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# Word Formation and Translation Strategies for Immunological Terminology

**WANG Kean[1], LENG Bingbing[2*]**

[1]MA Student of University of Shanghai for Science and Technology, Shanghai, China.

[2]Associate Professor of University of Shanghai for Science and Technology, Shanghai, China.

***Corresponding Author**
**LENG Bingbing**

Associate Professor of University of Shanghai for Science and Technology, Shanghai, China.

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**Abstract:** The main word formation of immunological terminology include compounding, derivation, abbreviation, and terminologization. Based on these word-formation principles, the translation of immunological terms should strictly follow the three requirements, i.e. *conceptual accuracy*, *standardized term* and *contextual appropriateness*. Based on the deep analysis of the context, translators should convey the accurate specialized knowledge and reproduce the translated term according to the writing convention of the target language. These translation requirements help translators to achieve the accuracy and appropriateness of terminology translation in immunological literature.

**Keywords:** Immunological Terminology; Word Formation; Translation Strategies.

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## 1. Introduction

Immunology studies the immune defense mechanisms of organisms against diseases and infections. A deep understanding and application of immunological research outcomes are crucial for accelerating vaccine and therapeutic development, thereby improving public health and human welfare. In the post-pandemic era, international collaboration necessitates the exchange of research findings across linguistic boundaries, making the accurate translation of immunological literature and terminology increasingly important. In recent years, the rapid expansion of immunology as a discipline has led to an exponential growth in new terminology. This rapid proliferation poses significant challenges for terminology translation, particularly in the context of increasingly interdisciplinary research. Immunological terminology not only encompasses foundational medical knowledge but also frequently intersects with molecular biology, bioinformatics, nanotechnology, and other fields. As a result, the development of systematic translation strategies is essential not only for facilitating academic communication but also for advancing the discipline itself.

## 2. Word Formation Mechanisms of Immunological Terminology

As a rapidly evolving discipline, immunology generates a diverse and complex set of terms through various word-formation mechanisms. This section explores the lexical characteristics of immunological terms through four primary mechanisms: *compounding, derivation, abbreviation, and terminologization of everyday vocabulary*. These features pose challenges for translators while also providing systematic guidelines for terminology translation. In recent years, the rapid expansion of immunology as a discipline has led to an exponential growth in new terminology.

### *2.1 Compounding*

Immunological terminology contains a substantial number of compound terms, which constitute a critical component of its lexicon. These compounds are formed by combining general vocabulary or basic medical terms with immunological vocabulary. However, the overall meaning of a compound term is not merely the sum of the literal meanings of its constituent words; instead, it requires interpretation based on specialized knowledge. This semantic complexity can be illustrated through several representative examples. In “vaccine efficacy” (疫苗效力), the term “efficacy” specifically refers to the ability of a vaccine to reduce the risk of disease occurrence, rather than its general meaning of “function” or “performance.” Similarly, in “antibody titer” (抗体滴度), “titer” denotes the concentration or quantity of antibodies in the blood, not the literal meaning of “titration.” The concept of “herd immunity” (群体免疫) describes the phenomenon where disease transmission within a population is halted when a certain proportion gains immunity; in this specialized context, “herd” signifies “population” or “community,” rather than literal “livestock.”

### *2.2 Derivation*

Greek and Latin are the primary etymological foundations of medical English vocabulary (Cai, 2010:1132), with immunology following this linguistic tradition. Immunological terminology frequently employs derivation—a word-formation process that

combines roots and affixes according to established morphological rules. This process generates specialized terms whose meanings emerge from the systematic integration of affixal semantics and forms, conferring several distinctive characteristics to immunological nomenclature:

First, semantic stability: Derived terms contain a substantial number of Greek and Latin morphemes, which carry relatively fixed meanings, aligning with the requirement for univocality in scientific terminology. For example, the prefix "leuko-" originates from the Greek leukos (white), as seen in leukocyte (白细胞, white blood cell), leukemia (白血病, blood cancer), and leukopenia (白细胞减少症, low white blood cell count).

Second, lexical flexibility: Roots and affixes can be combined in diverse ways to express rich concepts, providing ample lexical resources for the rapidly evolving field of immunology. For instance, "lympho-" derives from the Greek lympha (淋巴液, lymph fluid), forming terms such as lymphocyte (淋巴细胞, lymphocyte), lymphoma (淋巴瘤, lymphoma), and lymphoid (淋巴样的, lymph-like), all related to "lymph fluid" yet conveying distinct concepts.

Additionally, the widespread application of Greek and Latin morphemes in medical fields enhances the professionalism and disciplinary specificity of derived immunological terms.

### *2.3 Abbreviation*

Abbreviations in medical English represent one of the most dynamic categories within English abbreviations(Wang, 2006: 318). Immunological English employs a vast number of abbreviated terms, extensively used in research literature, professional communication, and clinical documentation (Yu, 2001: 50).

Immunological abbreviations exhibit diverse forms. These include simple truncations such as "Ag" (抗原, Antigen); initialisms like "ELISA" (酶联免疫吸附测定, Enzyme-Linked Immunosorbent Assay); hybrid constructions exemplified by "DC cells" (树突状细胞, Dendritic cells); and alphanumeric designations such as "IL-6" (白细胞介素-6, Interleukin-6).

The word-formation mechanisms of immunological abbreviations can be categorized into four principal categories: The first mechanism, truncation, involves abbreviating part of a single word, as exemplified by Ag (antigen), Ab (antibody), and Ig (immunoglobulin)—terms that facilitate rapid documentation of fundamental immunological entities. The second mechanism employs initialisms, formed by extracting the initial letters of key words in multi-word expressions, such as AIDS (Acquired Immunodeficiency Syndrome) and HIV (Human Immunodeficiency Virus), which efficiently encode complex diagnostic concepts. These purely abbreviatory forms are complemented by a third mechanism—hybrid formations—which combine abbreviations with full terms, as evidenced in T cell (thymus-derived cell) and B cell (bone marrow-derived cell), allowing for both precision and accessibility in cellular immunology. The fourth mechanism incorporates alphanumeric codes, wherein Arabic numerals serve to distinguish cell types, molecular subtypes, or subpopulations, demonstrated by CD4/8 (Cluster of Differentiation 4/8) and IL-1/2 (Interleukin-1/2), enabling systematic classification of increasingly specialized immunological components while maintaining terminological coherence across the field.

### *2.4 Terminologization of Everyday Vocabulary*

Immunological terminology frequently repurposes everyday vocabulary by assigning specialized meanings to create technical terms. For instance: "Complement" (补体): Originally meaning "supplement," this term in immunology refers to a group of proteins closely associated with the immune system. These proteins play critical roles in immune responses, including pathogen recognition, destruction, and elimination. Similarly, "Tolerance" (耐受性) , while carrying the everyday meaning of "toleration," denotes in immunology the specific concept of "immune tolerance," describing the immune system's ability to recognize self-tissues or commensal microorganisms to avoid attacking them.

The terminologization process in immunology often employs metaphors. Examples include "sentinel cell" (岗哨细胞), where the term "sentinel" (哨兵) metaphorically describes specialized immune cells that monitor internal environmental changes and rapidly trigger immune responses. Another metaphorical terminologization is "immune escape" (免疫逃逸), where "escape" (逃脱) refers to the phenomenon where pathogens or tumor cells evade recognition and elimination by the immune system.

### *2.5 Comparative Analysis of Word-Formation Mechanisms*

While the four primary word-formation mechanisms—compounding, derivation, abbreviation, and terminologization—each play a crucial role in the development of immunological terminology, they differ significantly in their frequency of use and functional emphasis. Compounding is particularly prevalent in describing complex immunological concepts, such as "immune checkpoint" or "antigen-presenting cell," where the combination of two or more words creates a precise and descriptive term. Derivation, on the other hand, is more common in naming specific cell types or molecular components, leveraging Greek and Latin roots to ensure semantic stability and disciplinary specificity. Abbreviation is widely used in clinical and research settings for efficiency, especially in contexts where rapid communication is essential, such as "IgE"(Immunoglobulin E) or "TNF-α" (Tumor Necrosis Factor-alpha). Finally, terminologization often serves to bridge the gap between everyday language and specialized scientific discourse, making complex immunological concepts more accessible to non-specialists. Understanding these differences is crucial for translators, as it informs the choice of translation strategies based on the specific word-formation mechanism employed.

## 3. Principles for Translating Immunological Terminology

Based on the four word-formation mechanisms of immunological terminology—*compounding, derivation, abbreviation, and terminologization of everyday vocabulary*—this paper proposes three fundamental translation principles: conceptual accuracy, standardized terminology, and contextual appropriateness. These translation principles are grounded in Functional Equivalence Theory (Nida, 1964) and Terminology Theory (Cabré, 1999). Functional Equivalence Theory emphasizes that the target text should elicit a response in the target language reader that is similar to that of the source language reader—a concept that is particularly relevant in the translation of specialized

terminology. Terminology Theory, on the other hand, highlights the systematic, monosemic, and normative characteristics of terms. In the context of immunological terminology translation, these two theories complement each other: functional equivalence ensures the communicative function of terms, while terminology theory guarantees their scientific and systematic nature. These principles are elucidated through specific case studies below.

### *3.1 Conceptual Accuracy*

When no established Chinese equivalent exists for an immunological term, translators must prioritize conceptual consistency between the source and target terms. Misinterpretation of the source term's conceptual essence inevitably leads to mistranslation (Li & Xu, 2022). The principle of conceptual accuracy dictates that scientific terms should precisely reflect the conceptual content of their referents, anchoring their meanings within specific disciplinary contexts (Ding, 2003: 14). Translators must meticulously analyze and generalize the conceptual framework of terms to ensure accurate conceptual transfer (Xin, 2011: 27).

Example 1:

ST: This concept, termed 'rational vaccinology', offers a path to structurally optimize the placement of antigens targeting multiple immune cell types within a vaccine for broad anti-tumour immunity.

TT: 这一概念称为"理性疫苗学"，为广泛的抗肿瘤免疫提供了一条路径，可以在疫苗中结构优化多种免疫细胞类型的抗原的定位。

Analysis: Online dictionaries lack an authoritative definition for the underlined term, and machine translation tools like DeepL render it as "合理疫苗学". However, the term's meaning derives from its conceptual foundation. Coined by the team of Academician Chad A. Mirkin at Northwestern University, "rational vaccinology" refers to a novel approach that enhances vaccine efficacy by structurally optimizing the placement of adjuvants and antigens on nanoscale vaccines using chemical and nanotechnology. The translation "理性疫苗学" accurately conveys this conceptual core. Similar terminology is used in other biological fields, such as Rational Protein Design (蛋白质分子理性设计) (Lin, 2012: 784).

Example 2:

ST: In fact, one measure of vaccine efficacy is the opsonophagocytosis killing (OPK) assay, which involves the engulfment of *S. pneumoniae* by human neutrophils in the presence of serum from a vaccinated individual.

TT: 事实上，衡量疫苗效力的一种方法是调理吞噬杀菌（OPK）试验，该试验通过接种疫苗个体的血清，让人体中性粒细胞清除肺炎链球菌。

Analysis: The term "opsono-" originates from the Greek opsōn ("to prepare for eating"), denoting the enhancement of microbial recognition and phagocytosis, while "phago-" derives from phagein ("to eat"). Current translations, such as "嗜溶蛋白细胞杀伤" (DeepL) or "调理吞噬杀伤" (Baidu Translator), fail to capture key nuances. A comprehensive analysis reveals three core elements: opsonin (调理素, e.g., antibodies or complement proteins that enhance phagocytosis), phagocytosis (吞噬作用, engulfment by immune cells), and killing (杀菌, bacterial elimination). Among existing translations, "调理吞噬杀菌" (Zhou et al., 2018: 252) is the most precise, as it integrates all three processes, specifies the bacterial target, aligns with Chinese linguistic norms, and is widely accepted in immunological literature.

### *3.2 Standardized Terminology*

As carriers of specialized knowledge, terms demand translations that align with disciplinary norms and linguistic conventions of the target language. The principle of standardized terminology requires adherence to authoritative dictionaries and established standards to ensure effective communication and application. Key aspects include: Providing both full terms and abbreviations upon first mention. Adopting standardized translations from authoritative sources.

Example 3:

ST: cytokine

TT: 细胞因子

Analysis: "Cytokine" specifically denotes soluble proteins secreted by immune and non-immune cells to regulate cellular functions, distinct from hormones. Despite alternatives like "细胞激素" or "细胞因素", the standardized term "细胞因子" is mandated by Immunology Terminology (Science Press, 2008).

Example 4:

ST: alpha-interferon

TT: α–干扰素

Analysis: While machine translations like "甲型干扰素" or "阿尔法干扰素" exist, "α–干扰素" is the established term in academic databases (e.g., CNKI). Greek letters (α, β, γ) must be retained to denote molecular subtypes unambiguously.

Example 5:

ST: MHC class II molecules

TT: MHC II类分子

Analysis: Retaining the abbreviation "MHC" aligns with immunological conventions and facilitates international exchange. Roman numerals (II) are used to classify MHC molecules, and "类" precedes the numeral in Chinese ("II类", not "类II").

### *3.3 Contextual Appropriateness*

The terminologization of everyday vocabulary poses significant challenges, as common words acquire specialized meanings that may be overlooked by non-specialists. The principle of contextual appropriateness necessitates contextual sensitivity to identify and preserve the "terminological nature" of such terms (Leng & Wang, 2020: 128). Terminology is deeply embedded in conceptual systems, and understanding these systems is essential for accurate translation (Chu & Xu, 2023: 44).

Example 6:

ST: Phagocytes, such as macrophages and neutrophils, play a crucial role in the immune system by eating and destroying invading pathogens.

TT: 吞噬细胞，如巨噬细胞和中性粒细胞，通过吞噬和破坏入侵的病原体，在免疫系统中发挥着至关重要的作用。

Analysis: The term “eating”(吞噬) metaphorically describes the engulfment and digestion of pathogens by phagocytes, reflecting immunological conventions.

Example 7:

ST: Dendritic cells (DCs) are specialized antigen-presenting cells (APCs) that play a crucial role in initiating adaptive immune responses by presenting antigens to T cells.

TT: 树突状细胞（DC）是一种专门的抗原呈递细胞（APC），通过将抗原呈递给T细胞来启动适应性免疫反应，发挥着关键作用。

Analysis: “Presenting” (呈递) in immunology specifically refers to the process of antigen presentation to T cells, distinct from its general meaning of “showing.”

Example 8:

ST: Memory B cells are awakened upon re-exposure to their cognate antigen, leading to a rapid and robust antibody response.

TT: 记忆B细胞在再次接触其特异性抗原时被激活，从而产生快速而强大的抗体应答。

Analysis: The term “awakened” (激活) here denotes the transition of memory B cells from a quiescent to an activated state, highlighting the need for context-aware translation.

## 4. Conclusion

Amid global biotechnological advancements and pandemic normalization, international collaboration in vaccinology underscores the importance of precise immunological translation. By analyzing word-formation mechanisms—*compounding, derivation, abbreviation, and terminologization*—this paper advocates adherence to conceptual accuracy, standardized terminology, and contextual appropriateness as the cornerstone principles for translating immunological terminology. These principles not only ensure the accurate transfer of scientific knowledge but also facilitate effective communication across linguistic and cultural boundaries.

The integration of linguistic expertise and immunological knowledge is essential in enhancing translation quality. Translators must navigate the complexities of specialized terminology while maintaining fidelity to both the source and target languages. This dual expertise is particularly critical in the context of rapidly evolving fields like immunology, where new terms and concepts emerge at an unprecedented pace. As immunology continues to advance and global collaboration intensifies, the development of robust translation strategies will remain a critical component of scientific communication. By adhering to the principles outlined in this study and embracing emerging technologies, translators can contribute to the accurate and effective dissemination of immunological knowledge, ultimately supporting global health initiatives and scientific progress.

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