Universal Terminology

Chapter 1: Introduction and scope

This chapter introduces the concept of terminology above an ontology. Terminology is the linguistic part of an ontology, intended to be independent of the representation of its content. It will be argued that terminology should preferably be language-independent to ensure its universality across different languages. With this in mind, the ontology is implemented completely independent of any language.
Ontology is a formal science within the domain of philosophy. Numerous publications on this science are available and provide context for any implementation. A terminology cannot be reduced to a list of terms and must, at a minimum, be consistent with the underlying ontology.
The definition of a terminology is introduced and will be revisited in Chapter 2. Many authors develop lists of terms and other classifications, often without a formal basis. However, the scientific community needs a more formal approach to this field.
This document constitutes Chapter 1 of the book Universal Terminology, which presents a comprehensive documentation on terminology.

Contents

1.1 What is a terminology?

At first glance and intuitively, the answer is: a set of terms related to a field of knowledge. This is not a bad answer and is essentially true. However, it lacks the precision to distinguish artifacts from true terminology. Anyone can write a list of terms and publish it, but that is not enough to qualify it as terminology, even if it meets our introductory definition.

From this point on, when we use the word *terminology* to talk about the implementation of anatomical terminology and its website, it will be labeled as $\mathbf{T}_{logy}$.

The first attempt at structuring $\mathbf{T}_{logy}$is to order the terms according to hierarchical criteria. Two main hierarchies are available for this task: taxonomy and partonomy. A taxonomy is easy to use (but difficult to construct) because it is based on a single relationship: the ISA link, which represents the Aristotelian principle of *genus et differentia*. A partonomy (also called a meronomy) is a complex hierarchy, prone to rough representations and numerous errors, but it is the hierarchy favored by anatomists! Other hierarchies can be considered, but they are of lesser importance.

Based on the previous comments, the simplest solution would be to take an existing taxonomy of the field and construct a partonomy from it, avoiding the pitfalls of partonomy. But does such a taxonomy exist? The answer is yes, with the taxonomy called the Fundamental Model of Anatomy (hereinafter the FMA).

[**Rosse and Mejino, 2003**]
The Fundamental Model of Anatomy is a major advancement for the ontology of human anatomy, where it is widely recognized. Coverage is close to 100 % regarding the ontology. The FMA is in the public domain. However, some entities are missing, particularly due to the recent development of the Terminologia NeuroAnatomica TNA, where new entities had to be created.

Up to this point, everything is practically language-independent, as we can think of the FMA's English names as labels or identifiers. We can actually ignore their naming conventions, despite the overall quality of the FMA in this regard. Furthermore, we have the ability to build the $\mathbf{T}_{logy}$, with the essential property of being language-independent, as we will see below. Our recipe is simple: adopt the FMA and build the $\mathbf{T}_{logy}$on top.

The basis of the $\mathbf{T}_{logy}$is the underlying ontology. The formalism we adhere to is the *Basic Formal Ontology BFO*, which is documented on the *Open Biomedical Ontologies OBO* website https://basic-formal-ontology.org.

[**Smith and al., 2007**]
OBO is a recommended standard for biomedical ontologies and widely adopted for the life sciences. It is managed by a consortium of experts in the field. Its main objective is to facilitate exchanges between different ontologies by adopting common representation rules, thus facilitating machine-readable interactivity. A website is available.

We can now ask ourselves the question again: what is $\mathbf{T}_{logy}$? This documentation and the accompanying comprehensive bibliography provide a detailed answer.

As an introduction, we can say this: since our primary goal is the communication of anatomical knowledge between speakers of multiple languages, we first create a terminology based on an abstract, language-independent representation. Then, we provide a machine translation tool capable of generating the terminology in any language, including Latin. This two-step process forms the basis of the terminology, called Universal Terminology to promote language independence.

To be concise and specific, the terminology is limited to the field of human anatomy.

Our introductory and provisional definition is as follows:

Terminology
`A terminology (definition) is a structured set of entities based on a taxonomy and partonomy of the domain, as well as an abstract, language-independent representation of the terms associated with these entities.`

This definition is not formal, but rather intuitive: it is aimed at human actors. It's a good starting point! A more precise and formal definition will be presented in *chapter 2*.

1.2 History of creation of $\mathbf{T}_{logy}$

1.2.1 Up to TA98

The history of the first publications of anatomical terminologies in the 20th century, up to Terminologia Anatomica, published in 1998, has been somewhat controversial [DiDio, 1998].

1.2.2 TA98

The events leading up to the official publication of TA98 have been summarized by Ian Whitmore, President of the FCAT and, as such, responsible for this publication [Whitmore, 1999].

1.2.3 FMA

At the very beginning of the 21st century, Professor Cornelius Rosse and his colleagues created the Fundamental Model of Anatomy [Rosse and Mejino, 2003]. They established a comprehensive taxonomy of human anatomy, with a fairly high level of detail, corresponding to the developments in medicine at that time.

1.2.4 BFO

A few years later, Professor Barry Smith advised the FMA team and published the *Basic Formal Ontology* [Smith and al., 2007]. This modern concept was applied to the FMA.

1.2.5 TNA

In 2017, the *International Federation of Associations of Anatomists IFAA* decided to revise part of Terminologia Anatomica (TA) published in 1998, under the new name Terminologia NeuroAnatomica (TNA). This important task was overseen by Professor Hans ten Donkelaar and a supporting committee [tenDonkelaar et al., 2016].

1.2.6 TAH

In June 2025, a completely revised version of TA98 will be available under the new name Terminologia Anatomica Humana, abbreviated to TAH. This new version of the terminology was overseen by Professor Hans ten Donkelaar and Professor David Kachlik. The final version, available from 2025 on the IFAA website in Fribourg, is awaiting official approval by the IFAA.

IFAA Fribourg website: https://ifaa.unifr.ch The database implementation and linguistic developments of TNA and TAH were carried out by Robert Baud, PhD, author of this book. The first official version was published at the end of 2021.

The website is hosted by the University of Fribourg, Switzerland. Thank you to Professors Pierre Sprumont and Luis Filgueira for their support of this project.

1.3 The book Universal Terminology

This section provides a brief introduction to all the chapters in this book. The subsection numbers below correspond to the chapter numbers. Chapters without titles are temporarily disabled.

1.3.1 Chapter 1: Introduction and Scope

Direct access to *chapter 1*.

This chapter provides a general overview of anatomical terminology: the main subject of the book. It defines the $\mathbf{T}_{logy}$, built on an ontology, itself formally defined.

Each chapter is briefly introduced with a direct link to access it.

This is also where all the conventions used in the book are presented and explained.

Another section deals with the size of the $\mathbf{T}_{logy}$. It shows how we have already reached a total of over 200,000 terms (50,000 terms in four languages) and explains that automatic generation tools are necessary for a secure implementation of the $\mathbf{T}_{logy}$.

1.3.2 Chapter 2: Fundamental Objects

Direct access to *chapitre 2*.

An entity is the central subject of the $\mathbf{T}_{logy}$: it is represented by an Def:**anatomical term** accompanied by all its variants, synonyms, and related terms.

This chapter considers all the fundamental objects included in the concept of universal terminology and provides precise, even formal, definitions of these objects.

1.3.3 Chapter 3: Identifiers

Direct access to *chapter 3*.

Identifiers are at the heart of $\mathbf{T}_{logy}$: over time, they become the permanent elements of entities and other atoms that make up the terminology.

This chapter presents the main characteristics of identifiers, as well as some comments on their implementation.

1.3.4 Chapter 4:

This chapter is temporarily disabled.

1.3.5 Chapter 5: Units

Direct access to *chapter 5*.

The different types of units are described in detail with examples.

Both physical and non-physical units are reviewed.

1.3.6 Chapitre 6 : Vocabulary

Accès direct au *chapter 6*.

This chapter analyzes the different aspects of vocabulary and demonstrates the vocabulary needed for each language in which terminology is expressed.

1.3.7 Chapter 7: Hierarchical Lists

Direct access to *chapter 7*.

These lists have their own unique characteristics: a dimension, a collection of entities, and a hierarchical structure. All these characteristics are language-independent, making them unique for all languages.

To preserve the lists' unique characteristics during terminology maintenance or update tasks, a **list signature** has been created. This is a blind integer calculated by a dedicated, permanent algorithm. The signature depends on the content of the list, but not the language.

The terminology database has several active hierarchies: the taxonomy, the partonomy, the TA98 hierarchy, and the partonomic list hierarchy. These hierarchies share the same database content but are independent of each other.

1.3.8 Chapter 8: Anatomy of a Term

Direct access to *chapter 8*.

This chapter examines the nature of anatomical terms, their structural similarities and differences.

1.3.9 Chapter 9: Grammar of Terms

Direct access to *chapter 9*.

This chapter defines a formal grammar for an anatomical term. The resulting rules constrain any regular term to a predefined, parsable, and translatable form. This is the basis of multilingual $\mathbf{T}_{logy}$. It is believed that this formalism does not limit the expressiveness of terminology authors and that $\mathbf{T}_{logy}$gains in consistency and presents fewer ambiguities than traditional approaches.

1.3.10 Chapter 10: Universal Terminology

Direct access to *chapter 10*.

This chapter presents the foundations of universal $\mathbf{T}_{logy}$. It also describes the process of automatically translating the universal formula into an anatomical term in any language.

1.3.11 Chapter 11: Irregular Terms

Direct access to *chapter 11*.

This chapter deals with irregular terms, as they exist and are the source of many problems. It shows, through examples and comments, why they are problematic and how to find an acceptable solution.

1.3.12 Chapter 12: Taxonomy

This chapter is temporarily disabled.

1.3.13 Chapter 13: Partonomy

Direct access to *chapter 13*.

The partonomic hierarchy is the hierarchy preferred by most anatomists because it mimics what is called an anatomy atlas, with its annotated drawings corresponding to a partonomic list.

Partonomy is a complex hierarchy, less natural or as simple as the single-relation taxonomy. Rather, the partof relationship is subdivided into numerous sub-links, which must be formally defined and enforced. This chapter lists all of these links.

1.3.14 Chapter 14: Definitions

Direct access to *chapter 14*.

A fundamental task of $\mathbf{T}_{logy}$is to define its atoms, here anatomical entities, but very few existing terminologies do so, considering that general knowledge of anatomy is sufficient. Indeed, the lack of definition of entities is a source of ambiguities and errors.

Experience shows that when there is confusion about the subdivisions of a given entity, we are generally faced with a problem of identifying what we are talking about. Different interpretations exist between different authors. The only solution is to precisely define each entity of interest, using an unambiguous definition. The objective of this chapter is to demonstrate the feasibility of this approach.

This chapter examines Def:**taxonomic definitions** and shows how they are applied.

1.3.15 Chapter 15:

This chapter is temporarily disabled.

1.3.16 Chapter 16: Navigation

Direct access to *chapter 16*.

This chapter describes the possible types of navigation within the terminology. Most navigation strategies are implemented on the terminology website.

1.3.17 Chapter 17: Help System

Direct access to *chapter 17*.

This chapter describes the help system underlying the implementation of the thelogy, with its different levels of detail, and explains how to best use it.

1.3.18 Chapter 18: Term Management

Direct access to *chapter 16*.

1.3.19 Chapter 19:

This chapter is temporarily disabled.

1.3.20 Chapter 20:

This chapter is temporarily disabled.

1.3.21 Chapter 21:

This chapter is temporarily disabled.

1.3.22 Chapter 22:

This chapter is temporarily disabled.

1.3.23 Chapter 23: Monolingual Implementation

Direct access to *chapter 23*.

1.3.24 Chapter 24:

This chapter is temporarily disabled.

1.3.25 Chapter 25: Properties

Direct access to *chapter 25*.

1.3.26 Chapter 50: Bibliography

Direct access to *chapter 50*.

Complete bibliography of all relevant publications related to this book. Most publications are cited elsewhere in the book's chapters.

Where possible, scientific articles mentioned in the bibliography are accompanied by a hyperlink to a PDF copy available elsewhere. This allows direct access for the casual user.

1.4 Conventions

This book uses several presentation conventions.

1.4.1 Chapters

The book is organized into chapters, each covering a well-defined topic within $\mathbf{T}_{logy}$. All chapters are briefly introduced in Chapter 1. The Universal Terminology is documented by all the chapters, the website and its content, the software corpus, the generator programs, the Tex documentation system, and the database.

Each chapter is defined as an independent document with its own files. Each chapter, as well as the help files used on the website, is created as a Tex document (.tex file) fully described elsewhere. Each chapter can be generated as a PDF and is thus made viewable.

A general format is applied to all chapters. It includes several elements, which are examined now:

- **Summary Box**
  The first visible element of any chapter is a box displaying a summary of the contents in the form of several paragraphs. The last paragraph positions the chapter in the Universal Terminology book. The summary box must fit on the first page.

- **Table of Contents**
  The table of contents, under the heading *Contents*, is automatically generated by the documentation system. It consists of a list of sections, each of which can have several subsections. The table of contents begins immediately after the summary box, on the first page if space permits. It can span multiple pages. Each entry in the table of contents is a hyperlink to its position in the document.

- **Page Header**
  A header is present at the top of every page, except the first.

- **Footer**
  A footer is present at the bottom of each page. It simply consists of the chapter's page number, centered. The page number is reset to 1 for each new chapter.

- **Update Log**
  This section presents all successive updates to this chapter, with the most recent at the top.

- **Reference Information**
  This paragraph places this document in the context of the Universal Terminology. An invitation to comment on the content is provided. A link to the official source file for this chapter, containing the latest available updates, is provided, allowing users to verify the latest valid version.

1.4.2 Predefined Commands

The Tex documentation system allows you to define preprogrammed actions capable of performing specific actions in the corpus of any text. Based on this, a number of features have been developed, usable throughout the $\mathbf{T}_{logy}$documentation.

These predefined commands are formally described below. The list is limited to specific elements created for the $\mathbf{T}_{logy}$, excluding the many elements of Tex environments, documented elsewhere with this system; see Chapter 24.

tlogy
`The tlogy (definition) command displays a dedicated logo representing common terminology.`

It is recommended to call this command as often as necessary to facilitate updating the logo. The current result is $\mathbf{T}_{logy}$.

A parallel command $\mathbf{T}_{logy}$defines the same situation in English. The current result is $\mathbf{T}_{logy}$.

cite{Author}
`The cite (definition) command accesses any bibliography entry using the Author argument.`

See the subsection on bibliography below for more information. An example of this command is [Smith and al., 2007].

reference{Citation}{Size}{Explain}
`The reference (definition) command documents a reference specified by Citation with the text Explain and the width Size.`

The actual purpose of this command is to display brief information about a citation from the bibliography. Examples of references are provided in the first section of this document.

chap{NoChap}
`The chapFR (definition) command opens the chapter specified in its French version by the NoChap argument, with a hyperlink to its valid URL.`

The hyperlink is active when the document is within the scope of an active Internet browser. For example, *chapter 02* is accessible via the associated hyperlink.

A parallel command chap{NoChap} defines the same situation in English.

LA{LatinTerm}{UID}
`The LA (definition) command displays the first LatinTerm argument and uses the second UID argument to create a link to the corresponding unit page, which is opened when there is an active internet connection.`

This command is commonly used to illustrate the arguments in the Universal Terminology book with an example. It also exists for other languages: EN, FR, ES, or RU.

La{LatinTerm}
`The La (definition) command displays the first LatinTerm argument, without a hyperlink.`

This command also exists for other languages: EN, FR, ES, or RU.

defw{Object}
`The defw (definition) command highlights the text given as the Object argument, when this text concerns an object of the T`$_{logy}$ `defined elsewhere in the Universal Terminology book.`

However, the defw command does not provide any link to such a definition. For example, the defined element Def:**defw** is defined in this subsection.

defin{Object}{DefText}
`The defin (definition) command prepares a heading on the first line from the first Object argument. Then, in a new paragraph, it displays the DefText of the second argument, which constitutes the body of the object's definition.`

1.4.3 Bibliography

The bibliography for the complete work is documented in *chapter 50*.

The defined element cite{...} allows you to insert a citation from a document in the bibliography. This element was defined above.

Each chapter can contain an unlimited number of citations. These citations, and only these, will be displayed at the end of the chapter, in a presentation similar to that of the complete bibliography.

1.5 Size of the terminology

This section aims to provide practical information on the size of the $\mathbf{T}_{logy}$. Of course, such a body of information is constantly evolving, and quantitative information is not stable by definition. Furthermore, the notion of large and small is highly relative when considering the processing of terminology by computer programs. In this context, we will only discuss the main quantitative issues and limitations of the current implementation of the $\mathbf{T}_{logy}$, taking care to mention the date on which each measurement was made.

The size values appearing below were determined in July 2025.

1.5.1 Number of entities and units

The number of units in the $\mathbf{T}_{logy}$is 19652.

The set of possible values is between 1 and 25000. The unassigned values point to a fictitious entity with a value of 50000.

The number of entities is 48483.

The number of vocabulary-type units is 1662. The number of distinct words can be estimated at 5000 words.

1.5.2 Number of languages

The number of languages in the $\mathbf{T}_{logy}$is 4 plus 1 as of **July 2025**. The four active languages are Latin, English, French, and Spanish: these languages are normally developed in parallel, with Latin taking priority. Russian is the fifth language and has been fully implemented, but has been temporarily suspended and is ready to become an active language again.

Other languages are candidates for implementation, pending a decision. Implementing a new language costs two to four man-months for programming, by someone who is not necessarily fluent in the target language, but has basic knowledge of the linguistic field. It requires three to six man-months for validation by a native speaker of the target language. These figures should probably be increased for non-Western languages.

Bibliography

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1.6 Log of updates

13 Jul 2025 Complete update of the chapter, now translated from the source French file.

22 May 2023 First appearance of the section on conventions.

30 Mar 2022 Standardization of the file as a chapter.

30 Oct 2021 Creation of the file.

1.7 Credentials

This document is part of the work *Universal Terminology*, which accompanies the Terminologia Anatomica website, sponsored by the University of Fribourg, Switzerland. It expresses the authors view of the $\mathbf{T}_{logy}$on the foundations of the science of ontology, supporting the terminology presented here. While it is as accurate as possible, close to the reality of the terminology database and the software that supports it, approximations, errors, and ambiguities are possible and should be considered beyond their control and intentions.

Any comments regarding the content of this document, the website, and its presentation are welcome. An appropriate response will be provided if necessary.

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It gives access to the last update of the present document.