

# **The Structure of Noun Phrases in Scientific Texts in English and Czech**

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**Huddleston, Rodney, Geoffrey K Pullum, and Laurie Bauer. 2002. The Cambridge grammar of the English language. Cambridge, UK.: Cambridge University Press.**

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## **ABSTRAKT**

Tato bakalářská práce se zabývá strukturou nominálních frází v anglickém a českém odborném textu. Práce je rozdělena do dvou částí. Teoretická část popisuje strukturu nominální fráze a charakteristické rysy odborného textu. Praktická část je rozdělena do dvou oddílů. První je zaměřen na analýzu struktury anglických nominálních frází. Cílem druhého oddílu je popsat rozdíly mezi strukturami anglických a českých nominálních frází.

Klíčová slova: nominální fráze, odborný text, pre determinant, centrální determinant, post determinant, pre modifikace, post modifikace

## **ABSTRACT**

This bachelor thesis deals with the structure of noun phrases in English and Czech scientific texts. The thesis is divided into two parts. The theoretical part describes the structure of a noun phrase and the characteristics of scientific texts. The practical part is divided into two sections. The first one is focused on the analysis of English noun phrase structure. The aim of the second section is to describe differences between the structures of English and Czech noun phrases.

Keywords: noun phrase, scientific text, pre-determiner, central determiner, post-determiner, pre modification, post modification.

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## INTRODUCTION

The focus of this bachelor thesis is to describe and analyze the noun phrase structures of English and Czech scientific texts. This work is primarily aimed at describing the most commonly used types of constituents of a noun phrase structure in English scientific texts and to make a comparison with the equivalent noun phrase structures translated into Czech.

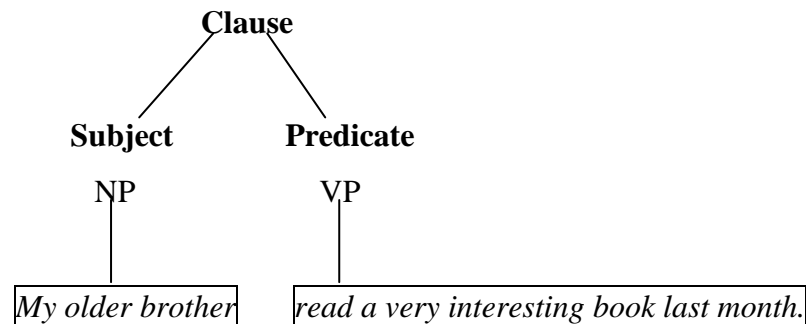
The bachelor thesis is divided into a theoretical and a practical part. The theoretical part deals with the description of the noun phrase structure and the main features of scientific texts. The beginning of the theoretical part briefly describes the structure of various types of English phrases and their structures. The next section of the theoretical part provides a detailed description of a noun phrase and its structure. In the last section the characteristic features of scientific texts are stated. The theoretical part is fundamental for the understanding of the analysis in the practical part.

The practical part of the thesis is aimed at analysing the noun phrase structures of scientific texts. The practical part is divided into two sections. The structure of both sections corresponds with that of the theoretical part. The first section is aimed at a description of a noun phrase structure in English scientific texts. It is based on the particular scientific texts which were chosen for this purpose. The second section focuses on the similarities and dissimilarities between the English and Czech noun phrase structure in scientific texts. It is based on the scientific texts originally written in English and their Czech translations. In the appendices of the thesis there are contained the corpora of analysed noun phrases.

## **I. THEORY**

## 1 THE STRUCTURE OF AN ENGLISH CLAUSE

Figure 1 The structure of an English clause



Source: own creation

The diagram above graphically demonstrates that the two essential constituents of a clause are subject and predicate. The subject is most commonly realised by a noun phrase as well as in this example and predicate is realised by a verb phrase (Huddleston, 2005, 63-64).

Regarding the diagram above, it can be said that the clauses are created by the combining of smaller units called phrases and in this thesis I would like to mention the types of phrases in English, and I would like to concentrate mostly on the noun phrases, their structure and their function in the sentence.

## 2 PHRASE

It is generally claimed that a clause consists of words, however from the syntactic point of view this definition is not entirely correct because it is missing the information about the unit, which is on the level between words and sentences. This unit, which is situated in the middle position between words and sentences, is called phrase. Therefore, with respect to the rules of English syntax, it is more accurate to say that a clause is formed by phrases because words are not syntactically independent whereas phrases are. A phrase can be described as a group of words that work together as a unit (Kuiper, 2004, 230-231).

As stated in Kuiper, there are some methods how to find a phrase in a sentence such as movement and substitution.

### (i) movement

[1] [*My little sister* *NP*] *drew* [*a picture* *NP*].

→ *What* [*my little sister* *NP*] *drew* *was* [*a picture* *NP*].

→ *It was* [*a picture* *NP*] *that* [*my little sister* *NP*] *drew*.

→ \**It was* *sister* *a picture* *that* *my little* *drew*.

Example [1] demonstrates that if we need to move the phrases in order to create another sentence they are moved as one unit, otherwise the sentence is ungrammatical (Kuiper, 2004, 231).

### (ii) substitution

According to Kuiper, any unit of words which can substitute for another one in a sentence is a phrase, as illustrated in example [2] (Kuiper, 2004, 232).

As Crystal claims, the phrase (no matter how complex it is) can also be replaced by a single word called pro-form (Crystal, 2011).

Table 1 Pro-forms

Type of phrase	pro-form
noun phrase	pronouns
adjective phrase	so
prepositional phrase	then, there
verb phrase	do

Source: (Crystal, 2011)

[2] [*My brother* *NP*] *sang* [*a song* *NP*].

→ [*That famous Australian singer* *NP*] *sang* [*a romantic ballad* *NP*].

→ [*He* <sub>NP</sub>] sang [*it* <sub>NP</sub>].

As Crystal says, a phrase is usually composed of more than only one word. It is also claimed that the phrase does not contain a subject and a predicate (Crystal, 2003, 222).

Nevertheless, this definition is not entirely correct because there can be subject and predicate within a phrase. As stated in Shoup, a clause which can be the post modifying constituent of a phrase includes both subject and predicate (Shoup, 2009, 199). See example [3].

[3] *what a wonderful place where children can play with each other*

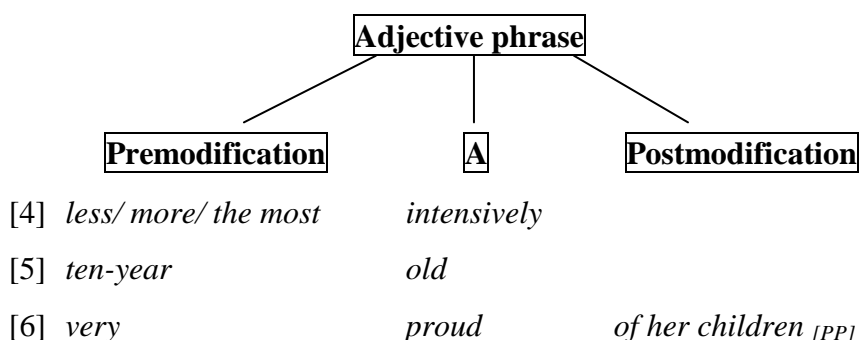
As stated in Crystal, phrases are categorized according to the word class of the essential constituent of a phrase which is called a head. Essentially, if the main constituent of a phrase is an adjective or an adverb, then the phrase is called an adjective phrase; if the most important word of the phrase is a preposition, then the phrase would be titled a prepositional phrase; verb – verb phrase, noun – noun phrase (Crystal, 2003, 222).

The aim of the following chapters is to describe the structure of English phrases, especially the structure of a noun phrase.

## 2.1 Adjective phrase

The adjective phrase is made up of the head, which is realised by A (A = adjective or adverbial). The head of an adjective phrase can stand alone without any other constituents but usually there are more elements within the adjective phrase that either precede (=pre modification) or follow (=post modification) the head. Pre modification can be realised by grading adverbs [4] or by measure phrases [5]. Post modification can be implemented by a prepositional phrase [6], that-clause [7] or to-infinitive VP [8]. Some modifying structures of adjective phrase contain both pre modification and post modification [9] (Veselovská and Emonds, 2005, 51-52).

Figure 2 Adjective phrase



[7]	<i>surprised</i>	<i>that she came</i> [that-clause]
[8]	<i>scared</i>	<i>to tell the truth</i> [to-infinitive VP]
[9]	<i>as</i>	<i>tall</i> <i>as</i>

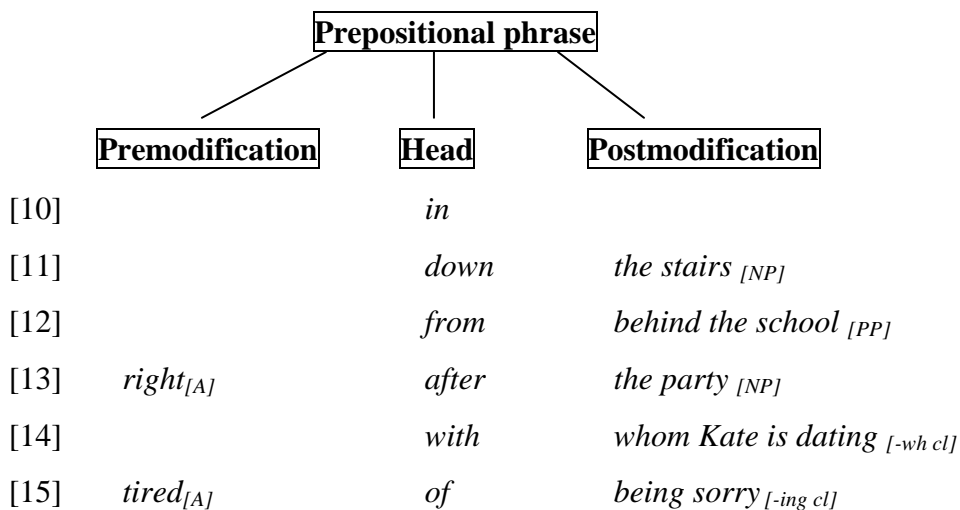
Source: (Veselovská and Emonds, 2005, 51-52)

## 2.2 Prepositional phrase

As stated in Kuiper, the prepositional phrase is composed of a preposition, which is the head of a prepositional phrase and it can stand alone and create the prepositional phrase itself. See example [10]. However, more commonly a preposition is accompanied by other elements that either precede (=pre modification) or follow (=post modification) the head. The complements that precede the preposition are usually adverbs, see example [13]. The complements that follow are most often in the form of a noun phrase [11] or prepositional phrase [12] (Kuiper, 2004, 254).

According to Bieber, the prepositional phrase can be created by a preposition which is followed by a clause, most frequently a –wh clause [14] or an –ing clause [15] (Bieber et al, 1999, 103).

Figure 3 Prepositional phrase



Source: (Bieber et al, 1999, 103)

## 2.3 Verb phrase

According to Bieber, the verb phrase is formed by a main verb, which is a head of a verb phrase. The main verb can stand alone and create a verb phrase by itself (Bieber et al, 1999, 99). See example [16].

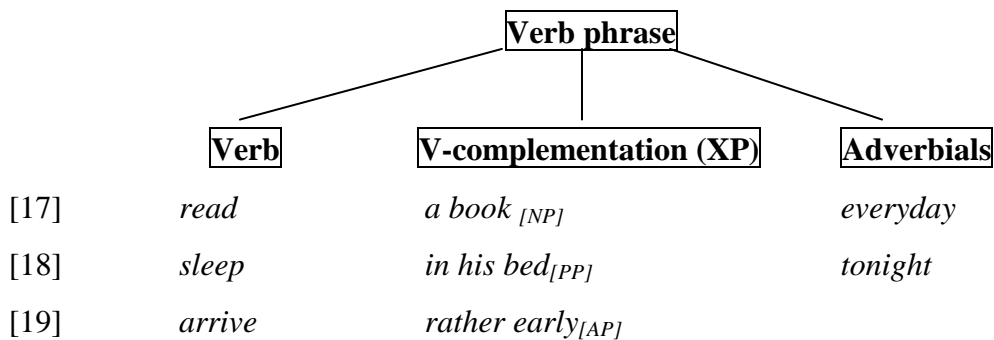
[16] *It hurts.*

As stated in Radford, this phrase structure is called a bare phrase (Radford, 2004, 95).

More prototypically the main verb of a verb phrase is followed by other accompanying elements (Bieber et al, 1999, 99).

The constituents following the main verb can be in the form of a noun phrase [17], a prepositional phrase [18] or an adjective phrase [19] (Veselovská and Emonds, 2011, 15, 66).

Figure 4 Verb phrase



Source: (Veselovská and Emonds, 2011, 15, 66)

## 2.4 Noun phrase

The last type of phrases that I would like to mention and to deal with in detail is a noun phrase. As stated in Huddleston, the noun phrase can be realised by only one word which is the head of a noun phrase and can create the noun phrase itself (Huddleston, 2002, 329). The noun phrases in the following examples [20] - [22] are underlined and their heads are in bold.

[20] **Soldiers** are brave.

However, noun phrases are more commonly composed from more than only one word. The head is usually surrounded by other elements that are either determiners or modifiers (Huddleston, 2002, 329).

[21] **That red haired girl** who I met yesterday was really charming.

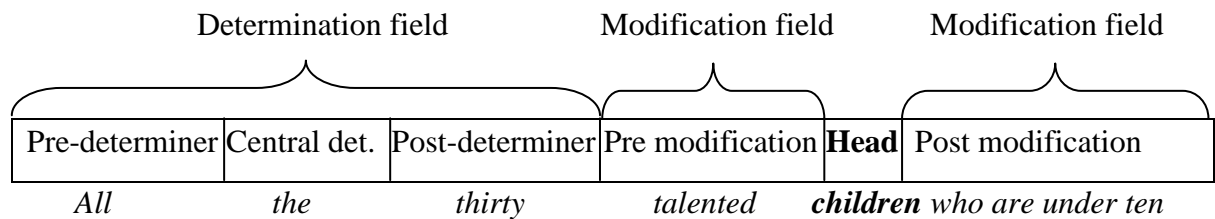
According to Eastwood, it is possible to substitute the whole noun phrase by a pronoun (Eastwood, 2005, 3).

[22] **She** was really charming.



### 3 STRUCTURE OF A NOUN PHRASE

Figure 5 Structure of a noun phrase



Source: own creation

The scheme above demonstrates the structure of noun phrase. The following chapters will deal with each part of this structure in details.

#### 3.1 Determination field

As Downing claims, the determiners specify the noun phrase by giving the recipient information about quantity, frequency, place and many more (Downing, 2006, 424).

The determination field is divided into three categories: *pre-determiners*, *central determiners* and *post-determiners* (Veselovská and Emonds, 2005, 19).

##### 3.1.1 Pre-determiners

According to Emonds, the pre-determiners are divided into two main groups:

- (i) *all*, *both*, *half* (Veselovská and Emonds, 2005, 19)

As Greenbaum says, these three pre-determiners can stand in front of the articles [23], the demonstratives [24] and the possessives [25] (Greenbaum, 1900, 75).

[23] *half a year*

[24] *all her friends*

[25] *both these books*

The pre-determiners *all*, *both* and *half* cannot precede central determiners such as *every*, *each*, *either*, *neither*, *some*, *any*, *no* and *enough* because they refer to quantity as well (Greenbaum, 1990, 75).

[26] \**all some books*

All these three pre-determiners can stand alone in the function of a pronoun (Quirk et al, 1985, 258).

[27] *All/ Both/ Half came late.*

(ii) *double, twice, three times, one third* (Veselovská and Emonds, 2005, 19)

This group of pre-determiners is called multipliers (Quirk et al, 1985, 260-261).

When a multiplier is followed by the definite article, a demonstrative or possessive pronoun, it denotes the quantity of given head noun. See examples [28] and [29] (Greenbaum, 1990, 76).

[28] *twice your age*

[29] *three times the weight*

If the multiplier is followed by the indefinite article, *each* or *every*, it refers to the frequency, as in the following examples (Greenbaum, 1990, 76).

[30] *twice a week*

[31] *once every year*

As Emonds claims the pre-determiners are optional so they do not need to occur in a noun phrase. There can be used only one pre-determiner within one noun phrase otherwise an ungrammatical phrase is then formed (Veselovská and Emonds, 2005, 19).

[32] *\*all both the students*

As stated in Quirk, a pre-determiner stands before a central determiner, therefore if the pre-determiner is present within a noun phrase it is in the initial position as demonstrated in the following example (Quirk et al, 1985, 257).

[33] *all the students*

On the contrary, example [34] is ungrammatical because the central determiner *the* precedes the pre-determiner *all*.

[34] *\*the all students*

### 3.1.2 Central determiners

In the structure of a noun phrase, the central determiners precede the head noun (Quirk et al, 1985, 254).

As Emonds claims the central determiners are obligatory, it means that a central determiner is present in every noun phrase. Within a noun phrase there can be only one central determiner because this constituent of a noun phrase is unique. The following classification of central determiners is taken from book: A Course in English Morpho-Syntax: Syllabi for the Lectures (Veselovská and Emonds, 2005,19).

(i) articles *a/an, the*

The definite article *the* and indefinite articles *a/an* are the most commonly used central determiners (Quirk et al, 1985, 253).

As Kuiper says the indefinite article *a/an* is used when something has not been mentioned before or when a noun that the article refers to cannot be assumed from the context. The definite article *the* is used when something is mentioned repeatedly or when the noun can be recognized from the context (Kuiper, 2004, 239).

[35] *I met **a** man *the* other day.*

[36] *I met **the** teacher *the* other day.*

In example [35] it is obvious we do not know who *a man* is and it is mentioned for the first time. In example [36] the definite article is used because it is obvious for both the sender and recipient which *teacher* is being referred to (there is probably only one teacher).

(ii) demonstratives *this, these/ that, those*

As stated in Kuiper, the demonstratives *this* and *these* are used to define a noun that is in a closer position to the speaker. The demonstrative *this* is used with singular nouns and *these* with plural nouns. The demonstratives *that* and *those* indicate the nouns that are in a further position away from the speaker, whereas *that* occurs with singular nouns and *those* stands with the plural nouns (Kuiper, 2004, 239).

[37] ***this** book*

[38] *all **those** boys*

[39] *\***this** boys*

[40] *\***these** book*

It is obvious that *boys* in example [38] are not very close to the speaker because the demonstrative *those* is used. Phrase [39] is wrong because the noun in plural *boys* requires the plural form of the demonstrative: *these* or *those*. The same mistake is seen in example [40]. The noun *book*, which is in singular, requires the singular form of the demonstrative: *this* or *that*.

(iii) possessives including *whose*

[41] *all his brothers*

[42] *John's sister*

(iv) *what, which*

[43] *Which day?*

(v) *some, any, no*

According to Greenbaum, the central determiners *some* and *any* precede plural count nouns and non-count nouns (Greenbaum, 1990, 74).

[44] *some girls*

[45] *\*some girl*

[46] *any milk*

Example [45] is wrong because the determiner *some* cannot co-occur with singular count noun (*girl*).

The central determiner *no* can co-occur with singular count nouns [47], plural count nouns [48] and non-count nouns [49] as demonstrated in examples below (Greenbaum, 1990, 74).

[47] *no book*

[48] *no books*

[49] *no information*

(vi) *every, each, either*

As stated in Greenbaum, these central determiners: *every, each* and *either* can precede only singular count nouns (Greenbaum, 1990, 74).

[50] *every/each girl*

[51] *\*each girls*

[52] *\*every tea*

Example [51] is ungrammatical because the central determiner *each* precedes the plural count noun *girls*. In example [52] the central determiner *every* precedes the non-count noun *tea*, therefore this phrase is not correct.

(vii)  $\emptyset$ 

The zero article can co-occur with plural count nouns [53] and with non-count nouns [54]. If the zero article precedes a singular count noun, it is ungrammatical [55].

[53]  $\emptyset$  *books*

[54]  $\emptyset$  *furniture*

[55] \*  $\emptyset$  *book*

**3.1.3 Post-determiners**

As Emonds claims, the post-determiners are optional so this means that they do not need to occur in a noun phrase (Veselovská and Emonds, 2005, 19).

As Greenbaum says, the post-determiners follow the central determiners in the structure of a noun phrase. There are two main groups of post-determiners (Greenbaum, 1990, 76-77).

## (i) ordinals

The ordinals usually precede count nouns in a noun phrase (Quirk et al, 1985, 262).

[56] *the **second** book in a row*

[57] *the **last** poem of this book*

## (ii) quantifiers

The quantifiers are usually realised by the numerals [58]. In this group of post-determiners, there are two constituents that involve special rules: the quantifier *little* appears with the non-count nouns [59] and the quantifier *few* precedes only plural count nouns [60] (Greenbaum, 1990, 77).

[58] *the **fifteen** red roses*

[59] *a **little** coffee*

[60] *a **few** pencils*

If the indefinite article *a* precedes the quantifiers *few* and *little*, they have a positive connotation. When the indefinite article *a* does not precede *few* and *little* their connotation is then negative (Greenbaum, 1990, 77).

[61] *I have a **few** friends.*

[62] *I have **few** friends.*

The meaning of sentence [61] is *I have several friends* but when the indefinite article is omitted the meaning changes as in example [62]: *I have a small number of friends.*

[63] *I drank **a little** coffee.*

[64] *I drank **little** coffee.*

Sentence [63] in other words means: *I drank some coffee* but by omitting the indefinite article the meaning of the sentence changes to: *I drank almost no coffee* [64].

The post-determiners are not unique therefore there can be more than only one of them. So the ordinals and quantifiers can both co-occur within a noun phrase. If both of them are present, the quantifiers are usually preceded by the ordinals. See examples [65] - [67]; the ordinals are underlined and the quantifiers are double underlined (Greenbaum, 1990, 77).

[65] *the last three chapters*

[66] *the first two participants*

[67] *my first few achievements*

### 3.2 Pre modification

According to Crystal, all the constituents that stand between the determination field and the head noun make up the pre modification part of a noun phrase structure. Essentially, in the noun phrase *that nice good-looking young American boy* all the constituents between *that* (=central determiner) and *boy* (=head noun) generate the pre modification. There are many types of constituents creating the pre modification but it is most commonly realised by the adjectives (Crystal, 2003, 222).

The following classification of pre modifying constituents is taken from A Comprehensive Grammar of the English Language (Quirk et al, 1985, 1322).

(i) adjective

According to Seng, adjectives are used to describe or specify a noun and there can be used more than only one adjective within a noun phrase. If a noun phrase contains more adjectives then there is a specific order in which they should be followed, otherwise the noun phrase would sound peculiar. The order of the

adjectives can be defined by the acronym OSACOM and these letters stand for: *Opinion, Shape, Age, Colour, Origin, Material* (Seng, 2004, 92).

The order of adjectives in the pre modifying part of a noun phrase is following:

Table 2 The order of adjectives

Opinion adjectives	<i>beautiful, smart, handsome, tasty, terrible</i>
Shape adjectives- size	<i>big, small, huge, enormous</i>
- length	<i>long, short, tall</i>
- shape	<i>fat, thin, round, square, triangular</i>
- width	<i>narrow, wide</i>
Age adjectives	<i>old, young, aged, ancient, teen</i>
Colour adjectives	<i>red, green, yellow, brown</i>
Origin adjectives	<i>English, American, French, Italian</i>
Material adjectives	<i>cotton, gold, wooden, iron</i>

Source: (Seng, 2004, 92)

[68] *my handsome teen American classmate*

[69] *an enormous round old wooden table*

(ii) participle

The –ing participle and –ed participle in a pre modification part usually express some permanent or typical feature.

(a) –ing participle

[70] *an interesting person*

(b) –ed participle

[71] *a complicated person*

(iii) noun

When two nouns are placed next to each other the first noun acts as a modifier of the second one. In other words, the first noun is in the function of an adjective. This type of pre modifying item is called secondary adjective (Veselovská and Emonds, 2005, 30).

[72] *all the city lights*

[73] *your birthday present*

- (iv) genitive
  - [74] *a new **girl's** dress*
  - [75] *an old **fisherman's** cottage*
  
- (v) adverb and other phrases
  - [76] *an **up-to-date** program*
  
- (vi) sentence
  - [77] *the **pop-down-for-the-weekend** house*

### 3.3 The head

As Crystal claims, the head is the most important constituent of the noun phrase therefore it must appear in every noun phrase. The head can stand alone but more commonly is surrounded by other constituents that either precede (determiners, pre modifiers) or follow (post modifiers) the head. The important role of the head is to control the agreement with the other segments of a sentence (Crystal, 2003, 222).

[78] *My sister works at a bank.*

[79] *\*My sister work\_ at a bank.*

Sentence [79] is ungrammatical considering the third person in singular (*sister*) requires adding of morpheme *-s* to the verb; consequently, example [78] is grammatical.

According to Downing, the head of the noun phrase can be realised by three main categories: common nouns [80], proper nouns [81], pronouns [82] (Downing, 2006, 405).

[80] *All the students in our class are treated equally.*

[81] *Kate has been working as a police officer since 2005.*

[82] *They will find the way, how to solve their problem.*

As stated in Downing, sometimes the head can be realized by a substitute head, which is usually implemented by the word *one* for the singular and by the word *ones* for the plural. This substitute *one/ones* is usually used for the purpose of avoiding repetition, therefore sentence [84] is not ungrammatical but it is peculiar. These items (*one/ones*) can replace either the whole noun phrase [83] or only a part of it [85] (Downing, 2006, 416).

[83] *Bradley knows how much Heather loves a home-made vanilla ice cream, so he made her one.*



[84] ?Bradley knows how much Heather loves a home-made vanilla ice cream, so he made her a home-made vanilla ice cream.

[85] I could not find the big bag of chips, so I bought a small one.

### 3.4 Post modification

As Crystal claims, the post modification of a noun phrase consists of all the constituents that follow the head noun (Crystal, 2003, 222).

As stated in Aarts, the post modifying field of is not unique, thus there can be more than only one post modifying element within a noun phrase. If the post modification is multiple, the right order of the post modifying constituents in a noun phrase is important to express the speaker's/writer's idea effectively. If the order of these constituents is not correct the phrase can sound peculiar or ambiguous. Basically, it can be said that one of the most important rules for ordering the post modifying constituents in a noun phrase is the avoidance of ambiguity. Therefore, if the order of post modifying constituents is changed the phrase can then become ambiguous. See examples [86] and [87] (Aarts, 1997, 117).

[86] *the girl [in the classroom PP] [talking to the teacher -ing cl]*

[87] *the girl [talking to the teacher -ing cl] [in the classroom PP]*

The prepositional phrase *in the classroom* in example [87] would be presumably considered the post modification of *the teacher* in the -ing clause *talking to the teacher*.

According to Downing, one of the types of post modifying constituents provides important information about the head noun in order to help define it therefore, these information cannot be omitted otherwise the meaning of the noun phrase is changed. This type of post modifying constituents is called restrictive (integrated). Another type of post modifying constituents is known as non-restrictive (supplementive) and it supplies the additional information to the head noun so it can be omitted in the noun phrase structure without changing the meaning of it. (Downing, 2006, 446).

[88] *The boy **who we met yesterday** is handsome.* restrictive

[89] *Jack Smith **who we met yesterday** is handsome.* non-restrictive

The two examples above demonstrate the difference between restrictive and non-restrictive post modification. In the example [88] the post modifying relative clause (*who we met yesterday*) cannot be omitted otherwise the meaning would be changed and the recipient would not know which boy is meant. On the contrary, in example [89] we can omit it because the head, which is realised by the proper name, does not need to be

specified by the relative clause. The post modifiers in the following examples are in bold and they are realized restrictively.

The following classification of post modifying constituents is taken from English Grammar: A University Course (Downing, 2006, 446).

- (i) prepositional phrase  
[90] *the vase **on the table***
  
- (ii) finite relative clause  
[91] *the boy **who is dancing on the floor***
  
- (iii) non-finite relative clause  
[92] *the boy **dancing on the floor** (-ing clause)*  
[93] *a time **to apologize** (to infinitive clause)*  
[94] *the present **packed in the paper box** (-en clause)*
  
- (iv) adjective or adjective group  
[95] *the boy **more intelligent than me***
  
- (v) adverb  
[96] *the car **outside***
  
- (vi) apposition nominal group  
[97] *Kate, **a very good friend of mine***
  
- (vii) reflexive pronoun  
[98] *John **himself***

### 3.5 Simple vs. Complex noun phrase

Simple noun phrase consists only of a head noun and determiner (or head noun only) and it does not contain any pre modifying and post modifying constituents. Complex noun phrase contains one or more pre modifying or/and post modifying constituents (Bakshi, 2000, 87).

### 3.6 The syntactic roles of a noun phrase

As stated in Emonds, there are many syntactic roles in which a noun phrase can appear and it does not matter how complex the noun phrase is. Some syntactic roles are more common for noun phrases than other ones (Veselovská and Emonds, 2005, 31).

The following classification of the syntactic roles of noun phrases is taken from the Longman Grammar of Spoken and Written English (Bieber et al, 1999, 98-99) and the syntactic roles (i) to (v) are the most common ones.

All the examples below demonstrate a different syntactic role of a noun phrase. In these examples the noun phrases in their stated functions are underlined. For each syntactic function, there is one example (the first one) of a simple noun phrase and one example (the second one) of a complex noun phrase.

(i) Subject

[99] The children were sleeping.

[100] All the international students who study at our university are very nice.

(ii) Direct object

[101] Helen met your boyfriend yesterday.

[102] Anthony saw a very catching and interesting documentary about the Second World War last week.

(iii) Indirect object

[103] Charlie gave his sister a wonderful birthday present.

[104] My mum will make our new neighbours living across the street an invitation cake.

(iv) Prepositional object

[105] Elizabeth was looking after her sister.

[106] Carly talked about the not very intriguing detective novel that she read because of literature classes.

(v) PP adverbial

[107] Chad was sleeping on the couch when I came home.

[108] *Taylor and Zachary had dinner at the very expensive restaurant situated downtown.*

(vi) Subject complement

[109] *Josh became a doctor.*

[110] *My great-grandmother was a very wise woman willing to help anybody.*

(vii) Object complement

[111] *At high school people called my brother a loser.*

[112] *My colleagues appointed me the most important member of our team.*

(viii) Adverbial

[113] *I will visit Jake next week.*

[114] *Paul studied all day long which was really exhausting to pass the exam.*

(ix) Pre modifier of noun

[115] *I gave my mum a picnic basket as a birthday present.*

[116] *Tim was wearing his father's old leather cowboy hat.*

(x) Apposition

[117] *My new dentist, Dr. Williams, is very careful.*

[118] *William Shakespeare, the world's greatest play writer, died in the 17<sup>th</sup> century.*

(xi) Pre modifier in APs

[119] *Megan called me two days later and asked me for a help.*

[120] *Carl is seven foot and four inch tall, he looks like a giant.*

## 4 SCIENTIFIC TEXT

As stated in Knittlová, the scientific genre is one of the basic styles of nonfiction literature. Nowadays scientific texts are divided into many subcategories because of the development of science within the last decades (Knittlová, 2010, 148).

The main purpose of scientific texts is either to inform or educate the reader. These texts should be written accurately and unambiguously in order to help the recipient understand the information easily. Another feature that helps the recipient to understand this type of text more easily is the logical construction and sequence of the sentences. The aim of scientific texts is to give the reader accurate information that is based on the facts and data (Knittlová, 2010, 148 – 150).

The scientific texts are not subjective, but on the contrary they are highly objective. Furthermore, to a great extent they are highly impersonal and the author's identity is not perceptible from this type of text. In order to support their statement the writers of scientific texts very commonly refer to other authors (Knittlová, 2010, 150).

### 4.1 Lexicology

In the matter of lexicology, there is a high incidence of terminology in scientific texts. The most commonly used parts of speech are the substantives and adjectives. As mentioned earlier no subjective expressions are used in this type of text. Since the vocabulary of scientific texts is stereotypical, the repetition frequency of words is relatively high. Due to this feature scientific texts are better understandable for foreign readers (Knittlová, 2010, 149).

### 4.2 Stylistics

Concerning stylistics, the oldest scientific texts were written in belles-lettres or in a flowery style, while contemporary scientific texts can be divided into two main groups: *scientific texts and popular scientific texts* (Knittlová, 2010, 150).

#### Scientific text (style)

According to Knittlová, this type of text is usually very complex and not that structured as popular scientific text, hence for ordinary readers it can be difficult to understand. Consequently, it requires an educated reader who is familiar with the particular field of

science. This subcategory of scientific texts uses special terminology extensively (Knittlová, 2010, 150).

#### Popular scientific text (style)

As stated in Knittlová, unlike the first group of scientific texts, this one can contain features of colloquialism or a publicistic style. This type of text is not that complex and it is usually more structured than the first one in order to be more comprehensible. In this subcategory of scientific texts the sentences are usually shorter and the terminology used is not that frequent. If there is used any special term it is usually explained. Considering all the mentioned features of the popular scientific text, it can be said that this subcategory of scientific text is not intended only for the recipients who are familiar with the particular discipline of the science, but it gives also valuable information to the ordinary readers (Knittlová, 2010, 150).

According to Skern, the writing style of scientific texts is a formal style of English, which differs from the style used for example in prose or newspapers (Skern, 2009, 17).

According to Swales, the features of formal style are the following:

- In the formal style the contractions should not be used, however some fields allow the use of these shortened forms.

[121] *The evidence hasn't been found yet.* → *The evidence has not been found yet.*

- The reader of the text written in a formal style is not usually addressed by the pronoun *you*.

[122] *You can see the examples in Table 3.* → *The examples can be seen in Table 3.*

- In the informal style the adverbs are usually placed in the initial position or at the end of the sentence, whereas in the formal style the position of adverbs is more commonly in the middle of the sentence.

[123] *Actually, the scientists have very little evidence to prove their hypothesis.* → *The scientists actually have very little evidence to prove their hypothesis.*

(Swales, 2004, 22-23)

### 4.3 Voice

Both constructions (active and passive) are used in scientific texts. Knittlová argues that there is 75% of passive constructions used and 25% of active constructions in scientific texts (Knittlová, 2010, 150-151).

When the active voice is used in scientific texts it is usually realised by the pronoun “we” which refers to the author more distinctively (*we assume, we discovered*). It is typical for the texts of exact sciences (Knittlová, 2010, 151).

As mentioned previously, the author’s personality is usually not perceptible from a scientific text. The passive voice is used in order not to express the author. When the active sentence is transformed into a passive voice there is no more emphasis on who it was that did something (considering that one of the functions of passivization is the omitting of the agent) but rather on what was done or on the facts. See example [124]. Therefore, the passive voice is used when the author wants to remain unknown (Knittlová, 2010, 151).

[124] *We<sub>[Ag]</sub> discovered new cure for malaria.* → *A new cure for malaria was discovered (by us<sub>[Ag]</sub>).*

### 4.4 Impersonal structures

As stated in Knittlová, scientific texts tend to express information impersonally and the passive voice is not the only means used for this purpose. The impersonal structures are used in order to make the text more objective and less personal. These structures are considered to be the essential feature of contemporary scientific texts (Knittlová, 2010, 152-153).

The impersonal structures are the following:

Table 3 Impersonal structure A

(i)	<b>IT IS</b>	+	<b>ADJ</b>	+	<b>TO</b>	+	<b>INF</b>
	<i>It is</i>		<i>essential</i>		<i>to</i>		<i>explore</i>
	<i>It appears</i>		<i>impossible</i>		<i>to</i>		<i>manage</i>
	<i>It seems</i>		<i>useful</i>		<i>to</i>		<i>do</i>

Source: (Knittlová, 2010, 152-153)

Table 4 Impersonal structure B

(ii)	<b>IT (IS)</b>	+	<b>ADJ / Vpp</b>	+	<b>THAT ...</b>
	<i>It is</i>		<i>obvious</i>		<i>that ...</i>
	<i>It has been</i>		<i>demonstrated</i>		<i>that ...</i>
	<i>It should be</i>		<i>realised</i>		<i>that ...</i>

Source: (Knittlová, 2010, 152-153)

## 4.5 Organization

Scientific texts are organized more strictly than any other type of text. The most commonly used organization of the scientific texts, especially research, is IMRAD structure. The letters of this acronym stand for: *introduction, method, results, and, discussion* (Day, 2011, 4-5).

## 4.6 Nominalization

Nominalization is the process when a verb or a verb phrase changes into a noun or a noun phrase (Foley, 2003, 251). See examples [126] and [127].

[126] *The scientists discovered a new cure for cancer, which hopefully will be effective.* →  
*The scientist's discovery of a new cure for cancer hopefully will be effective.*

[127] *The specialists analysed all the accessible data.* → *The analysis of all the accessible data ...*

Nominalization makes the text more formal because it enables the author to incorporate more information; consequently, the sentence is thus more complex. Considering that a feature of scientific text is the complexity of its sentences, the nominalization is used quite often in the scientific writing.

If a nominalised verb phrase contains an adverb, it changes to an adjective as shown in the following example (*constantly*→*constant*) (Foley, 2003, 251).

[128] *My sister worked **constantly** on her project.* → *My sister's **constant** work on her project ...*



## **II. ANALYSIS**

## 5 ENGLISH NOUN PHRASE

The main aim of the first part of the analysis is to describe the structure of English noun phrases in scientific texts. This part of the analysis is based on the corpus of noun phrases randomly selected from the scientific texts. The noun phrases were chosen from four books and each of these books deals with a different field of science, namely: chemistry, physics, biology, and mathematics.

The structure of the practical part corresponds with the structure of the theoretical part. The numbers of examples are not consecutive, but they are the same as in the corpus.

### 5.1 Determination field

As mentioned in the theoretical part, the determination field is divided into three subcategories: pre-determiners, central determiners and post-determiners.

#### 5.1.1 Pre-determiners

Since the pre-determiner is an optional constituent of a noun phrase, it does not occur in the noun phrase structure very frequently. The low occurrence of pre-determiners in the noun phrases of scientific texts can be explained by the fact that the pre-determiners express either a quantity or a frequency of a head noun, therefore the author uses it only when he/she wants to refer to one of these. The most commonly used pre-determiner in scientific texts is *all*. See examples [10] and [31].

[10] “*all the atoms of a given element*” (McMurry, 2011, 3)

[31] “*all the chemical changes within an organism which are necessary for life*” (Beckett, 1986, 2)

In both examples the pre-determiners and central determiners are in the correct order: the pre-determiner precedes the central determiner.

#### 5.1.2 Central determiners

As demonstrated in the theoretical part, the field of central determiners can be implemented by many types of constituents. Based on the analysis of the corpus it can be said that almost all of these types of central determiners are used in scientific texts, but some of them are used more frequently than others.

As already mentioned in the theoretical part, the most frequently used central determiners are articles and this applies also to the scientific texts. The definite or indefinite articles were used in more than half of the analyzed noun phrases.

[22] “*the actual weight of the cylinder*” (Lehrman, 1998, 3)

[1] “*a thin pencil line*” (McMurry, 2011, 3)

Another type of very commonly used central determiners in scientific texts is the demonstratives, especially *this* and *these*. The authors of scientific texts usually use them in order to refer to the thing or a fact that they have mentioned in a precedent sentence. The two other demonstratives *that* and *those* can be found in scientific texts only very rarely.

[25] “*those digits of a measurement that represent meaningful data*” (Lehrman, 1998, 4)

[3] “*this electron*” (McMurry, 2011, 3)

[19] “*these pitfalls in the process of measurement*” (Lehrman, 1998, 2)

The next type of central determiners is the zero article (Ø). According to the analysis, a zero article is used in scientific style often. As mentioned in the theoretical part, a zero article can precede plural count nouns or non-count nouns. This rule was kept in all the noun phrases taken from scientific texts.

[24] “*All measurements*” (Lehrman, 1998, 3)

[28] “*very incomplete information*” (Lehrman, 1998, 19)

Another group of central determiners are the possessives and these do not occur in scientific style very commonly. The low occurrence of possessives in scientific texts is presumably caused by the fact that this type of texts is impersonal and possessives such as: *my*, *your*, *our* have very personal characteristics. Therefore, the possessives are used in scientific style very rarely.

[11] “*their energy levels*” (McMurry, 2011, 4)

The next group of central determiners includes *some*, *any*, *no*. Based on the analysis, it can be said that all of them occur in the scientific texts equally. However, their occurrence is not as high as the occurrence of the articles but it is higher than the occurrence of the possessives. See the following examples.

[51] “*some equally sized pieces*” (Hewson, 2003, 7)

[55] “*any cubic equation*” (Hewson, 2003, 37)

[15] “*no well-defined rules that cover all cases*” (McMurry, 2011, 22)

The central determiner can be also implemented by the words: *every*, *each*, *either*. The occurrence of these three central determiners in scientific style is quite rare. None of the analysed noun phrases contains a central determiner realized by *either*.

[47] “*every natural number*” (Hewson, 2003, 4)

[8] “*each orbital within a shell*” (McMurry, 2011, 4)

As already stated in the theoretical part, the central determiner can be realized by *what* and *which*. However, none of the analysed noun phrases contains one of these in a role of a central determiner.

### 5.1.3 Post-determiners

As stated in the theoretical part, the post-determiners are optional and they are divided into two main subgroups: ordinals and quantifiers. Although they are not required constituents of a noun phrase structure their occurrence is not very low. The authors of scientific texts use quantifiers when they want to express the exact amount of the head noun. The ordinals are used less frequently than quantifiers.

[4] “*four different kinds of orbitals*” (McMurry, 2011, 3)

[5] “*the first shell*” (McMurry, 2011, 4)

The constituents in a determination field must keep the following sequence: pre-determiners, central determiners, post-determiners, otherwise the noun phrase is ungrammatical. This order is kept in all the analysed noun phrases.

## 5.2 Pre modification

As mentioned in the theory, the field of pre modification follows the determination field and precedes a head noun in the structure of a noun phrase. Pre modification is optional so it does not need to appear in every noun phrase, however the majority of the analyzed noun phrases contain pre modifying constituents. The pre modification is not unique so it can contain more than only one constituent, nevertheless most of the analyzed noun phrases contain simple pre modification.

As stated in the theoretical part, there are many types of constituents realising the pre modification, and the most frequently used are the adjectives. According to the analysis, the most frequently used pre modifying constituent in scientific style is an adjective.

[26] “*a [special<sub>A</sub>] name for a mathematical description of motion*” (Lehrman, 1998, 17)

[52] “*the [formal<sub>A</sub>] rules defining the integers*” (Hewson, 2003, 7)

As well as adjectives, nouns are very commonly used as pre modifying constituent of a noun phrase. As already mentioned in the theoretical part, if two nouns are placed next to each other, the first one is considered a modification and it is called a secondary adjective.

[18] “*the [centimetre<sub>N/A</sub>] scale*” (Lehrman, 1998, 2)

[30] “*[plant<sub>N/A</sub>] movements*” (Beckett, 1986, 1)

The pre modification can be realized by some type of a phrase, and a great deal of noun phrases in scientific texts uses the adjective phrases as a pre modification.

[21] “*a [rough-and-ready<sub>AP</sub>] method of evaluating*” (Lehrman, 1998, 3)

[28] “*[very incomplete<sub>AP</sub>] information*” (Lehrman, 1998, 19)

The pre modification of a noun phrase can be also realized by a participle. Both the forms of the participle, the *-ing participle* and the *-ed participle* appear in scientific style. See examples [45] and [20]. The occurrence of participles in a pre modifying part of a noun phrase in scientific texts is neither very high nor very low.

[45] “*this [counting<sub>-ing p</sub>] sequence*” (Hewson, 2003, 3)

[20] “*every [measured<sub>-ed p</sub>] value*” (Lehrman, 1998, 3)

As mentioned in the theoretical part, the pre modification can also be formed by a sentence or by a genitive form, nevertheless none of the analysed noun phrases contains these types of pre modifying constituents.

The majority of noun phrases in scientific texts contains only one pre modifying constituent and the occurrence of multiple pre modification is very rare. See the following examples.

[1] “*a [thin<sub>A</sub>] [pencil<sub>N/A</sub>] line*” (McMurry, 2011, 3)

[34] “*an [illustrated<sub>-ed p</sub>] [outline<sub>N/A</sub>] classification of some of the main phyla*” (Beckett, 1986, 5)

The order of the pre modifying constituents in these examples cannot be changed because the secondary adjective is adjacent to the head noun.

### 5.3 The head

As mentioned in the theoretical part, the head of a noun phrase can be realized by a common noun, a proper noun, a pronoun or by using the substitute one/ones. Based on the analysis, it can be said that the vast majority of heads are implemented by common nouns [2]. Pronouns in the position of a head are very rare in scientific style [35]. None of the analysed noun phrases contains a head implemented by a proper noun or substituted by one/ones.

[2] “*the **behaviour** of a specific electron in an atom*” (McMurry, 2011, 3)

[35] “*they*” (Beckett, 1986, 6)

### 5.4 Post modification

As already stated in the theoretical part, there are several types of post modifying constituents in English. The post modification in noun phrases of scientific texts is most frequently realized by prepositional phrases. As mentioned in the theoretical part, the most prototypical structure of a prepositional phrase is a preposition followed by a noun phrase and this applies also to the post modifying prepositional phrases in scientific texts. The majority of the analysed prepositional phrases have this structure. The preposition *of* is the most commonly used head preposition of the post modifying prepositional phrase. As Emonds claims, the *of*-prepositional phrase is adjacent to the head noun (Veselovská and Emonds, 2005, 19).

[39] “*a brain cell [of a frog PP]*” (Beckett, 1986, 14)

[43] “*the properties [of the natural numbers PP]*” (Hewson, 2003, 2)

The post modification implemented by the prepositional phrases with other head prepositions can be found in scientific texts, but not that frequently.

[13] “*The overlapping orbitals [in the H<sub>2</sub>O molecule PP]*” (McMurry, 2011, 10)

[26] “*a special name [for a mathematical description of motion PP]*” (Lehrman, 1998, 17)

The post modification of noun phrases in scientific texts is quite commonly realized by a finite relative clause. See the following examples.

[12] “*valence electrons [that are not used for bonding cl]*” (McMurry, 2011, 7)

[40] “*the single cell [which form the body of an amoeba cl]*” (Beckett, 1986, 14)


In scientific texts, there is a low occurrence of non-finite relative clauses in the post modifying field of a noun phrase. The post modification implemented by the –ing clause or the –en clause can be found in scientific style very rarely.

[49] “*a set [containing two copies of the counting numbers –ing cl]*” (Hewson, 2003, 4)


[9] “*the two orbital regions [separated by the node –en cl]*” (McMurry, 2011, 4)

As stated in the theoretical part, the post modification of a noun phrase can be multiple (=containing more than one post modifying constituent). The occurrence of multiple post modification in scientific texts is quite high. See the following examples.

[25] “*those digits [of a measurement PP] [that represent meaningful data cl]*” (Lehrman, 1998, 4)



[31] “*all the chemical changes [within an organism PP] [which are necessary for life cl]*” (Beckett, 1986, 2)



As can be seen from these graphic presentations, in both examples the post modification of the head noun is multiple because the post modifying constituents modify the head of the noun phrase. The order of the post modifying elements in example [25] cannot be changed because the prepositional phrase headed by *of* is adjacent to the head noun. The order of the post modifying constituents in example [31] cannot be changed either in order to avoid ambiguity.

## 6 ENGLISH AND CZECH NOUN PHRASE

The second part of the analysis focuses on the description of the noun phrase structure in scientific texts originally written in English and their comparison with the Czech equivalents. This part of analysis, as well as the first one, is based on the corpus of noun phrases that were chosen from four different scientific texts. Each of these four books is concerned with a distinct field of science, namely: anthropology, cosmology, sociology, and mathematics. As well as the first part of the analysis, the second part is structured in accordance with the theoretical part and examples are numbered the same way as in the corpus.

### 6.1 Determination field

As already mentioned, this field of a noun phrase consists of three parts: pre-determiner, central determiner, and post-determiner. All of them will be discussed in the following chapters.

#### 6.1.1 Pre-determiners

The authors of scientific texts do not use pre-determiners very often as they use them only if it is necessary to express quantity or frequency. Moreover, as already stated in the theoretical part, the pre-determiner is not a required constituent of a noun phrase structure so that is probably the reason why very few noun phrases of scientific texts contain this element. Based on the analysis of the second corpus, the pre-determiner *all* is the most commonly used one (the same was proved by the first part of the analysis). Regarding the position, the pre-determiner is placed in front of the central determiners. In other words, if a pre-determiner is present it is the first constituent in the structure of a noun phrase. See example [32].

[32] “*All parts of the universe*” (Rees, 2000, 12)

The Czech language has equivalents to all the pre-determiners and their function is similar to the English ones, so in scientific style they are not used very frequently either. As well as in the English, the Czech pre-determiner is in the initial position. Otherwise the noun phrase is ungrammatical.

[32'] “*Všechny části vesmíru*” (Rees, 2004, 23)



### 6.1.2 Central determiners

As mentioned in the theoretical part, there are several groups of constituents that can be in the position of a central determiner. The central determiners are realized by the definite and indefinite articles in the majority of the analyzed English noun phrases. As is generally known, Czech does not have a system of articles, therefore if an English noun phrase uses the article in the position of a central determiner, Czech usually leaves this position empty. See the following examples.

[1] “*the chimpanzees*” (Marks, 2002, 8)

[1’] “*šimpanzi*” (Marks, 2006, 20)

[50] “*a wonderful gift which we neither understand nor deserve*” (Livio, 2009)

[50’] “*úžasný dar, který nechápeme ani si jej nezasluhujeme*” (Livio, 2010)

As is generally known, English uses articles in order to refer to definiteness or indefiniteness. If Czech needs to refer to definiteness or indefiniteness it usually uses demonstrative pronouns See example [17]. However in the scientific style the replacement of the English article by a demonstrative in the Czech version is very rare. Concerning the position, it is the same in English and Czech – the central determiner precedes pre modification.

[17] “*the [sterile<sub>PreM</sub>] analysis of the scientist-philosopher*” (Marks, 2002, 17)

[17’] “*tato [plytká<sub>PreM</sub>] analýza vědce-filozofa*” (Marks, 2006, 30)

Another very commonly used constituent that realizes a central determiner in English scientific texts is the zero article ( $\emptyset$ ). It can precede plural count nouns or non-count nouns – this rule was kept in all the analyzed noun phrases. As already mentioned, the Czech language does not have a system of articles, therefore when English uses the zero article, the position of central determiner in Czech noun phrase is empty. See example [26].

[26] “*individual atoms*” (Rees, 2000, 6)

[26’] “*jednotlivé atomy*” (Rees, 2004, 17)

Another group of central determiners that occur frequently in English scientific texts are the demonstratives. As already mentioned in the first part of the analysis, they are used to refer to something what has been already mentioned. In Czech scientific style, the demonstratives are used almost as frequently as in English. In other words, the majority of the analysed noun phrases contain demonstratives in both the English and Czech versions.

[6] “*that species*” (Marks, 2002, 9)

[6'] “*tento druh*” (Marks, 2006, 21)

Nevertheless, in some cases the Czech language has a tendency to omit demonstratives from the noun phrase structure even though they are in the English original one. However this tendency is not that frequent, therefore it does not make such a big difference between the Czech and English noun phrase structure. See examples [14] and [51].

[14] “*that cockeyed genetic evidence*” (Marks, 2002, 12)

[14'] “*Pošetilé genetické důkazy*” (Marks, 2006, 24)

[51] “*Those perceiving minds*” (Livio, 2009)

[51'] “*Vnímající mysl*” (Livio, 2010)

The constituents *some*, *any*, *no* belong to one group of central determiners because they all usually refer to quantity. Based on the analysis, these constituents occur in the noun phrase structure of English scientific style quite frequently (more frequently than possessives but less frequently than the articles – the same result was achieved in the first part of the analysis as well). These constituents occur in the Czech scientific texts as frequently as in the English ones. They are usually not omitted from the Czech noun phrase structure because they carry important information (usually about quantity) of the head noun. Concerning the order, in both languages this type of central determiner must precede pre modification (or a post-determiner if one it is present) otherwise the noun phrase is ungrammatical. See the following examples.

[23] “*some [tall PreM] buildings*” (Rees, 2000, 5)

[23'] “*jakési [vysoké PreM] budovy*” (Rees, 2004, 16)

[27] “*no [real PreM] microscope*” (Rees, 2000, 6)

[27'] “*žádný [reálný PreM] mikroskop*” (Rees, 2004, 17)

[34] “*any [good scientific PreM] theory*” (Bruce, 2000, 1)

[34'] “*každá [správná vědecká PreM] teorie*” (Bruce, 2008, 10)

Another group of central determiners are the possessives. The analysis proves that the occurrence of the possessives in scientific style is low. However, if the English noun phrase contains a possessive as a central determiner, in the majority of cases, the equivalent Czech noun phrase contains it also because the possessive carries important information about the

head noun. Therefore it can be said that the group of possessives does not show any difference between the English and Czech noun phrase structure.

[4] “*our species*” (Marks, 2002, 8)

[4’] “*naš druh*” (Marks, 2006, 20)

The occurrence of *every, each, either* and *what, which* as central determiners is very low in scientific texts. None of the analysed noun phrase contains any of these constituents in the role of central determiner.

### 6.1.3 Post-determiners

As already stated in the theoretical part, there are two groups of post determiners: ordinals and quantifiers. Since this part of a noun phrase is optional, the constituents of these two groups occur in the noun phrases of scientific texts very rarely. The post determiners have reference either to the quantity or to the sequence. Therefore if the original English noun phrase contains a quantifier or an ordinal, they cannot be excluded from the Czech noun phrase structure.

[22] “*the second frame*” (Rees, 2000, 3)

[22’] “*druhý snímek*” (Rees, 2004, 16)

## 6.2 Pre modification

The next part of a noun phrase structure is the pre modification, which is in a position between the determination field and the head noun. Although this segment is optional, a great deal of the noun phrases in scientific texts contains the pre modification. Based on the analysis, it can be said that there are some differences between the Czech and English forms of pre modification. While the English uses the diverse forms of pre modifying elements, the Czech language is restricted to a smaller amount of pre modifying means. Let us have a look at the English forms of pre modification and their Czech equivalents.

The most commonly used pre modifying constituent of a noun phrase in English and Czech scientific style is an adjective. The analysis shows that if a pre modification of an English noun phrase is an adjective, the pre modification of a Czech equivalent noun phrase is in the vast majority of examples an adjective also. See examples [10] and [46].

[10] “*the [immune<sub>A</sub>] reaction*” (Marks, 2002, 10)

[10’] “*[imunitní<sub>A</sub>] reakce*” (Marks, 2006, 23)

[46] “*the [unreasonable<sub>A</sub>] effectiveness of mathematics*” (Livio, 2009)

[46'] "[*nepochopitelná* <sub>A</sub>] účinnost matematiky" (Livio, 2010)

As mentioned in the theoretical part, the pre modification of the English noun phrase can be realized by a participle. There are two types of participles: the -ing participle and the -ed participle. Based on the analysis, it can be said that English scientific style uses the -ing participle more frequently than the -ed participle. Let us look at the -ing participle first. If the pre modification of an English noun phrase is implemented by the -ing participle, the pre modification of Czech noun phrase is in some cases realized by an adjective. See examples [9] and [30].

[9] "*the [resulting -ing<sub>p</sub>] abundance of proto-human fossils*" (Marks, 2002, 9)

[9'] "[*výsledná* <sub>A</sub>] hojnost fosilií pravěkého člověka" (Marks, 2006, 22)

[30] "*[Living -ing<sub>p</sub>] organisms*" (Rees, 2000, 7)

[30'] "[*Živé* <sub>A</sub>] organismy" (Rees, 2004, 19)

If the pre modification of an English noun phrase is realized by the -ed participle, in the Czech one it is usually realized by an adjective. See example [21].

[21] "*an [unsuspected -ed<sub>p</sub>] new force*" (Rees, 2000, 3)

[21'] "[*netušená* <sub>A</sub>] nová síla" (Rees, 2004, 14)

As already stated in the theoretical part, the pre modification can be implemented by a secondary adjective. According to the analysis, their occurrence in English scientific texts is neither very high nor very low. There are no secondary adjectives in the Czech language therefore if the pre modification of an English noun phrase is realized by a secondary adjective, the pre modifying constituent of the Czech equivalent is usually an adjective. See examples [7] and [28].

[7] "*the [average <sub>N/A</sub>] species of clam*" (Marks, 2002, 9)

[7'] "[*průměrný* <sub>A</sub>] druh mlže" (Marks, 2006, 21)

[28] "*this [human <sub>N/A</sub>] scale*" (Rees, 2000, 7)

[28'] "*toto [lidské] měřítko*" (Rees, 2004, 18)

Another difference between English and Czech noun phrase structure is that the pre modification realized by a secondary adjective in the English noun phrase in some cases changes into a post modification of the Czech noun phrase. See the following examples (the head nouns are underlined for better illustration).

- [12] “*the [baboon<sub>N/A</sub>] protein*” (Marks, 2002, 10)  
 [12'] “*protein [šimpanze<sub>N</sub>]*” (Marks, 2006, 23)  
 [20] “*the initial [expansion<sub>N/A</sub>] speed*” (Rees, 2000, 3)  
 [20'] “*počáteční rychlost [rozpínání<sub>N</sub>]*” (Rees, 2004, 14)

As can be seen from the examples above, the resulting post modification of a Czech noun phrase is realized by a noun.

As mentioned in the theoretical part, the head noun can be pre modified by other kinds of phrases. The most commonly used pre modifying phrase in English scientific texts is an adjective phrase and it remains an adjective phrase in the Czech equivalent structure as well.

- [2] “*a [very mobile<sub>AP</sub>] shoulder*” (Marks, 2002, 8)  
 [2'] “*[velmi pohyblivé<sub>AP</sub>] rameno*” (Marks, 2006, 20)  
 [39] “*The [ideologically justified<sub>AP</sub>] rejection of ‘bourgeois’ genetics*” (Bruce, 2000, 5)  
 [39'] “*[Ideologicky zdůvodněné<sub>AP</sub>] odmítání ‘buržoázní’ genetiky*” (Bruce, 2008, 14)

Another type of pre modification in English scientific style is the genitive, though it is used very rarely. If the English noun phrase contains genitive as a pre modifier, the Czech usually replace it with an adjective.

- [11] “*the [rabbit's<sub>gen</sub>] blood*” (Marks, 2002, 10)  
 [11'] “*[králičí<sub>A</sub>] krev*” (Marks, 2006, 23)

The majority of noun phrases in scientific texts contain pre modification realized by only one constituent. However there are also noun phrases containing more than only one pre modifying element. If the pre modification of an English noun phrase is multiple, it is usually multiple in the Czech equivalent noun phrase as well. As already mentioned, the types of pre modifying elements can be different in English and in Czech.

- [5] “*our [closest<sub>A</sub>] [living<sub>-ing p</sub>] relatives*” (Marks, 2002, 8)  
 [5'] “*našimi [nejbližšími<sub>A</sub>] [žijícími<sub>A</sub>] příbuznými*” (Marks, 2006, 20)  
 [21] “*an [unsuspected<sub>-ed p</sub>] [new<sub>A</sub>] force*” (Rees, 2000, 3)  
 [21'] “*[netušená<sub>A</sub>] [nová<sub>A</sub>] síla*” (Rees, 2004, 14)

There are some noun phrases that contain multiple pre modification in English but their Czech equivalents contain just a simple pre modification because some English pre

modifying constituents tend to be in the role of post modification. See example [8]. (The head noun is underlined for better illustration).

[8] “[*later* <sub>A</sub>] [*ape* <sub>N/A</sub>] *fossils*” (Marks, 2002, 9)

[8’] “[*pozdější* <sub>A</sub>] *fosílie* [*lidoopů* <sub>N</sub>]” (Marks, 2006, 22)

### 6.3 The head

Based on the analysis, it can be said that the vast majority of heads in noun phrases of English and Czech scientific style are implemented by the common nouns [36]. The head realized by a pronoun occur in scientific style only rarely. See example [16]. None of the analysed noun phrases used a proper noun or substitute one/ones as a head.

[36] “*No evidence*” (Bruce, 2000, 3)

[36’] “*Žádný doklad*” (Bruce, 2008, 12)

[16] “*we*” (Marks, 2002, 17)

[16’] “*my*” (Marks, 2006, 29)

### 6.4 Post modification

The post modification can be implemented by many different constituents. Although the post modification is an optional part of a noun phrase, it is used in the noun phrases of English and Czech scientific style very commonly. There are some differences between the English and Czech post modifying items. Let us look at the most frequently used post modifying constituents of English and Czech noun phrases in scientific texts.

Based on the analysis, the most frequently used post modifying element on an English noun phrase is a prepositional phrase and the most commonly used head preposition is *of*. If the post modification in an English noun phrase is realized by an *of*-prepositional phrase, its Czech equivalent is most usually a post modification realized by a noun or a noun phrase. The Czech language does not use an *of*-phrase because on the contrary to English, Czech is an inflecting language so it uses the post modification realized by a noun or a noun phrase (using the different cases). See the following examples.

[13] “*the intensity [of reaction PP]*” (Marks, 2002, 11)

[13’] “*Intenzita [reakce N]*” (Marks, 2006, 23)

[33] “*the working life [of science PP]*” (Bruce, 2000, 1)

[33’] “*Každodenní život [vědy N]*” (Bruce, 2008, 10)

[48] “*This sense [of utter bewilderment PP]*” (Livio, 2009)

[48'] "*Onen pocit [naprosté nevysvětlitelnosti<sub>NP</sub>]*" (Livio, 2010)

The post modifying of- prepositional phrase of an English noun phrase can become a pre modifying adjective of a Czech noun phrase. This is very rare in scientific style. See example [25] (the head nouns are underlined for better illustration).

[25] "*a barely detectable smudge [of **light**<sub>PP</sub>] several billion light-years distant*" (Rees, 2000, 5)

[25'] "*sotva zachytitelná [světelná<sub>A</sub>] šmouha, vzdálená několik miliard světelných let*" (Rees, 2004, 17)

Post modifying prepositional phrases headed by other prepositions are used in scientific texts very rarely. Based on the analysis, if the post modification of an English noun phrase is realized by a prepositional phrase, the post modification of a Czech noun phrase can be realised either by a noun phrase or by a prepositional phrase. See examples [52] and [29].

[52] "*the planets [in our solar system<sub>PP</sub>]*" (Livio, 2009)

[52'] "*planety [naší sluneční soustavy<sub>NP</sub>]*" (Livio, 2010)

[29] "*An ordinary star [in the galaxy<sub>PP</sub>] that contains a hundred billion stars altogether*" (Rees, 2000, 7)

[29'] "*Obyčejnou hvězdou [v galaxii<sub>PP</sub>], jež obsahuje úhrnem sto miliard hvězd*" (Rees, 2004, 18)

Another post modifying constituent used quite frequently in scientific style is the finite relative clause. This type of post modifying constituent has the same form in Czech and English.

[18] "*The objects [that astronomers study<sub>cl</sub>]*" (Rees, 2000, 1)

[18'] "*Objekty, [jež zkoumají astronomové<sub>cl</sub>]*" (Rees, 2004, 13)

The occurrence of non-finite relative clauses as post modifying constituents of noun phrases in scientific style is quite low. Based on the analysis, it can be said that the post modifying -ing clause and -en clause are in the Czech noun phrase replaced by a post modifying adjective phrase. See the following examples.

[42] "*The chemist [studying bromide reactions<sub>-ing p</sub>]*" (Bruce, 2000, 7)

[42'] "*Chemik [zabývající se výzkumem reakcí bromide<sub>AP</sub>]*" (Bruce, 2008, 16)

[44] "*formalisms [developed in different branches of mathematics<sub>-en cl</sub>]*" (Livio, 2009)

[44'] "*formální systémy [vyvinuté různými matematickými obory AP]*" (Livio, 2010)

As already stated in the theoretical part, the post modification can be multiple. Nevertheless, the post modification of noun phrases in scientific texts usually contain only one post modifying constituent. Based on the analysis, it can be said that the multiple post modification of noun phrases in scientific style occurs rarely. As already mentioned, the types of post modifying constituents in English and Czech can be different. See examples [29] and [35].

[29] "*An ordinary star [in the galaxy PP] [that contains a hundred billion stars altogether cl]*" (Rees, 2000, 7)

[29'] "*Obyčejnou hvězdou [v galaxii PP], [jež obsahuje úhrnem sto miliard hvězd cl]*" (Rees, 2004, 18)

As can be seen from these graphic presentations, the post modification is multiple because both the post modifying constituents modify the head noun. The order of these post modifying constituents cannot be changed, otherwise the noun phrase is ambiguous.

[35] "*the personal experience [of practitioner PP] [supported by a few anecdotes of miracle cures -en cl]*" (Bruce, 2000, 2)

[35'] "*osobní zkušenost [jejich praktika NP], [podepřená několika příběhy o vyléčení AP]*" (Bruce, 2008, 11)

The post modification of this example is also multiple. The order of the post modifying items in the English noun phrase cannot be changed because the of-prepositional phrase is adjacent to the head noun. The order of the post modifying elements cannot be changed either in order to avoid ambiguity.



## CONCLUSION

The aim of this thesis was to describe and analyze the structure of the English noun phrase in scientific texts and to find the similarities and differences between the noun phrase structures of English original scientific texts and their Czech equivalents. A detailed description of each constituent of noun phrase structure was given in the theoretical part.

In the first part of the analysis I have analyzed 55 English noun phrases chosen from four different fields of science. This analysis has shown that the most frequently used central determiners in noun phrases of scientific texts are the definite and indefinite articles. Pre-determiners and post determiners are not used in scientific texts very often. Moreover, it has been shown that the most frequently used pre modifying constituents are not only adjectives but also nouns. Additionally, this analysis has shown that the head of a noun phrase in English scientific texts is in the vast majority implemented by a common noun, and the most prototypical post modifying item is the of-prepositional phrase. Furthermore, the analysis has shown that English scientific texts contain very few simple noun phrases. The majority of these analyzed noun phrases contains either pre modification or post modification and some of the phrases contain both. The occurrence of multiple pre modification in English scientific texts is quite low. However a multiple post modification occurs in scientific texts more commonly.

The second section of the analysis was aimed to find the similarities and dissimilarities between the English and Czech noun phrases of scientific texts. In this section, 53 English noun phrases along with their Czech equivalents were analyzed. This second section of the analysis has shown that there are quite a few differences between the English and Czech structure of a noun phrase. English uses the definite or indefinite article as a central determiner very often, but Czech does not have a system of articles and usually does not replace it by any other central determiner. Furthermore, the analysis has shown some differences between Czech and English in pre modification. While English has many various means of pre modification, Czech uses mostly adjectives as pre modifiers. The pre modifying constituents such as the participles, genitives or secondary adjectives are usually replaced by the adjectives in Czech scientific texts. In some cases Czech tends to change the English pre modifying secondary adjective to the post modification. Since Czech does not have the direct equivalent to the English of-prepositional phrase, it is usually replaced by a post modifying noun phrase in Czech scientific texts. Concerning the complexity of

English and Czech noun phrase in scientific texts, based on this analysis, it can be said that the noun phrases of both languages use a complex modification equally.

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**LIST OF ABBREVIATION**

N	Noun
A	adjective or adverb
N/A	secondary adjective
NP	noun phrase
AP	adjective phrase
PP	prepositional phrase
VP	verb phrase
XP	any type of phrase
-ing p	-ing participle
-en p	-en participle
cl	clause
-ing cl	-ing clause
-en cl	-en clause
-wh cl	-wh clause
-ing cl	-ing clause
PreM	pre modification
gen	genitive
Ag	agent
*	wrong example
?	ambiguous example

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## APENDIX P I: ENGLISH NOUN PHRASES FROM SCIENTIFIC TEXTS

- [1] *"a thin pencil line"* (McMurry, 2011, 3)
- [2] *"the behaviour of a specific electron in an atom"* (McMurry, 2011, 3)
- [3] *"this electron"* (McMurry, 2011, 3)
- [4] *"four different kinds of orbitals"* (McMurry, 2011, 3)
- [5] *"the first shell"* (McMurry, 2011, 4)
- [6] *"these orbital groupings"* (McMurry, 2011, 4)
- [7] *"a different electron shells, centred around the nucleus and having successively larger size and energy"* (McMurry, 2011, 4)
- [8] *"each orbital within a shell"* (McMurry, 2011, 4)
- [9] *"the two orbital regions separated by the node"* (McMurry, 2011, 4)
- [10] *"all the atoms of a given element"* (McMurry, 2011, 3)
- [11] *"their energy levels"* (McMurry, 2011, 4)
- [12] *"valence electrons that are not used for bonding"* (McMurry, 2011, 7)
- [13] *"The overlapping orbitals in the H<sub>2</sub>O molecule"* (McMurry, 2011, 10)
- [14] *"a plane"* (McMurry, 2011, 10)
- [15] *"no well-defined rules that cover all cases"* (McMurry, 2011, 22)
- [16] *"the nitrogen atom in ammonia, which has three covalent N-H bonds and two nonbonding electrons"* (McMurry, 2011, 40)
- [17] *"these two time values"* (Lehrman, 1998, 2)
- [18] *"the centimetre scale"* (Lehrman, 1998, 2)
- [19] *"these pitfalls in the process of measurement"* (Lehrman, 1998, 2)
- [20] *"every measured value"* (Lehrman, 1998, 3)
- [21] *"a rough-and-ready method of evaluating"* (Lehrman, 1998, 3)
- [22] *"the actual weight of the cylinder"* (Lehrman, 1998, 3)
- [23] *"the ratio of the limits of uncertainty to the measurement usually expressed as a percent"* (Lehrman, 1998, 3)
- [24] *"All measurements"* (Lehrman, 1998, 3)
- [25] *"those digits of a measurement that represent meaningful data"* (Lehrman, 1998, 4)
- [26] *"a special name for a mathematical description of motion"* (Lehrman, 1998, 17)
- [27] *"the average speed"* (Lehrman, 1998, 18)

- [28] “*very incomplete information*” (Lehrman, 1998, 19)
- [29] “*the quantity that defines the properties of a vector*” (Lehrman, 1998, 19)
- [30] “*plant movements*” (Beckett, 1986, 1)
- [31] “*all the chemical changes within an organism which are necessary for life*” (Beckett, 1986, 2)
- [32] “*the following pages*” (Beckett, 1986, 5)
- [33] “*fine threads called hyphae, which are collectively known as the mycelium of the fungus*” (Beckett, 1986, 5)
- [34] “*an illustrated outline classification of some of the main phyla*” (Beckett, 1986, 5)
- [35] “*they*” (Beckett, 1986, 6)
- [36] “*This seemingly trivial incident*” (Beckett, 1986, 13)
- [37] “*a fundamental part of the language of biology*” (Beckett, 1986, 13)
- [38] “*the most interesting ways of describing cells*” (Beckett, 1986, 13)
- [39] “*a brain cell of a frog*” (Beckett, 1986, 14)
- [40] “*the single cell which form the body of an amoeba*” (Beckett, 1986, 14)
- [41] “*a human hair*” (Beckett, 1986, 16)
- [42] “*water molecules*” (Beckett, 1986, 21)
- [43] “*the properties of the natural numbers*” (Hewson, 2003, 2)
- [44] “*any interesting logical implications which may not be immediately apparent from the definition*” (Hewson, 2003, 3)
- [45] “*this counting sequence*” (Hewson, 2003, 3)
- [46] “*these two rules*” (Hewson, 2003, 3)
- [47] “*every natural number*” (Hewson, 2003, 4)
- [48] “*each sequence*” (Hewson, 2003, 4)
- [49] “*a set containing two copies of the counting numbers*” (Hewson, 2003, 4)
- [50] “*a very basic level*” (Hewson, 2003, 7)
- [51] “*some equally sized pieces*” (Hewson, 2003, 7)
- [52] “*the formal rules defining the integers*” (Hewson, 2003, 7)
- [53] “*the natural number system*” (Hewson, 2003, 7)
- [54] “*no common factors*” (Hewson, 2003, 19)
- [55] “*any cubic equation*” (Hewson, 2003, 37)

## APENDIX P II: ENGLISH AND CZECH NOUN PHRASES FROM SCIENTIFIC TEXTS

- [1] “*the chimpanzees*” (Marks, 2002, 8)  
[1’] “*šimpanzi*” (Marks, 2006, 20)  
[2] “*a very mobile shoulder*” (Marks, 2002, 8)  
[2’] “*velmi pohyblivé rameno*” (Marks, 2006, 20)  
[3] “*the familiar common chimpanzee found across Central and West Africa*” (Marks, 2002, 8)  
[3’] “*starý známý obyčejný šimpanz rozšířený ve střední a západní Africe*” (Marks, 2006, 20)  
[4] “*our species*” (Marks, 2002, 8)  
[4’] “*naš druh*” (Marks, 2006, 20)  
[5] “*our closest living relatives*” (Marks, 2002, 8)  
[5’] “*našimi nejbližšími žijícími příbuznými*” (Marks, 2006, 20)  
[6] “*that species*” (Marks, 2002, 9)  
[6’] “*tento druh*” (Marks, 2006, 21)  
[7] “*the average species of clam*” (Marks, 2002, 9)  
[7’] “*průměrný druh mlže*” (Marks, 2006, 21)  
[8] “*later ape fossils*” (Marks, 2002, 9)  
[8’] “*pozdější fosílie lidoopů*” (Marks, 2006, 22)  
[9] “*the resulting abundance of proto-human fossils*” (Marks, 2002, 9)  
[9’] “*výsledná hojnost fosílií pravěkého člověka*” (Marks, 2006, 22)  
[10] “*the immune reaction*” (Marks, 2002, 10)  
[10’] “*imunitní reakce*” (Marks, 2006, 23)  
[11] “*the rabbit’s blood*” (Marks, 2002, 10)  
[11’] “*Králičí krev*” (Marks, 2006, 23)  
[12] “*the baboon protein*” (Marks, 2002, 10)  
[12’] “*Protein šimpanze*” (Marks, 2006, 23)  
[13] “*the intensity of reaction*” (Marks, 2002, 11)  
[13’] “*Intenzita reakce*” (Marks, 2006, 23)  
[14] “*that cockeyed genetic evidence*” (Marks, 2002, 12)  
[14’] “*pošetilé genetické důkazy*” (Marks, 2006, 24)

- [15] “*these monsters*” (Marks, 2002, 15)
- [15’] “*tito netvoři*” (Marks, 2006, 27)
- [16] “*we*” (Marks, 2002, 17)
- [16’] “*my*” (Marks, 2006, 29)
- [17] “*the sterile analysis of the scientist-philosopher*” (Marks, 2002, 17)
- [17’] “*tato plytká analýza vědce-filozofa*” (Marks, 2006, 30)
- [18] “*The objects that astronomers study*” (Rees, 2000, 1)
- [18’] “*Objekty, jež zkoumají astronomové*” (Rees, 2004, 13)
- [19] “*the relative importance of gravity and expansion energy in the universe*” (Rees, 2000, 2)
- [19’] “*relativní důležitost gravitace a energie rozpínání ve vesmíru*” (Rees, 2004, 14)
- [20] “*the initial expansion speed*” (Rees, 2000, 3)
- [20’] “*počáteční rychlost rozpínání*” (Rees, 2004, 14)
- [21] “*an unsuspected new force*” (Rees, 2000, 3)
- [21’] “*Netušená nová síla*” (Rees, 2004, 14)
- [22] “*the second frame*” (Rees, 2000, 3)
- [22’] “*druhý snímek*” (Rees, 2004, 16)
- [23] “*some tall buildings*” (Rees, 2000, 5)
- [23’] “*Jakési vysoké budovy*” (Rees, 2004, 16)
- [24] “*the billions of similar stars in the flash disc of our Milky Way*” (Rees, 2000, 5)
- [24’] “*Miliardy podobných hvězd v plochem disku naší mléčné dráhy*” (Rees, 2004, 17)
- [25] “*a barely detectable smudge of light several billion light-years distant*” (Rees, 2000, 5)
- [25’] “*sotva zachytitelná světelná šmouha, vzdálená několik miliard světelných let*” (Rees, 2004, 17)
- [26] “*individual atoms*” (Rees, 2000, 6)
- [26’] “*jednotlivé atomy*” (Rees, 2004, 17)
- [27] “*no real microscope*” (Rees, 2000, 6)
- [27’] “*Žádný reálný mikroskop*” (Rees, 2004, 17)
- [28] “*this human scale*” (Rees, 2000, 7)
- [28’] “*toto lidské měřítko*” (Rees, 2004, 18)
- [29] “*An ordinary star in the galaxy that contains a hundred billion stars altogether*” (Rees, 2000, 7)

- [29'] "*Obyčejnou hvězdou v galaxii, jež obsahuje úhrnem sto miliard hvězd*" (Rees, 2004, 18)
- [30] "*Living organisms*" (Rees, 2000, 7)
- [30'] "*Živé organismy*" (Rees, 2004, 19)
- [31] "*The tremendous timespans involved in evolution*" (Rees, 2000, 9)
- [31'] "*Obrovská časová rozpětí provázající evoluci*" (Rees, 2004, 21)
- [32] "*All parts of the universe*" (Rees, 2000, 12)
- [32'] "*Všechny části vesmíru*" (Rees, 2004, 23)
- [33] "*the working life of science*" (Bruce, 2000, 1)
- [33'] "*Každodenní život vědy*" (Bruce, 2008, 10)
- [34] "*any good scientific theory*" (Bruce, 2000, 1)
- [34'] "*Každá správná vědecká teorie*" (Bruce, 2008, 10)
- [35] "*the personal experience of practitioner supported by a few anecdotes of miracle cures*" (Bruce, 2000, 2)
- [35'] "*osobní zkušenost jejich praktika, podepřená několika příběhy o vyléčení*" (Bruce, 2008, 11)
- [36] "*No evidence*" (Bruce, 2000, 3)
- [36'] "*Žádný doklad*" (Bruce, 2008, 12)
- [37] "*It*" (Bruce, 2000, 2)
- [37'] "*To*" (Bruce, 2008, 11)
- [38] "*good evidence of the effectiveness of the drug*" (Bruce, 2000, 2)
- [38'] "*Důkaz účinnosti nového léku*" (Bruce, 2008, 11)
- [39] "*The ideologically justified rejection of 'bourgeois' genetics*" (Bruce, 2000, 5)
- [39'] "*Ideologicky zdůvodněné odmítání 'buržoázní' genetiky*" (Bruce, 2008, 14)
- [40] "*This skill*" (Bruce, 2000, 6)
- [40'] "*Tato schopnost*" (Bruce, 2008, 15)
- [41] "*The men who came to prominence in the late 1980s*" (Bruce, 2000, 6)
- [41'] "*Muži, kteří se vyšvihli na vedoucí pozice v osmdesátých letech*" (Bruce, 2008, 16)
- [42] "*The chemist studying bromide reactions*" (Bruce, 2000, 7)
- [42'] "*Chemik zabývající se výzkumem reakcí bromidu*" (Bruce, 2008, 16)
- [43] "*Some sociologists*" (Bruce, 2000, 10)
- [43'] "*Některé sociology*" (Bruce, 2008, 20)
- [44] "*formalisms developed in different branches of mathematics*" (Livio, 2009)

- [44'] "*formální systémy vyvinuté různými matematickými obory*" (Livio, 2010)
- [45] "*a perfect example of an extraordinarily precise, self-consistent mathematical theory*" (Livio, 2009)
- [45'] "*dokonalý příklad mimořádně přesné a vnitřně bezesporné matematické teorie*" (Livio, 2010)
- [46] "*the unreasonable effectiveness of mathematics*" (Livio, 2009)
- [46'] "*nepochopitelná účinnost matematiky*" (Livio, 2010)
- [47] "*that slide*" (Livio, 2009)
- [47'] "*tahle stránka*" (Livio, 2010)
- [48] "*This sense of utter bewilderment*" (Livio, 2009)
- [48'] "*Onen pocit naprosté nevysvětlitelnosti*" (Livio, 2010)
- [49] "*the paradigm of rational argument*" (Livio, 2009)
- [49'] "*vzor racionální argumentace*" (Livio, 2010)
- [50] "*a wonderful gift which we neither understand nor deserve*" (Livio, 2009)
- [50'] "*úžasný dar, který nechápeme ani si jej nezasluhujeme*" (Livio, 2010)
- [51] "*Those perceiving minds*" (Livio, 2009)
- [51'] "*Vnímající mysli*" (Livio, 2010)
- [52] "*the planets in our solar systém*" (Livio, 2009)
- [52'] "*planety naší sluneční soustavy*" (Livio, 2010)
- [53] "*the behaviour of a simple equation*" (Livio, 2009)
- [53'] "*chování jedné jednoduché rovnice*" (Livio, 2010)