Universal Terminology

Chapter 9: The grammar of terms

This chapter defines the formal grammar governing the corpus of all anatomical terms. Any term must fit to this grammar.
An anatomical term is basically an ordered sequence of words usually separated by a space. A term is necessarily related to an entry of the terminology and reciprocally any entry of the terminogy has one or more terms. Any term is commonly expressed in different vernacular languages which syntax is documented elsewhere and which words belongs to a dictionary of each language. The sequence of words is governed by a set of structural rules issued from the core of the terminology, restricting the terms to a precise sublanguage and excluding the ambiguities frequently accompanying the natural languages.
The main goal of this chapter is to define the formal grammar of any anatomical term.
This document is the chapter 9 of the book Universal Terminology which presents a global documentation on the $\mathbf{T}_{logy}$.

Contents

9.1 Introduction

This chapter of the theory of terminology defines the **formal grammar** applicable to all the **terms** of the $\mathbf{T}_{logy}$. Each object of the grammar is presented as the left part of a rule, the right part being its definition made of one or more contributions based on less general objects. In this way a hierarchy from the most general to the most particular object is designed. It pretends to define any term that can be present in the $\mathbf{T}_{logy}$.

The formal grammar is a collection of rules. Each **rule** is necessarily of any one of the following forms:

1. DefinedObject := SubObjectA || SubObjectB .
2. DefinedObject := SubObjectC & SubObjectD .
3. DefinedObject := F^{LG} (SubObjectE) .
4. DefinedObject := Symbol .

The rule is defined by its **operator :=** and has two arguments, its **left part** and its **right part**. The rule defines the left part by the operations presented in the right part.

There are 4 possible types of operation: In the first form, the operator || offers an alternative between SubObjectA and SubObjectB. In the second form, the operator & defines the concatenation of SubObjectC and SubObjectD. In the third form, the **grammatical function** F^{LG} realizes an operation on SubObjectE. Grammatical functions are described elsewhere in this chapter. Usually, all grammatical functions are language dependant. In the fourth form, the defined object is a **symbol** of the grammar, that means a predefined building block of the terminology. Symbols are described elsewhere in this chapter.

The rules are possibly recursive, because any SubObject may refer to an already defined object and forming in this way a recursive loop.

In order to ease the reading of the formal grammar, upper and lower indices are used for the defining objects. An upper index, represented by LG, means any specific language, and can take the following values: LA for Latin, EN for English, FR for French, ES for Spanish and RU for Russian. An upper index is not necessarily always present: it can be ommited. A lower index is a reference to the rule number where this object is defined.

The here presented rules are a didactic representation of the programs used for generation of terms of the terminology. They document as precisely as possible the main functions of the generation. The inverse path, from this grammar to the generating programs, is not implemented: the programs do not know formally about this grammar.

9.2 Order of words

The order of objects of the formal grammar corresponds to the **Latin order** of words. For all languages where the Latin term must be translated, the order of words is directly dependant on the Latin order, by rules specific for that language.

The Latin order follows a few simple rules. They are:

1. The nominative part preceeds the genitive part. This rule accepts exceptions for the so-call traditional terms, where the genitive part is inserted within the nominative part, at a specified position.
2. Adjectives are ordered from the most to the less significant.
3. Adjective from adjective expansion comes first.
4. A preposition expansion preceeds a mandatory expansion.
5. A mandatory expansion preceeds an optional expansion.
6. Apposition are in the order main noun - apposed noun.

The French order and the Spanish order are the same as the Latin order.

The English order is equal to the inverted Latin order, with a few exceptions. The English order follows a few simple rules: They are:

1. The nominative part preceeds the genitive part.
2. Adjectives are ordered from the less to the most significant.
3. Adjective from adjective expansion comes last.
4. A preposition expansion preceeds a mandatory expansion.
5. A mandatory expansion preceeds an optional expansion.
6. Apposition are in the order apposed noun - main noun.

The Russian order is equal to the inverted Latin order, with a few exceptions.

9.3 Definition of the formal grammar

This section provides a formal definition of a term, valid for all terms of the $\mathbf{T}_{logy}$. A formal grammar is used. Different definitions are given in cascade and alltogether they exhaustively define the top object : AnatomicalTerm. The rules are given interspersed with comments.

The following conventions are used in this formal grammar:

- The := operator signifies that the left term is defined by the right formula.
- The ¦ operator is the OR operator between the left and right arguments.
- The + operator is the concatenation operator of the right argument to the left argument.
- The numbers in lower indices are pointers to another rule where this argument is defined.
- The argument Lg in upper indices defines a specific language.
- Symbols initiated by the # sign are constant strings of characters defined elsewhere below.
- Rightmost references in round parentheses are identifiers of rules.

9.3.1 Top levels

$$\begin{aligned} AnatomicalTerm &:= RegularTerm_{9.1} \mid \\ &\quad IrregularTerm_{9.36} \mid \\ RegularTerm &:= RootTerm_{9.1} \mid \\ &\quad DerivedTerm^{Lg}_{9.37} \mid \\ RootTerm &:= UniversalTerm_{9.2} \mid \\ &\quad LanguageTerm^{Lg}_{9.20} \mid \end{aligned} \tag{9.1}$$

Anatomical terms are existing under 2 broad categories: regular and irregular terms: the regular terms are the target of the present grammar and the irregular terms are whatever does not fit with the rules. The regular terms are expected to make more than 99% of the $\mathbf{T}_{logy}$.

The regular terms are either original root terms or computed derived terms.

The root terms are existing under 2 categories: the first is a **universal term** based on a formula, the second is a specific **language term** formulated in a specific language Lg and uniquely valid in this language.

$$\begin{aligned} UniversalTerm &:= BasePart_{9.3} \mid \\ &\quad BasePart_{9.3} + \#Comma + ExpansionPart_{9.11} \end{aligned} \tag{9.2}$$

A **universal term** is made of a mandatory **base part** and an optional **expansion part**.

$$\begin{aligned} BasePart &:= WordReference_{9.4} \mid \\ &\quad WordReference_{9.4} + \#Comma + WordReference_{9.4} \end{aligned} \tag{9.3}$$

A **base part** is a sequence of word references in variable numbers (in practice up to 6).

$$WordReference \;:=\; WordType_{9.5} + \#Rol + WordIdentifier_{9.10} + \#Ror \tag{9.4}$$

A **word reference** is a pointer to a specific type of word using its identifier.

$$\begin{aligned} WordType &:= NounType_{9.6} \mid \\ &\quad AdjectiveType_{9.7} \mid \\ &\quad PrefixType_{9.8} \mid \\ &\quad InvariantType_{9.9} \end{aligned} \tag{9.5}$$

There are exclusively 4 **types of word**, but this does not include additional words which are specific to some languages, like prepositions, articles, etc.

$$NounType \;:=\; \#UpperCaseLetter \tag{9.6}$$

The wordtype **noun** is qualified by the letter N. They are usually common substantives.

$$AdjectiveType \ := \ \#UpperCaseLetter \tag{9.7}$$

The wordtype **adjective** is qualified by the letter A. It concerns any type of adjectives, including the ordinal adjectives.

$$PrefixType \ := \ \#UpperCaseLetter \tag{9.8}$$

The wordtype **prefix** is qualified by the letter P. Prefixes are invariant and located on the left part of words, usually wihout separating character.

$$InvariantType \ := \ \#UpperCaseLetter \tag{9.9}$$

The wordtype **invariant** is qualified by the letter I.

$$WordIdentifier \ := \ \#Integer \tag{9.10}$$

The **word identifiers** are defined in the database of the $\mathbf{T}_{logy}$. Each word is defined as member of a vocabulary entity, that is a non physical entity in the taxonomy of the domain. As each anatomical entity, these entries receive a unique identifier. The final number of vocabulary entities in the $\mathbf{T}_{logy}$is estimated to be less than 2500 items (1400 items in February 2023). With a mean count of 2 words per vocabulary entity, the number of individual words is estimatedto be less than 5000 items.

$$\begin{aligned} ExpansionPart := \ & Expansion_{9.12} \ | \\ & Expansion_{9.12} + \#Comma + Expansion_{9.12} \end{aligned} \tag{9.11}$$

An **expansion part** is a sequence of single expansions, from 0 to 6 (all possible expansions). Each type of expansion is necessary unique or absent.

$$\begin{aligned} Expansion := \ & \#Ampersand + ExpansionType_{9.13} + \\ & \#Rol + ExpansionIdentifier_{9.14} + \#Ror \end{aligned} \tag{9.12}$$

An **expansion** is defined by its type and its identifier. Each expansion is pointing to another anatomical entity that is identified by its unique identifier.

$$\begin{aligned} ExpansionType := \ & PrepositionType_{9.15} \ | \\ & AdjectiveType_{9.16} \ | \\ & PrefixType_{9.17} \ | \\ & MandatoryType_{9.18} \ | \\ & OptionalType_{9.19} \end{aligned} \tag{9.13}$$

An **expansion type** is one of the 5 types of expansion.

$$ExpansionIdentifier \ := \ \#Integer \tag{9.14}$$

An **expansion identifier** is a entity identifier TID as defined in the database for each entity.

$$PrepositionType \ := \ \#UpperCaseLetter \tag{9.15}$$

The expansion type for a **preposition expansion** is qualified by the letter R.

$$AdjectiveType \ := \ \#UpperCaseLetter \tag{9.16}$$

The expansion type for an **adjective expansion** is qualified by the letter Q.

$$PrefixType \ := \ \#UpperCaseLetter \tag{9.17}$$

The expansion type for a **prefix expansion** is qualified by the letter X.

$$MandatoryType \ := \ \#UpperCaseLetter \tag{9.18}$$

The expansion type for a **mandatory expansion** is qualified by the letter G.

$$OptionalType \ := \ \#UpperCaseLetter \tag{9.19}$$

The expansion type for an **optional expansion** is qualified by the letter F.

9.3.2 Language terms

A **language term** is specific to a language and is considered as a derogation for this language only to the **universal term**. When such a derogation is applicable to different languages, it must be repeated as many times as necessary.

$$\begin{aligned} LanguageTerm^{Lg} := \ & GenericTerm^{Lg}_{9.21} \ | \\ & ProcessedTerm^{Lg}_{9.35} \end{aligned} \tag{9.20}$$

There are 2 different ways to represent a **language term** of the $\mathbf{T}_{logy}$, when it is not directly issued from a universal formula. The **generic term** is an explicite definition in the language, with a similar structure as a universal term. The **processed term** is a term in the language inherited from a formula with some variations.

$$GenericTerm^{Lg} := Base_{9.22} \mid \\ Base_{9.22} + ExpansionPart_{9.11} \tag{9.21}$$

The **generic term** is made of a mandatory base part, followed by 0 to 6 expansions.

$$Base := NounGroup_{9.23} + AdjectiveGroup_{9.31} + Invariant_{9.28} \tag{9.22}$$

The **base** of a generic term consists necessarily of a noun group, which may be followed by an optional adjective group and an optional invariant.

$$\begin{aligned} NounGroup := {} & nil \mid \\ & Noun_{9.24} \mid \\ & Noun_{9.24} + \#Space + NounComplement_{9.29} \mid \\ & Noun_{9.24} + \#Space + NounApposition_{9.30} \end{aligned} \tag{9.23}$$

A **noun group** is either a single noun, or a noun followed by a noun complement, or a noun followed by another noun in apposition. Normally a noun is mandatory, but there are a few exceptions.

$$Noun := SingleNoun_{9.26} \mid \\ PrefixedNoun_{9.25} \mid \tag{9.24}$$

A **noun** is either a single noun or a prefixed noun.

$$PrefixedNoun := Prefix_{9.27} + SingleNoun_{9.26} \mid \\ Prefix_{9.27} + Prefix_{9.27} + SingleNoun_{9.26} \tag{9.25}$$

A **prefixed noun** is a single noun preceeded by one or two prefixes.

$$SingleNoun \ := \ \#WordString \tag{9.26}$$

A **single noun** is a string of word characters without blanks. This string is possibly affected by the case, the gender and the number that is applicable according to the position in the term.

$$Prefix \ := \ \#WordString \tag{9.27}$$

A **prefix** is a string of word characters without blanks, that is invariable, in principle not separated by a dash from the noun it preceeds.

$$Invariant := \#nil \mid \\ \#Space + \#WordString \tag{9.28}$$

An **invariant** is a string of word characters without blanks, that is invariable in case, gender or number. Invariants are often used for cardinal numbers (arabic or roman) or acronyms.

$$NounComplement := GSLG(Noun_{9.24}) \tag{9.29}$$

A **noun complement** is obtained by application of the function genitive singular, applied to a noun.

$$NounApposition := Noun_{9.24} \tag{9.30}$$

A **noun apposition** is a noun which share the case, the gender and the number with its counterpart.

$$\begin{aligned} AdjectiveGroup := {} & nil \mid \\ & Adjective_{9.32} + AdjectiveGroup_{9.31} \end{aligned} \tag{9.31}$$

An **adjective group** is a sequence of adjectives, from 0 to N. The order of adjectives in the sequence is significant.

$$\begin{aligned} Adjective := {} & SingleAdjective_{9.34} \mid \\ & PrefixedAdjective_{9.33} \mid \end{aligned} \tag{9.32}$$

An **adjective** is either a single adjective or a prefixed adjective.

$$\begin{aligned} PrefixedAdjective := {} & Prefix_{9.27} + SingleAdjective_{9.34} \mid \\ & Prefix_{9.27} + Prefix_{9.27} + SingleAdjective_{9.34} \end{aligned} \tag{9.33}$$

A **prefixed adjective** is a single adjective preceeded by one or two prefixes.

$$SingleAdjective := \#WordString \tag{9.34}$$

A **single adjective** is a string of word characters without blanks. This string is possibly affected by the case, the gender and the number that is applicable according to the position in the term.

$$ProcessedTerm := INH(UniversalTerm_{9.2}) \tag{9.35}$$

A **processed term** is a term resulting from an inheritance mechanism (function INH) applied on a universal term. It allows to inherit a slightly different formula than the original.

$$IrregularTerm := \#WordString \tag{9.36}$$

An **irregular term** is a term not following any rule of the present grammar. Irregular terms cannot be safely processed by the several language dependant

functions. Therefore, they cannot be transformed and they can only be used as they are specified, they cannot receive changes in case, number or gender. Their presence is strictly limited in the $\mathbf{T}_{logy}$.

$$\begin{aligned} DerivedTerm := {} & SetTerm_{9.38} \mid \\ & PairTerm_{9.41} \mid \\ & PSetTerm_{9.44} \mid \\ & LateralTerm_{9.47} \end{aligned} \tag{9.37}$$

A **derived term** is any term computed from a root term. Each derived term is obtained by application of a language independant function applied on a root term. This function usually transfers the task to language specific functions, one being provided by its language implemented in the $\mathbf{T}_{logy}$.

$$\begin{aligned} SetTerm := {} & SetDisplayTerm_{9.39} \mid \\ & SetFormalTerm_{9.40} \mid \end{aligned} \tag{9.38}$$

The **set term** exists in two different options: a display form and a formal form.

$$SetDisplayTerm := P^{Lg}(RootTerm_{9.1}) \tag{9.39}$$

A **set display term** is obtained by the plural function.

$$SetFormalTerm := \#Classis^{Lg} + \#Space + GP^{Lg}(RootTerm_{9.1}) \tag{9.40}$$

A **set formal term** is obtained by the set symbol followed by the genitive plural of the root term.

$$\begin{aligned} PairTerm := {} & PairDisplayTerm_{9.41} \mid \\ & PairFormalTerm_{9.42} \mid \end{aligned} \tag{9.41}$$

The **pair term** exists in two different options: a display form and a formal form.

$$PairDisplayTerm := RootTerm_{9.1} + \#Space + \#Rol + \#Pair + \#Ror \tag{9.42}$$

A **pair display term** is obtained by the adjunction between round parentheses of the pair symbol to the root term.

$$PairFormalTerm := \#Pair^{Lg} + \#Space + GP^{Lg}(RootTerm_{9.1}) \tag{9.43}$$

A **pair formal term** is obtained by the pair symbol followed by the genitive plural of the root term.

$$PSetTerm := PSetDisplayTerm_{9.43} \mid PSetFormalTerm_{9.44} \mid \tag{9.44}$$

The **pair set term** exists in two different options: a display form and a formal form.

$$PSetDisplayTerm := P^{Lg}(RootTerm_{9.1}) + \#Space + \#Rol + \#Pair + \#Ror \tag{9.45}$$

A **pair set display term** is obtained by the adjunction between round parentheses of the pair symbol to the plural function applied to the root term.

$$PSetFormalTerm := \#Pair^{Lg} + \#Space + GP^{Lg}(\#Classis^{Lg}) + \#Space + GP^{Lg}(RootTerm_{9.1}) \tag{9.46}$$

A **pair set formal term** is obtained by the pair symbol followed by the set symbol at genitive plural followed by the genitive plural of the root term.

$$LateralTerm := RootTerm_{9.43} + LateralAdj^{Lg}_{9.48} \tag{9.47}$$

A **lateral term** is obtained by the adjunction of a lateral adjective to the right of the root term.

$$LateralAdj^{Lg} := \#Dexter^{Lg} \mid \#Sinister^{Lg} \tag{9.48}$$

A **lateral adjective** either right or left, being language dependant.

9.3.3 Mandatory expansion

This expansion is the expression of the natural link of an entity to another entity which enters in the making of its terms. Typically, the term LA:*sulcus terminalis cordis* is made of the basis sulcus terminalis and a mandatory link to the entity LA:*cor*. In the present $\mathbf{T}_{logy}$, such a link is necessary made explicit and the linked entity is always represented by its identifier and never by its term. The current value of the term representing an entity is defined once and only once.

This expansion is specified by its corresponding Expansion, which type is the GenitiveType.

The resolution of this expansion is done by either the GSLG or the GPLG function applied on the corresponding ExpansionIdentifier. The resulting string is appended to the base part of the term, relatively to posssible other expansions. In some situations of Latin, the mandatory expansion may be inserted somewhere within the base term.

The mandatory expansion is recursive, in the sense that the expansion term can itself be expanded by other expansions without limit (in practice, no more than 4 levels are observed).

9.3.4 Optional expansion

This expansion is similar to the mandatory expansion, except it is displayed on demand only, depending on the context where the term is used.

This expansion is specified by its corresponding Expansion, which type is the OptionalType.

The optional expansion is generally displayed in italics, in order to make it distinct from the main term.

9.3.5 Adjective and prefix expansions

This expansion is parallel to the mandatory expansion, except that it is represented by a single (possibly prefixed) adjective, considered to be significant as representative of the entity specified by the Adjective identifier. This expansion may be prefixed by a Prefix identifier. The existence of a representative adjective is not guarantted and limits the application of this expansion.

The adjective expansion is always inserted immediatly after the noun of the base term. Of course, when necessary depending on the current language, the adjective is adjusted in gender and number.

The adjective and mandatory expansions can be interchanged in some specific circumstances. This means that the corresponding identifiers are interchanged. This is always possible when moving to a mandatory expansion, but it is restricted in the other direction, as mentioned above. The interchange can be realised by specification of an inherited term from a formula.

9.3.6 Preposition expansion

This type of expansion is not yet implemented.

9.4 Functions

The formal grammar of anatomical terms is made of imbricated symbols, describing an anatomical term in a top-down approach, from general to particular. However this approah is not sufficient to grasp all aspects of the generating programs. It is necessary to add a couple of functions about syntactic operations accompanying each languages. These functions are presented here in two steps: 1) description of the action in a language independant fashion; 2) description for the main target languages of the generation.

PLG: Plural This function makes the plural of a term given in argument, supposed at nominative singular.

GSLG: Genitive singular, GPLG: Genitive plural This function consider a term given in argument, supposed at nominative singular, and transform it to genitive singular or plural.

LLG: Lateral member of a pair This function add the laterality adjective to a term given in argument, supposed at nominative singular. The postion of the laterality adjective obeys to strict universal rules, selecting this position between the base part of a term or any of its expansions.

CLG: Any case This function consider a term given in argument, supposed at nominative singular, and transform it to the specified case at singular. Cases are related to prepositions (accusative, dative and ablative).

CNLG: Any case with number This function consider a term given in argument, supposed at nominative singular, and transform it to the specified case at singular, with respect of the indications about number. Cases are related to prepositions (accusative, dative and ablative).

CNGLG: Any case with number and gender This function consider a term given in argument, supposed at nominative singular, and transform it to the specified case at singular, with respect of the indications about gender and number. Cases are related to prepositions (accusative, dative and ablative).

INH: Inheritance from a formula. This function slightly modify a given formula, generating a new term.

9.4.1 The plural function

In the present frame of anatomical terms, the plural function is exclusively limited to nouns and adjectives. For the English language, the adjectives are invariable and only the nouns are affected by this function.

The plural function only applies to a nominative term. But any nominative term may contain genitive complement nouns that are forming the right part of the term, or prepositions governing different cases. These parts must be skiped by the plural function. This is realized by the recognition of the case or by the presence of prepositions, depending on the languages.

Attention has also to be given to the possible invariants, by definition invariable at plural. But the list of them is below 100 items. The presence of prefixes before any noun or adjective is always possible. These occurences must be recognized, but of course the prefixes are invariable with number.

The plural is generated on rule and exceptions basis. In a first step, the candidate singular word is searched for in a list of exceptions giving explicitely its plural form. If not found, the word is transformed to plural by application of the first rule matching its ending characters and replacing them by a specific plural string.

The list of exceptions is as low as 100 items and a set of 25 rules maximum is generally sufficient for resolving all situations. This is true because the vocabulary of anatomy is made of less than 400 entries.

Several languages are matching the adjectives to a noun, with respect to the gender. This is evidently true for the singular and the plural. But a singular term does not necessarily make visible which gender has the noun. Therefore, the gender of the noun has to be defined in each situation, in order to be sure of the generated plural. The gender is also generated on a rule and exceptions basis.

However, a difficulty arises when a language accepts numerous words of a foreign language, like English with Latin words. In this situation, the rules are in fact two sets of rules which are conflicting or present ambiguities: the formation of plural may follow one language or the other. In addition, the official plural is often unknown to non experts in Latin, like casual users of the terminology or students. The plural of sinus is sinuses and the plural of plexus is plexus!

Anyway, the generating programs are built with a relative orthodoxy in its rules, favouring essentially the source language, despite the usage or the tradition. In the above example, the plural plexuses and plexi are not acceptable.

9.4.2 The genitive functions

The genitive functions only apply to a nominative term. But any nominative term may contain genitive complement nouns that are forming the right part of the term, or prepositions governing different cases. These parts must be skiped by the genitive functions. This is realized by the recognition of the case or by the presence of prepositions, depending on the languages.

Attention has also to be given to the possible invariants, by definition invariable at plural. But the list of them is below 100 items. The presence of prefixes before any noun or adjective is always possible. These occurences must be recognized, but of course the prefixes are invariable with cases.

The genitive functions are different in language with declension (Latin and Russian) than in language without declension (English, French, Spanish). In presence of declension, the nouns and adjectives receive a different ending at genitive singular or plural. In the absence of declension, the genitive is simply introduced by a preposition, but the nouns and adjectives are left unchanged.

The genitive for declension languages is generated on rules and exceptions basis. In a first step, the candidate nominative word is searched for in a list of exceptions giving explicitely its genitive form. If not found, the word is transformed to genitive by application of the first rule matching its nominative ending characters and replacing them by a specific genitive string. This processing is the same for genitive singular and plural, but with different sets of exceptions and rules.

For languages with gender concordance between the noun and its qualifying adjectives, the gender of the noun is retrieved and used for guiding the preparation of adjectives.

The difficulty with words of a foreign language is here also important. Should the genitive be retrieved in the native language or the foreign language? It seems that the most common practice is to make the genitive in the native language, but this is not really coherent. For this reason the terms with foreign words are often declared as irregular.

9.4.3 Lateral members function

At first it should be remebered that left and right entities belonging to a pair are of first importance for the writing of the medical records relative to a specific patient. This is especially true for surgeons and radiologists. A broken humerus is necessarily on one side and not on the other. This problem is less important when teaching anatomy. This is to say that lateral members are not a side aspect of the terminology.

The main problem with lateral members is where to place the lateral adjective in a term? Indeed a term is made of a base part and possibly several expansions to other entity: which entity receives the qualifier? For the term cephalic vein of forearm, what is left, the vein or the forearm?

Hopefully, this problem is regulated by a unique rule, valid for all languages and apparently without exceptions. This rules says: when a term consists of a sequence of referred entities from left to right, the most right entity that is bilateral will receice the lateral adjective. For this reason the above example gives cephalic vein of left forearm, but we have left incisura of sternum.

Lateral members of pairs are difficult to generate and the irregular terms are often rejected.

9.5 Symbols

A number of symbols are defined in the formal grammar. In the formal grammar above, all symbols are initiated by the # sign. They are documented thereafter:

#Ampersand
This is the & character, valid in all languages.

#Classis
This is the representative text for sets. It is language dependant.

#Pair
This is the representative text for pairs. It is language dependant. It is made of the word pair in each specific language between round parentheses: (par) in Latin and Spanish, (pair) in English, (paire) in French and (para) in Russian.

#Comma
This is the comma character valid in all languages. It is accepted in formulas, but forbidden in terms as well as any conjunction.

#Rol, #Ror
These symbols are the left and right round parentheses. They are present in formulas and in paired terms with the symbol Pair.

#UpperCaseLetter
This symbol represent any single upper case letter.

#Integer
This is the symbol for a positive integer, used in particular for the UID (Unit identifier).

#nil
This is the symbol for nothing, used to represent the fact that the defined object may be missing.

#WordString
This symbol represents a string of the characters which are usually forming words. This string is dependant on the language and its alphabet. It is limited to lower and upper case letters, plus a few special characters (hyphen, apostrophy, etc) and excludes numerals and most special characters.

#InvariantString
This symbol represents a string of letters and numerals, plus a few special characters forming invariants.

#TermString
This symbol represents a string of letters, numerals and a few special characters forming a term.

#AnyString
This symbol represents a string of all possible displayable characters.

#Hyphen
This symbol represents the hyphen character.

#Space
This symbol represents the blank or space character.

#PrepositionTo
This symbol represents the preposition 'to' in any specific language using it.

#PrepositionFrom
This symbol represents the preposition 'from' in any specific language using it.

#Dexter, #Sinister
This symbol represents a lateral adjective.

9.6 Examples

9.6.1 Single noun formula

Let represent the LA:*cor*, a single entity, which term is made of a single noun in all languages.

The formula is: N(13022). It results from the grammar by application of the rules 9.1 to 9.6.

The entity 13022 is a vocabulary entity defining the noun *heart*, the adjective *cardiac* and the prefix *cardio* in all languages where the $\mathbf{T}_{logy}$is generated, currently 5 languages: Latin, English, French, Spanish and Russian.

→TAH3614

LA: *cor*	
EN: *heart*	
FR: *coeur*	This term is made of a noun without expansion.
ES: *corazón*	
RU:	

9.6.2 Noun with adjectives formula

Let represent the LA:*confluens venosus subinguinalis*, a pair entity, which term is made of a single noun plus two adjectives (the second being prefixed) in all languages.

The formula is: N(12409),A(12987),P(11745),A(13958).

There a 4 vocabulary entities call by this formula: in that order a noun, an adjective, a prefix and an adjective.

→TAH15583

LA: *confluens venosus subinguinalis*	This term is made of a noun plus two adjectives. One can observe the similar order of words in Latin, French and Spanish, and the inverted order in English.
EN: *subinguinal venous confluence*	
FR: *confluence veineuse sousinguinale*	
ES:	
RU:	

9.6.3 Noun plus mandatory expansion formula

Let represent the LA:*vena acqueductus cochleae*, a pair entity, which term is made of a single noun plus a mandatory expansion on an entity made of a noun plus an adjective. The entity pointed in the mandatory expansion is explained in the next example below.

The formula is: N(12987),&M(585).

There is 1 vocabulary entity call by this formula for a noun. The mandatory expansion specifies the entity 585 which resolves in a noun plus adjective term in English, French and Spanish, but in a noun plus noun complement in Latin.

One can observe the genitive singular function used for this term. In Latin, only the noun acqueductus is transformed to genitive singular (not visible here because it is as the nominative singular!). In English, the genitive is obtained by adding the preposition of. In French, the genitive is obtained by adding the preposition de plus the definite article le before conduit, making du by contraction.

→TAH4508

LA:*vena acqueductus cochleae*
EN:*vein of cochlear canaliculus*
FR:*veine du conduit cochléaire*
ES:
RU:

This term is made of a noun plus a mandatory expansion.

9.6.4 Noun with adjective expansion formula

Let represent the LA:*acqueductus cochleae*, a pair entity, which term is made of a single noun plus an adjective expansion, refuted in Latin where it is modified to a mandatory expansion.

The formula is: N(9947),&Q(7271) transformed to N(9947),&M(7271).

There is 1 vocabulary entity call by this formula for a noun. In addition there is an adjective expansion to the entity 7271, transformed by inheritance to a mandatory expansion in Latin.

One can observe the effect of the adjective expansion in English and French: the refered entity 7271 is the reference for the vocabulary entity 13597, from where the adjective is retrieved. In Latin the expansion is modified to a mandatory expansion on 7271, which formula is N(13597) giving the expected noun and presented at genitive singular.

→TAH585

LA:*acqueductus cochleae*
EN:*cochlear canaliculus*
FR:*conduit cochléaire*
ES:
RU:

This term is made of a noun plus an adjective expansion, except Latin with a mandatory expansion.

9.7 Log of updates

22 Feb 2023 Completion of the grammar for all situations.

30 Mar 2022 Standardisation of the file as a chapter.

10 Mar 2021 Creation of the file.

9.8 Credentials

This document is part of the book "Universal Terminology" accompanying the website on Terminologia Anatomica. It expresses the vision of the authors of the $\mathbf{T}_{logy}$about the foundations of the science of ontology, supporting the here presented $\mathbf{T}_{logy}$. Despite it is as exact as possible, close to the reality of the database of the $\mathbf{T}_{logy}$and the surrounding software, approximations, errors and ambiguities are possible and should be considered as independent of their willingness and intents.

Identified comments about the content of the website and its presentation are welcome. An appropriate answer will be given when pertinent.

Authentic URL of this file: https://ifaa.unifr.ch/Public/TNAEntryPage/help/Chap09.pdf