



The Translation of English Popular Science Articles into Arabic: A Descriptive Study on Terminology and Cultural Adaptation

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Abstract

This paper presents a descriptive study of the translation strategies employed in rendering English popular science articles into Arabic. Focusing on the dual challenges of terminology and cultural adaptation, the research analyzes a corpus of ten articles published between 2020 and 2024, drawn from the Arabic editions of Scientific American and Nature. The study adopts a qualitative and comparative methodology to identify and categorize the strategies used for translating scientific terms and adapting cultural references for an Arabic-speaking audience. The analysis reveals a sophisticated, hybrid approach to terminology, favoring transliteration for novel terms (e.g., 'CRISPR') and calque for descriptive compounds (e.g., 'dark matter'). Crucially, the study identifies a prevailing norm of foreignization coupled with amplification for cultural references, preserving the source context while ensuring comprehension. However, the research also uncovers significant operational inconsistencies in the application of these strategies, suggesting a lack of standardized editorial norms. These variations, particularly in the handling of complex neologisms and cultural metaphors, pose a tangible risk to the uniformity and accessibility of scientific knowledge transfer, thereby complicating the goal of fostering robust science literacy in the Arab world. This research contributes to the field of Descriptive Translation Studies (DTS) by providing empirical evidence on current practices in English-Arabic science popularization and underscores the critical role of translation in fostering global science literacy.

Keywords: Descriptive Translation Studies, scientific terminology, cultural adaptation, English-Arabic translation, popular science, foreignization, domestication

1. Introduction

In an increasingly globalized world, the dissemination of scientific knowledge across linguistic and cultural barriers is paramount for societal progress, public education, and informed discourse. Popular science articles, which bridge the gap between specialized academic research and the general public, play a crucial role in this process (Al-Jarf, 2025). For the Arabic-speaking world - encompassing over 400 million people across diverse regions - access to up-to-date scientific information is vital for educational development, technological advancement, and participation in global scientific conversations (Hamdi et al., 2023). Consequently, the translation of English popular science articles, originating from a dominant language in scientific publication, into Arabic is an activity of immense importance (Baker, 2018). However, this translation process is fraught with challenges. The English-Arabic language pair presents significant structural, lexical, and cultural disparities. Scientific discourse, in particular, poses unique problems related to the translation of complex terminology, neologisms, and culturally embedded concepts (Farghal & Shunnaq, 1999). How translators navigate these challenges directly impacts the accuracy, clarity, and accessibility

of the translated text, thereby influencing the public's understanding of science (Ennebati, 2026); (Asiri et al., 2024). This study employs the framework of Descriptive Translation Studies (DTS), as pioneered by scholars like Gideon Toury (1995), to investigate the observable realities of translation practice. Rather than prescribing how translation should be done, DTS aims to describe what translators actually do. By examining the product - the translated texts - we can uncover the norms, strategies, and constraints that govern the translation of popular science into Arabic. This paper seeks to answer the following research questions:

1. What are the primary strategies used to translate scientific terminology from English to Arabic in popular science articles?
2. How are culturally specific references and concepts adapted for the target Arabic readership?
3. What do these strategies reveal about the norms governing science popularization in the Arab world?

By analyzing a corpus of contemporary articles from leading international science magazines with established Arabic editions, this research provides an empirical account of current translation practices. The findings aim to contribute to a deeper understanding of the dynamics of science communication in the Arab context and offer insights for translators, editors, and educators involved in the cross-cultural transfer of knowledge.

2. Literature Review

This study is situated at the intersection of Descriptive Translation Studies, terminology studies, and intercultural communication. The following review outlines the theoretical foundations and identifies the research gap this paper aims to address.

2.1. Descriptive Translation Studies (DTS)

The theoretical underpinning of this research is Descriptive Translation Studies (DTS), which shifted the focus of the discipline from prescriptive "how-to" models to empirical observation of translation as a real-world phenomenon. Gideon Toury (1995) is a central figure in this paradigm, proposing that translations are "facts of a target culture" and should be studied as such. He introduced the concept of "norms" as the socio-cultural constraints and expectations that guide a translator's choices (Thawabteh et al., 2022). These norms can be preliminary (governing translation policy), initial (a translator's choice to adhere to source or target culture norms), or operational (governing the decisions made during the act of translation). This study focuses on identifying the operational norms manifest in the translation of terminology and cultural elements.

2.2. Challenges in Scientific and Technical Translation

The translation of scientific texts presents a distinct set of challenges, primarily centered on terminology. As science evolves, it constantly generates new terms (neologisms), acronyms, and concepts that may lack direct equivalents in the target language. Newmark (1988) outlines several procedures for handling such terms, including transference (transliteration), calque (loan translation), and the use of descriptive or functional equivalents. The choice of strategy is critical; an over-reliance on transliteration can alienate readers unfamiliar with the source language, while a poorly crafted neologism in the target language can cause confusion (Farghal & Shunnaq, 1999). In the context of English-Arabic translation, the Arabization of scientific terms has been a subject of extensive debate among language academies and institutions, with varying degrees of success and standardization (Al-Hassnawi, 2000).

2.3. Cultural Adaptation in Translation

Translation is not merely a linguistic transfer but a cultural one. Lawrence Venuti's (1995) influential dichotomy of "domestication" and "foreignization" provides a powerful lens for

analyzing cultural adaptation. Domestication involves adapting the source text to the values and conventions of the target culture, making it more familiar and accessible to the target reader (El-Farahaty and Alwazna, 2024). Foreignization preserves the foreignness of the source text, challenging the target reader and highlighting cultural differences. In the context of popular science, the balance between these two poles often reflects underlying ideological currents and the perceived relationship between the source and target cultures (Baker, 2018).

2.4. Gaps in Current Research: The Specificity of Popular Science

While there is a substantial body of literature on English-Arabic translation and on scientific translation generally, there is a relative scarcity of empirical, descriptive studies focusing specifically on the translation of popular science articles. Much of the existing work on Arabic scientific translation centers on pedagogical concerns or the institutional efforts of Arabization (Al-Hassnawi, 2000). However, popular science, unlike specialized technical or academic texts, is characterized by a higher degree of rhetorical flourish, the use of analogy and metaphor, and a greater reliance on cultural examples to make complex ideas accessible (Ben Dalla, 2020). This requires a different set of translational norms that integrate both scientific accuracy and rhetorical engagement. This research addresses this gap by systematically analyzing both terminological and cultural strategies within a defined corpus of contemporary popular science articles, using the DTS framework to uncover the norms guiding current translation practices in this specific, yet crucial, domain.

3. Methodology

This study employs a qualitative and comparative descriptive approach to analyze the translation of popular science articles from English to Arabic. The methodology is designed to systematically identify, categorize, and interpret the translation strategies used for scientific terminology and cultural elements.

3.1. Data Collection and Corpus

The corpus for this study consists of 10 English popular science articles and their official Arabic translations. The articles were selected from two prominent international publications known for their high-quality science journalism and their established Arabic editions: *Majallat Al-Oloom* (the Arabic edition of *Scientific American*, published by the Kuwait Foundation for the Advancement of Sciences) and *Nature Arabic Edition* (published by Springer Nature in partnership with the King Abdulaziz City for Science and Technology, KACST). To ensure relevance and contemporaneity, the articles were chosen from issues published between 2020 and 2024, covering a range of scientific disciplines such as astrophysics, biology, and environmental science.

The selection criteria were as follows:

- Publication in both English and official Arabic editions.
- Content that includes both specialized scientific terminology and culturally-inflected examples or analogies.
- Representation of diverse scientific disciplines to ensure breadth of terminology.

A total of five article pairs were selected from each publication, resulting in a balanced corpus of 10 pairs. While this is a relatively small corpus, the qualitative depth of the comparative analysis - focusing on the nuanced choices made by the translators at the micro-level - is prioritized over quantitative breadth, which is a common and accepted approach within Descriptive Translation Studies (Toury, 1995). The specific articles analyzed include pieces on CRISPR technology, climate change, quantum physics, neuroscience, and space exploration, ensuring representation of both established and emerging scientific terminology.

3.2. Analytical Framework

A two-pronged analytical framework was developed to address the research questions. The source texts (ST) and target texts (TT) were compared sentence by sentence to identify significant translation shifts.

3.2.1. Terminology Handling

The analysis of terminology translation was guided by a categorization of strategies adapted from Newmark (1988). Each instance of a specialized scientific term in the ST was compared with its rendition in the TT and classified according to the following strategies:

Table 1 Strategies and Example (English → Observed Arabic)

Strategy	Description	Example (English → Observed Arabic)
Lexical Equivalence	Use of a standardized, pre-existing Arabic term.	"Photosynthesis" → التمثيل الضوئي (al-tamthīl al-ḍawī)
Transliteration	Rendering the English term phonetically using Arabic script.	"Boson" → بوزون (būzūn)
Calque (Loan Translation)	A literal, morpheme-by-morpheme translation of a compound term.	"Black Hole" → الثقب الأسود (al-thuqb al-aswad)
Gloss/Paraphrasing	Providing a short definition or explanation of the term instead of a direct equivalent.	"Epigenetics" → علم التخلق، أو ما فوق الجينات (ilm al-takhalluq, aw mā fawqa al-jīnāt)
Neologism	The creation of a new term in Arabic based on morphological derivation. Observed rarely; often replaced by Gloss or Transliteration.	(Not commonly observed; no specific example provided)

3.2.2. Cultural Adaptation

The analysis of cultural adaptation was based on Venuti's (1995) framework. Instances of culturally specific references, idioms, metaphors, or examples were identified and their translations categorized as:

Table 2 **Strategies and Effect on Text**

Strategy	Description	Effect on Text
Domestication	Replacing the source culture reference with a target culture equivalent.	Increases familiarity; reduces foreignness.
Foreignization	Retaining the source culture reference, sometimes with an explanation.	Preserves source context; increases reader effort.
Omission	Deleting the cultural reference entirely.	Simplifies text; potentially loses nuance.
Explanation (Amplification)	Keeping the original reference but adding an intra-textual explanation or gloss.	Preserves context while ensuring comprehension.

3.3. Procedure and Validation

The analysis was conducted manually by the researcher (Ben Dalla, 2021). The source and target texts were aligned in a parallel-text format using a spreadsheet application. Each segment containing a term or cultural reference of interest was highlighted, coded according to the framework above, and annotated with contextual notes regarding the translation choice. To ensure reliability, a subset of the data (20%) was reviewed by a second rater familiar with both translation studies and scientific Arabic, with inter-rater reliability calculated at 0.85 (substantial agreement). The findings were then synthesized to identify patterns and prevailing norms across the corpus.

4. Analysis and Findings

The comparative analysis of the 10 article pairs yielded significant data on the translation strategies employed. The findings are presented below, organized according to the analytical framework of terminology handling and cultural adaptation.

4.1. Terminology Handling Strategies

The translation of scientific terminology was characterized by a pragmatic, multi-strategy approach rather than adherence to a single prescriptive method. The frequency and context of each strategy revealed clear patterns. *Lexical Equivalence* was the most common strategy for fundamental scientific concepts that have long been integrated into Arabic scientific discourse e.g., "cell" → خلية [khalīya], "gravity" → جاذبية [jādhabīyya]). This reflects the success of earlier Arabization efforts for core curricula and established scientific concepts. *Transliteration* was heavily favored for two categories of terms: proper names of particles, laws, or scientists (e.g., "Higgs boson" → بوزون هيغز [būzūn Hīghaz]) and modern acronyms or neologisms that have gained international currency (e.g., "DNA" → دي إن إيه [dī in āy], "laser"

→ ليزر [līzar]). This foreignizing strategy prioritizes fidelity to the international scientific lexicon, assuming a certain level of familiarity from the reader or establishing the term for future use. Notably, CRISPR was consistently transliterated as كريسبر (Krisbar) rather than translated, reflecting its recent emergence and lack of established Arabic equivalent.

Calque was frequently used for descriptive compound terms where a literal translation was both possible and semantically transparent. Terms like "dark matter" (المادة المظلمة [al-mādah al-muzlimah]) and "greenhouse effect" (تأثير البيت الزجاجي [ta'thīr al-bayt al-zujājī]) were consistently translated this way, creating intuitive and self-explanatory terms in Arabic.

Gloss Translation and Paraphrasing were often employed in conjunction with transliteration, especially for highly complex or novel concepts. For instance, a first mention of "epigenetics" might be rendered as علم التخلق، أو ما فوق الجينات ('ilm al-takhalluq, aw mā fawqa al-jīnāt—the science of epigenesis, or what is 'above' the genes). This dual approach serves to both introduce the international term and ensure immediate comprehension, reflecting a strong operational norm for clarity.

Neologism through Arabic morphological derivation (e.g., using the pattern فَعَال [fa'āl] for instruments, or مِفْعَل [mif'al] for locations) was observed rarely in this corpus. When encountered, such as attempts to Arabize "quark" as قُوَارِك (quwārak), they were often inconsistent with established dictionary entries, suggesting that translators prefer borrowing over innovation for novel terms.

4.2. Cultural Adaptation Strategies

The adaptation of cultural elements revealed a dynamic interplay between making the text accessible (domestication) and preserving its scientific and cultural origin (foreignization). *Domestication* was used sparingly and strategically. It was most apparent in the adaptation of measurements (e.g., converting miles to kilometers) and in replacing highly idiomatic or colloquial English expressions with more formal Arabic equivalents. For example, an expression like "it's not rocket science" appeared in two variants across the corpus: one instance used a domesticated rendering as الأمر ليس معقداً (al-amr laysa mu'aqqadan the matter is not complicated), while another retained the literal "rocket" reference as ليس علم الصواريخ (laysa 'ilm al-ṣawārīḫ). This inconsistency suggests individual translator preference rather than editorial standardization. *Foreignization combined with Explanation* was the most prevalent strategy for handling substantive cultural references. For example, a reference to the "Apollo missions" was not replaced but retained and briefly explained as بعثات أبولو لاستكشاف القمر (bi'thāt Abūlū li-istikshāf al-qamar the Apollo missions to explore the moon). This approach respects the reader's intelligence while providing necessary context, effectively enriching their knowledge base rather than simplifying the content.

Omission was rare and typically reserved for fleeting cultural references, humor, or wordplay that were deemed untranslatable or whose explanation would disrupt the flow of the scientific narrative. For instance, a pun based on an English homophone was omitted in the Arabic version, while the surrounding scientific content was preserved.

Amplification through footnotes or parenthetical explanations was observed in Nature Arabic Edition more frequently than in Majallat Al-Oloom, suggesting different editorial policies regarding reader support. This finding indicates that operational norms may vary not just between individual translators but between publishing institutions.

5. Discussion

The translation choices observed in the corpus reflect a delicate balancing act. The translators are mediating between the authority and specificity of the source scientific discourse and the needs of a diverse Arabic-speaking audience spanning multiple dialect regions and educational

backgrounds (Zitouni et al., 2022); (Abu-Rayyash et al., 2023); (Al-Jarf, 2026). The prevailing norms appear to favor clarity and accuracy, using a flexible toolkit of strategies to achieve that goal, thereby facilitating the effective communication of science and enhancing public scientific literacy in the Arab world.

5.1. The Norm of Hybridity and Amplification

The most significant finding is the establishment of a norm of hybridity and amplification. Translators do not adhere to a single, rigid Arabization policy. Instead, they strategically select from a range of options transliteration, calque, and lexical equivalence often coupling them with explanatory glosses. This is a sophisticated operational norm that acknowledges the reader's need for both access to the international scientific lexicon and immediate comprehension. The preference for foreignization with explanation in cultural contexts further reinforces this norm, suggesting a commitment to a cosmopolitan model of science communication that values source-culture context. This approach aligns with the mission of both KFAS and KACST to connect Arab readers with global scientific discourse while building local scientific capacity.

5.2. The Problem of Operational Inconsistency

Despite the overall sophistication, the analysis also revealed significant operational inconsistencies, even within the same publication. In one Majallat Al-Oloom article, a specific Western scientist's anecdote was retained with explanation, while in another article from the same publication, a similar anecdote was omitted entirely. Similarly, the translation of a newly coined term might be transliterated in one instance and given a lengthy, paraphrased gloss in another, without a clear editorial rationale.

These inconsistencies suggest that decisions regarding terminology and cultural adaptation may be made on a case-by-case basis by individual translators or editors, rather than being governed by a rigid institutional style guide. This represents a weak point in current practice. The lack of a unified approach can lead to a fragmented reading experience, potentially confusing the target reader and undermining the authority of the translated text. For a field as critical as science popularization, where clarity and consistency are paramount to building public trust and literacy, the development of more robust and consistent style guides is essential.

5.3. Implications for Science Communication in the Arab World

The findings of this study have several implications for science communication policy in the Arab world:

1. Standardization Needs: There is a clear need for standardized guidelines for scientific terminology translation, particularly for emerging fields like gene editing and quantum computing.
2. Training: Translator training programs should emphasize the strategic use of hybrid approaches rather than rigid adherence to either pure Arabization or wholesale transliteration.
3. Reader Engagement: The prevalence of foreignization with explanation suggests that Arab readers are expected to engage with international scientific culture, countering assumptions that they require heavy domestication.

6. Conclusion

This descriptive study set out to investigate the strategies used in the translation of English popular science articles into Arabic, focusing on terminology and cultural adaptation. The analysis of a corpus from Majallat Al-Oloom (Scientific American Arabic Edition) and Nature

Arabic Edition reveals a set of pragmatic and sophisticated operational norms that guide current translation practice in this domain.

The contribution of this research is threefold. First, it provides empirical data that fills a gap in Descriptive Translation Studies concerning contemporary English-Arabic popular science translation. It moves beyond prescriptive debates on Arabization to describe what is actually being done in high-profile publications. Second, it highlights the crucial role of translation as a vehicle for not just information transfer, but also for fostering global scientific and cultural literacy. Third, it identifies specific areas—particularly operational inconsistency—where editorial policy could be strengthened to improve the reader experience.

This study is not without limitations. The relatively small size of the corpus (10 articles) means that the findings should be seen as indicative rather than definitive. The study focused on two prestigious publications, which may not represent the practices of smaller or less well-resourced science publications in the Arab world. Future research could build upon this work by analyzing a larger, diachronic corpus to track the evolution of translation norms over time, and by including publications from diverse Arab countries to capture regional variations. Furthermore, reception studies that survey and interview target readers would provide invaluable insight into the actual impact and effectiveness of the translation strategies identified here. Such research would complete the communication loop, connecting the production of translated texts with their consumption and understanding by the public.

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