RESEARCH ARTICLE

Employing Genre Analysis and Parallel Texts as a Guide to Translating Medical Research Articles between Chinese and English

Received: 16 October 2022; Revised: 10 December 2022; Published: 21 December 2022

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Abstract:

Despite technical and scientific texts constituting a considerable proportion of translated materials worldwide, the translation of such texts, particularly academic texts in medical science, remains understudied. Some translators may be unfamiliar with specialist medical and pharmaceutical terminology or lack knowledge about translation conventions. This article examines the bi-directional translation of pharmaceutical research articles between English and Chinese, providing insights to translators experiencing these problems. We analyse the genre's features in both languages and locate similarities and differences via recourse to parallel texts. The findings and our approach can be generalised to the translation of texts of this kind, addressing certain translation problems in an evidence-based way.

Keywords: translation of pharmaceutical research articles, Chinese-English translation, scientific and medical translation, genre analysis, parallel texts, translation strategies

1. Introduction

Despite tremendous advance that translator training has made over the past few decades, students of scientific and technical translation, and practising scientific and technical translators may face challenges that are not easy to address. These include: a perceived lack of knowledge of the topic area of the text being translated; insecurity whether the text genre of the target language (TL) has the same features as that of the source language (SL) text; uncertainty whether the structure of the source text (ST) is characteristic of this genre and whether the target text (TT) should retain congruent features; what strategies are available to translators to address these problems. In this article, we demonstrate how the employment of genre analysis of SL texts and the use of parallel texts can guide translators to navigate through these challenges, especially when they have limited knowledge of specific features of the TT genre. The current work looks at Chinese and English pharmaceutical research articles (RAs) and examines translation in both directions.

The current work attempts to shed light on the following questions:

a. Through a genre-based analysis of pharmaceutical RAs, what structural features of Chinese language texts are similar to those of English language ones, and what appear to be different?

b. How can parallel texts be employed as a resource to inform translation practice?

c. What are apparent and common problems in the translation process?

d. What translation strategies can be used to address the problems?

The first question relates to the identification of features that characterise the genre of pharmaceutical RAs in the two languages. Identification of features as either similar or dissimilar in the same genre of text across both languages provides the translator with an evidence-based view of what features can be transferred without intervention and what features may warrant adaptation due to dissimilarity.

The second question is an exercise in parallel text analysis. The use of parallel texts is a common practice amongst translators. Despite being a common resource that translators draw on, there appears to be a paucity of research studies that examine the amenability of parallel texts. The relatively modest number of research papers that examine parallel texts do so from the perspectives of translation pedagogy (e.g. Bolaños Cuéllar, 2007; Kaczmarek & Matulewska, 2010), foreign language learning (Barlow, 2000), contrastive linguistics (e.g. Barlow, 2008; Pluwak, 2021), text linguistics (Goethals, 2007), linguistic computing (Tufis, 2002). Amongst the small number of research papers on parallel texts that focus on actual translation practice, these studies tend to be on retrieval of these texts rather than on their actual use (e.g. Gallego-Hernández, 2018). This paper shows how parallel texts can be used and applied to inform the translator when they locate features that are dissimilar in the two languages.

The third question follows from findings gained in relation to the first two questions. Specifically, we refer to instances in which 'translation problems' are located (Nord, 1997) which are then identified as occurring due to culturally-based dissimilarities between texts in the two languages, specific to the RA genre. Analysis also encompasses dissimilarities not primarily culturally-based.

The fourth question illustrates in a descriptive way what translation strategies can be employed to address certain problems. We describe these strategies by applying Chesterman's (2016) framework of different categories of strategies. In this way, we seek to demonstrate how specific problems can be addressed in a principled way (Pym, 2018; Hu et al., 2020).

2. Review of Background Concepts and Previous Studies

2.1 Genre analysis of research articles

In general, scientific and medical RAs aim to inform the reader. This information exchange function means that scientific and medical RAs can be classified as an informative/descriptive text type (Reiss & Vermeer, 1984, 2014; Nord, 1997). To be sure, some medical RAs may seek to expound a particular perspective or confirm or refute a topic of debate and can have features of an argumentative text type

(Werlich, 1983; Paltridge, 1994). However, most scientific and medical RAs are likely to be of an informative/descriptive text type.

Although scientific and medical RAs may traverse two text types, they constitute a single recognisable genre distinguishable from other scientific and medical ones such as case reports or review articles. Hatim and Mason (1997, p. 219) defines 'genre' as a text with a specific communicative purpose with particular linguistic characteristics. These characteristics relate to its structure, such as format and macro-structure, rhetorical features and lexical features, and grammatical and stylistic ones (Swales, 1990, 2004; Bhatia, 2002; Biber & Conrad, 2009). Within the genre of scientific and medical RAs, we identify pharmaceutical RAs as a sub-genre with a certain number of distinct features, while most other features are common to scientific and medical RAs (Li & Ge, 2009).

Looking at the structure of English language medical RAs as a whole, we see that a hallmark is the sequential structure, consisting of four sections: Introduction, Materials and Methods, Results, and Discussion, known as the 'IMRD' format. In English language journals, the IMRD format is now widely accepted as a convention of the medical RA genre. Analysis of the features of medical or academic RAs can also include features within and between these four sections (Ozturk, 2007). For example, in his analysis of 15 medical RAs in English from five leading medical journals, Nwogu (1997) focuses on text structure within the IMRD sections. Based on recognisable similarities in sequential structuring, he develops a model which consists of 11 'moves' where each move refers to "a text segment made up of linguistic features (lexical meaning, propositional meanings, and illocutionary force etc.), which give the segment a uniform orientation" (Nwogu, 1997, p. 122). Most 'moves' are obligatory, but some are optional. When examining introductions, Nwogu (1997) contends that there can be three moves: presenting background information, reviewing related research and presenting new research. The first move is not found in any of the RAs in his corpus and appears optional, but the second and third moves are found in all 15 RAs studied and are obligatory. The notions of 'optional' and 'obligatory' moves, based on statistical frequency, can guide the translator when relevant questions arise.

Amongst the features of a particular genre that differ from one language to another is sentence length. In European languages (including English), RAs have an average word count per sentence of around 21 (Brett, 1994; Kelih et al., 2006). This is a higher number than that found in texts of other genres, such as private letters, recipes, novels, or dramatic texts, with only articles in journalism having a higher word count per sentence (Kelih et al., 2006, p. 383). In terms of what is considered 'optimal cognitive load' for the length of a written sentence, Mikk (2008) reports that this is between 50 to 130 Roman-script characters, i.e., 10 to 27 words per sentence.

Studies on medical RAs regard the IMRD format as a characteristic of this genre and observe that there can be variation in the length of sections. For example, Brett (1994) claims that variation in word count is more significant in the Results section than in the Introduction and Discussion sections. Williams (2009) locates other differences in medical RAs, namely that some sections are relatively short and undivided (i.e., not clearly distinguished from other sections), while other examples of medical RAs, particularly those of multiple experimental studies, can contain more than four sections and multiple subsections as well.

We now move to pharmaceutical RAs as a sub-genre of medical RAs. Unfortunately, no studies examine the discourse features of pharmaceutical RAs as such. The only known analysis of the discourse structures of pharmaceutical texts is Grabowski (2015). His study encompasses four different genres: patient information leaflets, summaries of product characteristics, clinical trial protocols, and chapters from academic pharmacology textbooks, but not the sub-genre of pharmaceutical RAs. Hence, we are guided by the instructions given to authors in leading Chinese language and English language pharmaceutical journals and the format of RAs published in them. A perusal of both Chinese language and English language journals confirms that the IMRD structure is the requisite format published in both languages (See the 'Methodology and description of corpora' section below).

2.2 Parallel texts

Parallel texts are a useful resource for translators. They refer to texts of the same type or genre, on the same topic as the ST but written in the TL (Göpferich, 1999). They help the translator to check actual usage or terms, phrases and collocations, and overall discourse structure (Pym, 2014, p. 12). Parallel texts are identified by Wright (2011) as a critical resource for translators working with scientific and medical texts. Wright (2011, p. 4) advises those translators wishing to locate an appropriate scientific register in the TC (target culture) that they "must study TL parallel texts carefully to adopt the TT effectively." Referral to parallel texts has become a standard practice for trainees and practising translators (Pearson, 2003; Bolaños Cuéllar, 2007).

This section shows that while pharmaceutical RAs in English and Chinese share a common macro-structure, some comparative studies of Chinese and English scientific literature (including medical RAs) have found discrepancies. For instance, Taylor and Chen (1991) report that the general rhetorical style of Introduction sections in RAs in both languages is similar, but Chinese RAs tend to refrain from identifying those studies with which the authors may disagree. Hu and Cao (2011), and Yang (2013) also locate differences in the form of RA sections between English and Chinese. These differences can affect the section length and/or the proportion of individual section in articles, which may be different in RAs of both languages.

2.3 Translation problems and strategies

In relation to studies on translation practice, we focus, where possible, on technical or scientific translation, i.e., the translation performed for a specific or limited audience (Byrne, 2006). Translators working in these areas come with knowledge or training background in a specialist area. However, more often translators may not have received systematic specialist training but acquired related knowledge during their careers. Nevertheless, as we demonstrate it is not only specialist knowledge of the subject area that is advantageous; via genre analysis and referral to parallel texts, technical and scientific translators may also be able to acquire knowledge of the TT genre (Olohan, 2016).

In this paper, we apply Nord's (1997) notion of translation problems, emphasizing the two categories: *inter-cultural* ones "that arise from differences in the conventions between the two cultures involved such as […] text-type and genre conventions"; *text-specific* ones relating to specific features that cannot be generalised, such as individual names, titles, alliteration etc. (Schäffner & Wiesemann,

2001, p. 24–25). By focusing on these two categories only, we do not suggest that they are more conspicuous or important than the other two categories of *pragmatic* or *inter-lingual* problems identified by Nord (1997). Instead, our focus on *inter-cultural* and *text-specific* problems only is based on the findings from our examination of the text discourse features of the same medical RA genre in both languages and our recourse to parallel texts. In relation to *pragmatic* and *inter-lingual* problems we direct readers to the studies that examine these, including the strategies that can enable translators to address them. (Pym, 2018; Hu et al., 2020).

As mentioned, translators need to draw on translation strategies, general procedures or approaches in order to address specific problems. Lörscher (1991, p. 76) defines a *translation strategy* as "a potentially conscious procedure for the solution of a problem which an individual was faced with when translating a text segment from one language into another." We adopt Chesterman's (2016) classification of strategies encompassing three main groups: syntactic/grammatical, semantic, and pragmatic translation. We are also informed about the choice of strategies by studies on medical translation, such as that of Pilegaard (1997, p. 164), who advocates a two-fold approach: "most studies are content to state that translation problems stem from differences between language systems, it must be noted that translation problems also stem from conceptual differences."

3. Methodology and Description of the Data

This study relates to the features of pharmaceutical RAs in both languages and bi-directional translation. Our corpora consist of 12 pharmaceutical RAs from each language. Chinese language RAs were selected randomly from only those journals that are indexed by the following bibliographical catalogues: Chemical Abstracts (CA), Japan Science and Technology Agency (JST), Chinese Science Citation Database (CSCD), and Guide to Core Journals of China (GCJC). English language RAs were chosen randomly from journals that have an impact factor of 2.0 or more and are listed in the latest edition of the Science Citation Index (SCI). Table 1 contains details of the journals selected.

Table 1. Chinese and English Language Source Journals Selected for Dataset 1

Title of Chinese language journal	**No. of RAs selected**	**Title of English language journal**	**No. of RAs selected**
中国临床药理学与治疗学 Chinese Journal of Clinical Pharmacology and Therapeutics	3	*European Journal of Pharmaceutical Sciences*	3
中国生化药物杂志 Chinese Journal of Biochemical and Pharmaceuticals	3	*Toxicology*	2
中国药科大学学报 Journal of China Pharmaceutical University	3	*International Journal of Pharmaceutics*	2
中国药学杂志 Chinese Pharmaceutical Journal	3	*Journal of Pharmaceutical and Biomedical Analysis*	2
		Pharmacological Research	1
		Nature Medicine	1
		Biochemical Pharmacology	1
Total	**12**	***Total***	**12**

All journals listed in Table 1 contain instructions that submissions should follow IRMD format. Bibliographical details of the 24 RAs are selected, and their character/word length are presented in the appendix. These 24 RAs form Dataset 1 were analysed in relation to the first research question: a genre-based analysis of the structural features of RAs and whether these conform to the IMRD model. Structural features were also examined by length. Length here refers to the length of each section, i.e., the total structural features examined via the number of characters or words in each section, and it also refers to the length of sentences in all sections. The results are presented in Section 4.

The last research question involves translation problems encountered when translating Chinese RAs into English and English RAs into Chinese and the strategies that can be drawn on to address these problems. Insight into translation problems is best obtained by translating an entire text. One RA in each language was selected for translation into the other language. Pharmaceutical RA no. 12 from each language was chosen for translation, and the translations of these two RAs into the other language form Dataset 2.

4. Analysis of the RAs Format and Character/Word Length of Sections

This section provides the results of our analysis of format and length of the RAs in Dataset 1. Our purpose was to verify whether the IMRD structure was employed in both Chinese- and English language pharmaceutical RAs and to work out the average length of each section and the proportion of individual section in articles. In most cases, it was straightforward to calculate section length. In those instances where two sections were combined into one, we allocated 50% of the character/word count to one section and the remaining 50% to the other. Table 2 presents the data relating to these features.

Table 2. Structure and Character/Word Length of Sections, Character/Word Length of Sentences Within Each Section

	Features of sections	**Chinese language RAs**	**English language RAs**
Introduction	Distinct section (or combined with other sections)	12	12
	Ave. no. of characters/words	526.0 characters	639.8 words
	Ave. no. of characters/words per sentence	63.0 characters	27.1 words
	Proportion of RA in total as %	12.4%	14.5%
Materials and methods	Distinct section (or combined with others)	11 (1 combined with 'Results')	12
	Ave. no. of characters/words	1,648.2 characters	1,344.1 words
	Ave. no. of characters/words per sentence	162.5 characters	22.7 words
	Proportion of RA in total as %	38.7.5%	30.5%
Results	Distinct section (or combined with other sections)	9 (1 combined with 'Materials/Methods', 2 combined with 'Discussion')	9 (3 combined with 'Discussion')
	Ave. no. of characters/words	912.7 characters	1,555.9 words
	Ave. no. of characters/words per sentence	53.4 characters	28.9 words
	Proportion of RA in total as %	21.4%	35.3%
Discussion	Distinct section (or combined with other sections)	10 (2 combined with 'Results')	8 (3 combined with 'Results', 1 with 'Conclusion')
	Ave. no. of characters/words	1,154.9 characters	1,334.1 per section
	Ave. no. of characters/words per sentence	79.7 characters	22.7 per sentence
	Proportion of RA in total as %	27.1%	23.1%
Conclusion	Distinct section (or combined with other sections)	1	8 (1 combined with 'Discussion')
	Ave. no. of characters/words	123 characters	193.7
	Ave. no. of characters/words per sentence	61.5 characters	24.4
	Proportion of RA in total as %	0.4%	4.4%
Total	Average total number or characters / words in Ras	4,262.9 characters	4,409 words

Table 2 shows that the structure of pharmaceutical RAs in both languages conforms to the IMRD format, at least in general terms. While all introductions of both languages are separate and distinct sections. Among a small number of RAs of both languages, two of the subsequent three sections are merged, e.g., the 'Materials and Methods' is integrated with the 'Results' and is labelled 'Materials, Methods and Results'. While this may appear to be statistically unusual, it indicates that the authors may prioritise the organisation of their papers that suits their purposes of presenting results and

discussing them concurrently. They see it as better serving the informative or argumentative text type. This non-strict application of the IMRD format is also congruent to Nwogu's (1997) study, which focused on the importance of authors' discourse-rhetorical moves occurring across sectional boundaries. Among the English language RAs, eight of the 12 have a fifth section, namely the 'Conclusion', but only one Chinese language RA has this. The presence of this fifth section may not be so unusual when we recall Williams's (2004) findings that English language medical RAs often contain more than four sections.

Among the Chinese language pharmaceutical RAs, the largest single section is the 'Materials and Methods', with this section making up, on average, 38.7% of the whole RA. In contrast, among the English language pharmaceutical RAs, the 'Results' is the largest, on average, constituting 35.3% of the RA. The 'Introduction' and 'Discussion' sections in all RAs of both languages generally make up similar proportions of the RA overall. Although eight of the 12 English language RAs have a Conclusion section, and they make up 4.4% of the RA overall, with an average word length of 193.7 words.

The average word length of sentences in sections in the English language RAs range from 22.7 words in the 'Materials and Methods' and the 'Discussion' to 27.1 words in the 'Introduction' and 28.9 words in the 'Results'. It is not unexpected as Brett (1994) reported that 'Results' sections of English language RAs have the greatest (here upward) variation in the sentence word count. The average number of words per sentence for the 'Materials and Methods' and the 'Discussion' are congruent to the average sentence length of 21 words in English scientific RAs (Kelih et al., 2006), while the other sections are closer to the optimal upper limit of around 27 words per sentence according to Mikk (2008). Looking at the sentence length in the Chinese language pharmaceutical RAs, we find (excluding the one RA with a Conclusion) that they range from 53.4 characters in the 'Results' to 63.0 characters in the 'Introduction', 79.7 characters in the 'Discussion', and an average of 162.5 characters per sentence in the 'Materials and Methods'. Concerning the 'Materials and Methods' section, we hasten to add that in the Chinese language pharmaceutical RAs this section often consist of sentences with multiple clauses separated by a semi-colon or comma, not a full stop. It gives rise to a higher total of characters in this section.

To compare the sentence length of the Chinese language RAs with that of the English language ones, we resort to the expertise of Chinese-English scientific translators, e.g., ACTranslation.com (n.d.) and Proz.com (n.d.) who, when measuring text length, report a ratio of between 1.2 to 2.5 Chinese characters per each English word. With the observations of these scientific translators in mind, we find that even the lowest average number of characters per sentence (53.4 for 'Results') and a high conversion ratio of 2.5 characters per word results in 21.3 'words' per sentence. At the other end of the spectrum, a count of 162.5 characters per sentence for the 'Materials and Methods' with a low conversion ratio of 1.2 characters per word results in 135.4 'words' per sentence. It is clear that there is a greater variation in sentence length in Chinese RAs than in English ones, and the same applies across different sections. Moreover, the influence of punctuation norms (i.e., higher use of semi-colons and commas) and the high frequency of technical terms can result in Chinese sentences having a higher number of characters. Thus, sentences in Chinese pharmaceutical RAs can be (but need not be) much more extended than English language ones.

5. Translation Problems Identified and Strategies Employed

As stated, one RA from each language was translated by the first author into the other language (RA no. 12 in each language was translated–see the Appendix). In this section, we identify and discuss certain translation problems encountered. We focus on inter-cultural and text-specific problems only, but as stated in 2.3, we do not suggest that inter-lingual and pragmatic problems are absent in the STs. In 5.1 we identify inter-cultural problems that arise due to the genre-based differences between Chinese and English RAs. We focus on problems of format differences or section arrangements and those in relation to differences in sentence length. We draw on findings from previous studies on the structure of RAs in Chinese and English presented in 2.1 and on results from our main corpus presented in 4.1. Further, we briefly examine some issues specific to the medical RA texts in 5.2.

5.1 Inter-cultural problems

We commence with problems at a macro-level of the ST, namely concerning the sequence and length of sections and whether they are distinct or composite. There is no significant difference with reference to the Chinese ST: the order and designations of each section are the same as in English. With regard to the English ST, we observe that most English language RAs conform to the IMRD format, but some do not. For example, the English ST has a separate ‘Conclusion’ section. Table 3 below shows the distribution of sections, lengths of sections and number of characters/words per sentence per section in the two STs and their respective TTs.

Table 3. Sections and Character/Word Lengths of Two STs and in their TTs (Dataset 2)

	Features of sections	**Chinese ST > English TT**		**English ST > Chinese TT**	
Introduction	Distinct section	Yes	Yes	Yes	Yes
	No. of characters/words	379 characters	231 words	1,013 words	1,808 characters
	No. of characters/words per sentence	54.1 characters	25.7 words	29.8 words	48.9 characters
Materials and methods	Distinct section	Yes	Yes	Yes	Yes
	No. of characters/words	1,153 characters	692 words	472 words	832 characters
	No. of characters/words per sentence	82.4 characters	24.7 words	15.7 words	28.7 characters
Results	Distinct section	Yes	Yes	Yes	Yes
	No. of characters/words	294 characters	251 words	968 words	1,672 characters
	No. of characters/words per sentence	73.5 characters	25.1 words	34.2 words	41.8 characters
Discussion	Distinct section	Yes	Yes	Yes	Yes
	No. of characters/words	1,565 characters	866 words	687 words	1,178 characters
	No. of characters/words per sentence	64.1 characters	22.8 words	27.5 words	51.2 characters
Conclusion	Distinct section	No	No	Yes	Yes
	No. of characters/words	N/A	N/A	315 words	603 characters
	No. of characters/words per sentence	N/A	N/A	31.5 words	50.3 characters
Total	No. of characters / words	3,391 characters	2,040 words	3,455 words	6,093 characters

Table 3 shows that some TT features replicate the STs: the English ST has a Conclusion, and this section is retained in the Chinese TT. Although this section is not typical in Chinese pharmaceutical RAs, Table 2 shows that Conclusion section is not entirely uncommon in Chinese language RAs. Therefore, the decision was taken for the Chinese TT to have a Conclusion, no consideration needed whether to and how to re-position the English ST Conclusion section in the Chinese TT discussion section.

Sentence length in the TT generally follows that of the ST. However, conspicuously long sentences in the ST are usually replicated in the TT via sentences of a shorter length, based on our results in Table 2 and discussion in Section 4.1. For example, sentence lengths of 82.4 and 73.5 characters per sentence in the 'Materials and Methods' and the 'Results' of the Chinese ST are rendered via shorter equivalent sentences in the English TTs. Similarly, the sentence length of the 'Results' in the English ST is reduced in the equivalent section of the Chinese TT.

Focusing on sentence length, Table 2 shows variation between Chinese and English, particularly among sentences in the 'Materials and Methods' and 'Discussion'. Example (1) below contains 106 characters and numbers.

> **Example (1):** *选取 2011 年 4 月-2016 年 10 月间在湖北省中西医结合医院临床各科室送检至检验科的成年结核病患者 257 例，其中肺结核 129 例，淋巴结核 64 例，骨结核 23 例，结核性腹膜炎 17 例，结核性心包炎 9 例，结核性脑膜炎 7 例，结核性胸膜炎 6 例，肾结核 2 例。* (Chi.RA.no. 12) (Song et al., 2016, p. 174)
>
> **Translation:** The 257 cases of our studies were selected from the adult TB patients' samples (April 2011 to October 2016) in the clinical lab of Hubei Provincial Hospital of Integrated Traditional Chinese and Western Medicine. The sample selection contained 129 pulmonary TB, 64 lymphatic TB, 23 osseous TB, 17 TB peritonitis, 9 TB pericarditis, 7 TB meningitis, 6 TB pleuritis and 2 renal TB patients.

To address the issues identified above, we provide the translation in Example (1) that contains a *unit shift*, i.e. a single Chinese sentence consisting of 107 characters rendered in English in 64 words divided over two sentences. A *unit shift* refers to the notion of a *unit*, e.g., morpheme, word, phrase or sentence where such a unit in the SL is translated with a different kind of unit in the TL (Catford, 1965; Chesterman, 2016). Table 3 shows that, on average, even the average sentence length in English RAs is long, e.g., in the 'Results' section, the average length is 28.9 words.

Example (2) is taken from the 'Results' section of an English RA and contains 58 words, numbers and measures. Although Chinese RAs can contain long sentences, we found an equally long sentence in Chinese problematic. Hence, a *unit shift* is employed here, dividing the sentence into two and separating them at the point where the contrastive linking word, 'but', is used. An equivalent linking word *不过* [bù guò] [but] is employed to commence the second sentence in Chinese.

> **Example (2):** The sub-proportional exposure, in terms of AUC (0–∞), at the lowest dose level, 20 mg/kg, is possibly due to concentrations being smaller relative to the animals NA pool, but we note they are also close to the limits of quantification, and hence there were fewer detectable data points; the corresponding pharmacokinetic parameters are therefore less well defined. (Eng.RA.no. 12) (Linnik et al., 2019, p. 35)
>
> **Translation:** *以曲线下面积*（AUC, area under the concentration-time curve）（0-∞）*最低给药量*（20 mg/kg）*的次级成比例曝光而言，可能与实验动物烟酰胺*（NA, nicotinamide ）*池相关血浆浓度的降低有关。不过，本实验表明这些也与定量限制密切相关，因此较少存在可检测的数据点，且较少确定相应的药物代谢动力学参数。*

Another common and conspicuous problem in translation is how to represent abbreviations and acronyms. We did not examine this feature in our analysis of genre features and parallel texts, though abbreviations and acronyms are standard in scientific and medical RAs (Kuzmina et al., 2015), and as such, they represent a text-specific problem.

5.2 Text-specific problems

An issue that is usually specific to particular texts rather than a genre of text in a specific language culture is the use of abbreviations and acronyms. English-origin abbreviations and acronyms are conventionalised in RAs in English and other languages, including Chinese. At the same time, we cannot always assume that the English-origin abbreviation or acronym utilised in a text in another language has the function or even semantic value identical to its function or semantic value in English. This raises the question of how to deal with abbreviations and acronyms in both languages.

In Example (3), a specialist term is given in Chinese *超薄液基制片技术* [ultra-thin liquid-based filming technology], followed by the English acronym 'TCT', which stands for 'ThinPrep Cytology Test'. The constituents of the English term are lexically different from the constituents in the equivalent Chinese term, even though both terms relate to the same referent. It raises the question how well known this acronym is to an English-speaking readership of a pharmaceutical RA and, in a broader sense, how acronyms should be represented in TT. Concerning the first issue, this problem was addressed via a pragmatic strategy of *cultural filtering* whereby the complete form of the English acronym 'TCT' was used. Using the complete English form of the acronym, namely 'ThinPrep Cytology Test', a pragmatic explicitation strategy is employed involving expanding terms or concepts that may not be clearly understood if a verbatim translation of the ST terms is used.

> **Example (3):** *在临床上超薄液基制片技术*（TCT）*已广泛展开，并使阻止宫颈癌的发生成为可能。在本次研究中，旨在对超薄液基制片技术检测应用于宫颈癌前病变筛查的临床诊断价值进行探讨。* (Chi.RA.no. 1) (Luo et al., 2016, p. 143)
>
> **Translation:** ThinPrep Cytology Test (TCT) has been extensively used in clinical practice, which makes preventing cervical cancer possible. Our research aims to discuss and study the clinical diagnosis value of TCT in screening cervical precancerous lesions.

Example (3) also covers an example of a different pragmatic strategy, *implicitation*. In the second sentence of the TT, only the acronym 'TCT' is given, not its complete form. This is in line with conventions in English RAs that recommend that once an acronym has been introduced in a text, it alone should be used as the designating form. In the second sentence Chinese ST, the complete form *超薄液基制片技术* [ultra-thin liquid-based filming technology] is repeated.

Working in the opposite direction, we face the converse problem of representing English-origin acronyms and if or how they may require *explicitation* in a translated Chinese text. In Example (4), the term's complete form is given in the English ST, followed by its acronym. A subsequent reference to the term in the English ST is rendered via the acronym only. Working in a way converse to that shown in Example (3), in Example (4), we opt for the pragmatic strategy of *explicitation*, giving the Chinese conventionalised equivalent, *磷酸盐缓冲盐水*, which the English original term, *phosphate-buffered saline* together with its acronym *PBS*. This is in line with conventions applied in Chinese RAs concerning English-origin terms: they appear in their original English form following the Chinese equivalent form.

Example (4): Slides were washed with phosphate-buffered saline (PBS) and incubated with primary antibody in appropriate conditions... Slides were washed twice with PBS, then incubated for 1 h at room temperature (Eng.RA.no. 5) (Takemura et al., 2019, p. 33).

Translation: *使用磷酸盐缓冲盐水* (phosphate-buffered saline, PBS) *冲洗载物玻璃片，且将其在合适的条件下用以孵育第一抗体.…使用*PBS *二次冲洗载物玻璃片，然后在室温中进行1小时的第一抗体孵育。*

Regarding the second appearance of 'PBS' in the Chinese translation of Example (4), the English acronym is used in the Chinese TT. This is in line with conventions of Chinese language RAs, in which second and subsequent references to an English specialist term usually adopt the acronym only.

6. Conclusion

This research article addresses four research questions. The first one is related to the congruence of structural features between Chinese and English language pharmaceutical RAs. Using genre analysis and parallel text comparison, we report that the genre of pharmaceutical RAs of both languages is usually of the same text type, namely informative/descriptive, following the 'IMRD' format that consists of four sections in the following order: Introduction, Materials and Methods, Results, and Discussion. Many English language RAs differ from Chinese language ones with the presence of a fifth concluding section. Other differences are observed, such as the greater length of Materials and Methods sections in Chinese language RAs than the Results section, whereas in the English language RAs, it is the opposite. Lengthy sentences are a characteristic of RAs in both languages, with Chinese language RAs having conspicuously high average sentence length. Thus, while overall congruence may be evident, there are some differences between Chinese and English language pharmaceutical RAs that genre analysis and parallel text comparison can help to ascertain.

Addressing the third and fourth research questions relating to translation problems and strategies, we have shown that in some instances, these strategies led to conspicuous interventions such as the reduction of sentence length in the TT as found in the TL parallel texts.

In some instances, the findings do not reflect the translator's choices. For example, the English ST that features an 'extra' section, namely the Conclusion, overrides the structure used in the TL. This results in the retention of a Conclusion section in the Chinese TT even though this section is uncommon in Chinese parallel texts: the potential infelicities of merging this with the Discussion are greater than remaining a 'stand-alone' section. The inter-cultural problems are addressed through syntactic strategies such as a *unit shift*, while text-specific problems call for a pragmatic approach. The prevalence of this group of problems and strategies are congruent, in general terms, to the problems identified and translation strategies employed by Schäffner and Wiesemann (2001, p. 122–132) in their translation of a medical text from English into German.

The findings from this paper will, we hope, be instructional to trainees, practitioners and trainers alike. This paper shows how an examination of STs that includes genre analysis and parallel text analysis can inform the identification of translation problems and the choice of translation strategies. This model is amenable to the translation of RAs in other disciplines and text genres.

Declarations and Acknowledgement:

Both authors declare that no financial interests or benefits have arisen from the direct application of our research.

This work is supported by China Scholarship Council under the Overseas Visiting Grant [201807060030]; Jiangsu Provincial Department of Education under the Provincial Philosophy and Social Sciences Grant [2017SJB0045]; China Pharmaceutical University under the Teaching Reform Grant [2017XJYB36], and the Fundamental Research Grant [2632020PY17].

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Appendix

This appendix details the titles of the RAs that were randomly selected, and their length counted in Chinese characters or English words. The corpus selected here consists of 12 Chinese language and 12 English language pharmaceutical RAs (Dataset 1). The Chinese and English RAs numbered 12, with two asterisks *, were selected for translation (Dataset 2).

	Chinese language pharmaceutical RAs	**Total no. of char-acters**	**English language pharmaceutical RAs**	**Total no. of words**
1	罗丹霞 等. (2016). HPV 联合 TCT 在宫颈癌前病变筛查中的临床价值分析. *中国生化药物杂志*, *36*(10), 143–145. Luo, D. X. et al. (2016). Clinical value of HPV combined with TCT in the screening ofcervical precancerous lesions. *Chinese Journal of Biochemical and Pharmaceuticals*, *36*(10), 143–145.	2,495	de Alencar Danda, L. J. et al. (2019). Combining amorphous solid dispersions for improved kinetic solubility of 17osaconazole simultaneously released from soluble PVP/VA64 and an insoluble ammonio methacrylate copolymer. *European Journal of Pharmaceutical Sciences*, *133*(3), 79–85.	3,574
2	徐昌榕 等. (2018). 靶向临床试验全随机设计四种分析策略的比较. *中国临床药理学与治疗学*, *23*(7), 782–789. Xu, C. R. et al. (2018). Comparison of four testing strategies for all-randomized design in targeted clinical trials. *Chinese Journal of Clinical Pharmacology and Therapeutics*, *23*(7), 782–789.	4,416	Arrighi, A. et al. (2019). Development of PLGA microparticles with high immunoglobulin G-loaded levels and sustained-release properties obtained by spray-drying a water-in-oil emulsion. *International Journal of Pharmaceutics*, *566*(5), 291–298.	5,857
3	张艺丹 等. (2016). 不同剂量 rtPA 静脉溶栓治疗急伴心房颤动患者的疗效及安全性分析. *中国生化药物杂志*, *36*(11), 170–172. Zhang, Y. D. et al. (2016). Efficacy and safety of intravenous thrombolysis with different doses of rt-PA in the treatment of acute anterior circulation cerebral infarction with atrial fibrillation. *Chinese Journal of Biochemical and Pharmaceuticals*, *36*(11), 170–172.	2,726	Garrido-Moreno, V. et al. (2019). GDF-11 prevents cardiomyocyte hypertrophy by maintaining the sarcoplasmic reticulum-mitochondria communication. *Pharmacological Research*, *146*(5), 1–10.	3,985
4	李天傲 等. (2018). 多柔比星 TiO2 纳米粒克服肿瘤多药耐药的研究. *中国药学杂志*, *53*(14), 1198–1202. Li, T. A. et al. (2018). Overcoming cancer multidrug resistance by	4,469	Wu, J. Y. et al. (2019). Effect of thermal and shear stresses in the spray drying process on the stability of siRNA dry powders. *International*	3,897

	Doxorubicin-TiO2 nanoparticles. *Chinese Pharmaceutical Journal*, *53*(14), 1198–1202.		*Journal of Pharmaceutics*, *566*(5), 32–39.	
5	刘佳 等. (2018). 吗啡免疫荧光层析快速定量方法的建立. *中国药学杂志*, *53*(16), 1413–1418. Liu, J. et al. (2018). Establishment of fluorescence immunochromatographic assay for quantitative detection of Morphine. *Chinese Pharmaceutical Journal*, *53*(16), 1413–1418.	4,900	Takemura, A. et al. (2019). Inhibition of biliary network reconstruction by benzbromarone delays recovery from pre-existing liver injury. *Toxicology*, *423*(5), 32–41.	5,215
6	王依婷 等. (2018). 青钱柳三萜酸对高糖所致的胰岛细胞胰岛素抵抗的影响. *中国药科大学学报*, *49*(2), 215–221. Wang, Y. T. et al. (2018). Effect of triterpenic acid-enriched fraction from Cyclocarya paliurus on high glucose-induced pancreatic α cells insulin resistance. *Journal of China Pharmaceutical University*, *49*(2), 215–221.	4,304	Kourtis, N. et al. (2018). Oncogenic hijacking of the stress response machinery in T cell acute lymphoblastic leukemia. *Nature Medicine*, *24*(8), 1157–1166.	8,189
7	韦柳萍 等. (2018). 乳铁蛋白预防早产儿晚发型败血症有效性和安全性的系统评价. *中国临床药理学与治疗学*, *23*(6), 653–660. Wei, L. P. et al. (2018). Effect and safety of lactoferrin for prevention of late-onset sepsis in premature neonates: A systematic review. *Chinese Journal of Clinical Pharmacology and Therapeutics*, *23*(6), 653–660.	4,382	Magréault, S. et al. (2019). UPLC/MS/MS assay for the simultaneous determination of seven antibiotics in human serum – Application to pediatric studies. *Journal of Pharmaceutical and Biomedical Analysis*, *174*(3), 256–262.	2,663
8	王蕾 等. (2018). 五元杂环并嘧啶类 MTH1 抑制剂的设计合成及生物活性评价. *中国药科大学学报*, *49*(4), 407–412. Wang, L. et al. (2018). Design, synthesis, and biological evaluation of five-membered heterocyclopyrimidines as MTH1 inhibitors. *Journal of China Pharmaceutical University*, *49*(4), 407–412.	5,120	Grumann, C. et al. (2019). Validation of an LC-MS/MS method for the quantitative analysis of 1P-LSD and its tentative metabolite LSD in fortified urine and serum samples including stability tests for 1P-LSD under different storage conditions. *Journal of Pharmaceutical and Biomedical Analysis*, *174*(5), 270–276.	3,319

9 *	朱廷富, 邹朝春. (2018). 百令胶囊对小儿糖尿病肾损伤患儿疗效研究. *中国临床药理学与治疗学*, *23*(8), 912–915. Zhu, T. F., & Zou, C. C. (2018). Clinical effect of Bailing capsule in children with diabetic renal injury. *Chinese Journal of Clinical Pharmacology and Therapeutics*, *23*(8), 912–915.	2,447	Zwartsen, A. et al. (2019). Differential effects of psychoactive substances on human wildtype and polymorphic T356M dopamine transporters (DAT). *Toxicology*, *422*(4), 69–75.	3,743
10 *	寇晋萍 等. (2018). 反相梯度 HPLC 测定注射用阿奇霉素有关物质. *中国药学杂志*, *53*(15), 1301–1308. Kou, J. P. et al. (2018). Determination of related substances of azithromycin for injection by gradient RP-HPLC. *Chinese Pharmaceutical Journal*, *53*(15), 1301–1308.	5,781	Kiene, K. et al. (2019). Microdosed midazolam for the determination of cytochrome P450 3A activity: Development and clinical evaluation of a buccal film. *European Journal of Pharmaceutical Sciences*, *135*(5), 77–82.	3,137
11 *	李辉 等. (2018). 基于流通池装置的新溶出方法用于尼莫地平片的一致性评价. *中国药科大学学报*, *49*(3), 301–309. Li, H. et al. (2018). A new method based on flow-through cell apparatus to evaluate dissolution consistency of nimodipine tablets. *Journal of China Pharmaceutical University*, *49*(3), 301–309.	6,724	Eshleman, A. et al. (2018). Neurochemical pharmacology of psychoactive substituted N-benzylphenethylamines: High potency agonists at 5-HT2A receptors. *Biochemical Pharmacology*, *158*(9), 27–34.	5,878
12 **	宋能 等. (2016). 结核分枝杆菌 IgG 抗体蛋白芯片对动性与非活动性结核患者疗效的评价. *中国生化药物杂志*, *36*(12), 174–176. Song, N. et al. (2016). Evaluation of mycobacterium tuberculosis IgG antibody protein chip in patients with active and inactive tuberculosis. *Chinese Journal of Biochemical and Pharmaceuticals*, *36*(12), 174–176.	3,391	Linnik, I. et al. (2019). Pharmacokinetics of the SABRE agent 4, 6-d2-nicotinamide and nicotinamide in rats following oral and intravenous administration. *European Journal of Pharmaceutical Sciences*, *135*(5), 32–37.	3,455
	Average	4,263	**Average**	4,409