loss of merlin.	Brain	14.25	2008	review	105
The tumour suppressor protein NF2/merlin: the puzzle continues	J Clin Neurosci.	2.1	2001	review	22
Merlin: the wizard requires protein stability to function as a tumor suppressor.	BiochimBiophys Acta.	3.4	2012	review	23
Shedding light on Merlin’s wizardry	Trends Cell Biol.	16	2007	review	84

TITLE	JOURNAL	IMPACT FACTOR	YEAR	TYPE	CITE SCORE
Merlin, a «magic» linker between extracellular cues and intracellular signaling pathways that regulate cell motility, proliferation, and survival.	Curr Protein Pept Sci.	2.5	2010	review	108
NF2: the wizardry of merlin.	Genes Chromosomes Cancer	4.04	2003	review	42

DISCUSSION AND CONCLUSION

The analyzed case of an image becoming a metaphor and further giving rise to a term being an acronym in the specialized context is particularly interesting. It brings to the limelight not only the sheer complexity of the changes but also the role of metaphors in the initial phase of discussing and describing a novel scientific concept. Metaphors are indispensable from popular scientific writing and communicating ideas to a broader audience, yet here we observe how the complex multilayered image was transferred from one domain to another specifically to grasp the enigmatic entity to be further resolved through rational thinking. This is what makes the case of “merlin” both unique and symptomatic pointing to some specific pull of source domains valued by science for the heuristic potential they carry. The source domains to be used in science are connected with culture, mythology, and literature as they are emotionally rich domains of knowledge.

The example of terminological multivariance (“merlin”, “schwanomin”, and “NF2 protein”/ “NF2 gene product”/ “neurofibromin”) is particularly interesting as three terms got introduced, used, interpreted nearly at the same time and within the same knowledge domain. Moreover, they were used by nearly the same people in different papers for different purposes. As Gordin stressed in his book on scientific English, “scientific languages are not born, they are made, and made with a good deal of effort” (2015), thus underlying the significance of each change and choice.

Given the complexity of the chosen material, we developed the following procedure to outline the conceptual characteristics to be further ana-

lyzed in biomedical discourse. First, the analysis of lexicographic entries to get the core characteristics, then dictionaries of associations and encyclopedic knowledge to obtain the complete structure of a concept. Then the collected material from PubMed is analyzed to build the key pathways the original concept gets exploited in scientific discourse.

Studies of the protein merlin are associated with molecular oncology, morphogenesis, and cell differentiation as well as the origin of multicellular animals from the evolutionary point of view. At the same time, merlin can play an important role in the intriguing processes occurring during such a general biological phenomenon as oxidative stress. These scientific areas are united by the necessity to elucidate the fundamental mechanisms of cell programming and proliferation regulation. These are the questions with many unknown blocks of information, not yet formed knowledge. Merlin may not be the key to all these areas, but it seems to be an important piece of a puzzle, a riddle, or even a mystery. It should be noted that the acronym merlin is often used in works containing the most significant and non-trivial results, allowing to lift the veil of some yet unknown mystery. So, when the majority of questions are more or less resolved, and it is possible to use these revelations in practice (medicine or treatment), the mystery vanishes into thin air and there seems to be no need in the term “merlin” having associations with the image of a wizard from the Arthurian myth capable of knowing what other people cannot. This drives the heuristic potential of the term and makes use of the initial structures of knowledge and conceptual characteristics.

In this context, the initial image complexity carrying the burden of cultural knowledge is not the problem for using the term. On the contrary, it is a way to facilitate the construal of this very knowledge being first and foremost the communal effort largely relying on the initial complexity. In modern science, especially in biomedicine, the knowledge is so unbelievably complex that we are inevitably dealing with heterogeneous networks comprising humans, the results of their intellectual work, and various artifacts (Latour 1999). In order to facilitate science progression we just have to resort to all kinds of scaffolds mediated by discourse: creating and using cognitive artifacts, metaphors, and repurposing mental models, powerful images, concepts. They “are more knowledge-laden, smart and autonomous” (Paavola, Hakkarainen 2005: 536). The mythological, cultural, and literary images surprisingly have an unprecedented heuristic potential.

They offer a mental modal that is complex yet holistic, multifaceted yet structured, an open and undetermined, yet having the stable core. Most importantly it allows for creative, nonrestrained use and reuse of previous knowledge, thus stretching the borders of the unknown.

Concluding the terms' indeterminacy is a boon, not a problem for a term, especially within a particular period of knowledge development. The conceptual structure of the original image beneath the term plays a huge role, facilitating the communal efforts on construing knowledge and even advancing it in a completely different area. Specific characteristics get played upon in each realization of the term in the discourse of scientific biomedical English. The analysis has shown that more complex and fundamental papers feature the term "merlin" over "schwanomin" or "NF 2 gene product". When most of protein merlin's features and its role in numerous processes are solved, its frequency decreases. It was also noted, that more creative titles are used in review papers, and are cited more often, yet this feature of scientific discourse is to be studied further.

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MERLINO MĖSLĖ BIOMEDICINOS MOKSLUOSE: VAIZDINYS, SĄVOKA, TERMINAS

Santrauka

Straipsnyje analizuojama, kaip karaliaus Artūro legendos personažas buvo perkeltas į biomedicinos mokslus, taip užsimezgant sudėtingiems, variantiškumu grindžiamais santykiams su kitais tuo pat metu šiuose moksluose atsiradusiais terminais, o būtent su terminu „švanominas“, kuris atsirado tais pačiais 1993 metais, kaip ir „merlinas“, tačiau jį paskelbė kita tyrėjų grupė kitame žurnale. Iš pradžių abu terminai gyvavo tuo pat metu ir buvo sinonimai, bet vėliau juos imta vartoti skirtinguose mokslo darbuose ir skirtingose biomedicinos tyrimų srityse. „Merlinas“ dažniau vartotas fundamentaliuosiuose moksluose, o „švanominas“ – biomedicinos srities tyrimuose. Kadangi terminas „merlinas“ susiformavo kaip atvirkštinis akronimas (angl. *backronym*) iš termino „moezino-ezrino-radiksino tipo baltymas“ (angl. *moesin-ezrin-radixin-like protein*) ir jam pavadinti tinka paslaptingojo personažo vardas, pirmiausia turėjome sumodeliuoti pradinę sąvokos struktūrą. Taikydami kognityvinės lingvistikos metodą (leksikografinių straipsnių analizę, asociacijų žodynus), pirmiausia apibrėžėme pagrindinius sąvokos požymius. Tuomet analizavome diskursyviuosius termino „merlinas“ požymius ir išskyrėme tuos požymius, kurie aktualizuojami moksliniuose darbuose. Analizuodami visus surinktus pavyzdžius, išskyrėme keturias pagrindines šio termino aiškinimo

kryptis, vadovaudamiesi pagrindiniais sąvokos požymiais: žynys-globėjas, iš kurio kyla nuo navikų susidarymo saugančio baltymo koncepcija; žynys-patarėjas, kuriam yra prieinamos žinios ir informacija, nurodo į tam tikrus signalus perduodantį baltymą; sunkiai surandamas ir paslaptingas žynys-burtininkas, atliekantis daug sunkiai nustatomų ir įvardijamų funkcijų, ir žynys-tarpininkas, kuris gyvena tarp dviejų pasaulių ir taip vienu metu prisideda prie dviejų svarbių biologinių procesų. Šios kryptys visiškai atitinka pradinės sąvokos struktūrą. Panaudojant šias struktūras ir perkeltiant jas į kitą žinių sritį, terminas teikia galimybių dideliame kūrybiškumui. Palyginti su „švanominu“; „merlinas“ dažniau vartojamas apžvalgose ir yra tarsi ženklas, žymintis tam tikrus neišspręstus fundamentaliųjų mokslų srities klausimus.

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