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The translation of scientific literature from German into Spanish at the turn of the 20th century

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Abstract: In the last decades English has become the undisputed *lingua franca* of scientific and technical communication. This has not always been the case and it is well documented that scientific production used to be shared among German, French and English up to the beginning of the 20th century (Baethge, 2008, p. 37). This paper looks at scientific literature written in German by means of analysing translated papers published in Spanish journals. A traditional recipient of German research, the Spanish scientific community relied on translations in order to keep up with the swift progress of the so-called Natural Sciences at the turn of the century. Thus, Spanish was the first language into which Freud's complete works were translated (Martin & Gallego, 2011, p. 309). Following prior research on science and translation (Montgomery, 2000; Olohan & Salama-Carr, 2011; Byrne, 2014), this study explores the works of translated scientists (German-Spanish) in the fields of microbiology and biochemistry in the 19th century. The aim is to ascertain which scientific articles and topics were translated and published in Spanish at the time, to analyse textual features of the genre and translation techniques applied to them. The results also offer some points for comparison with current scientific translation. This work also aims to highlight the long-standing role of translation in the dissemination of specialised knowledge.

Keywords: history of science, translated papers, German researchers

1. The 'heroic age' of German Science

This paper focuses on the results of scientific research published in German language in the last decades of the 19th century. As Magnus-Levy puts it, "The second half of the nineteenth century was the heroic age of German medicine, and of the other sciences as well" (1944, p. 331). Although they are usually associated with advances in the medical sciences, the truth is that most breakthrough discoveries at the time occurred in related fields such as microbiology, chemistry, radiology, physiology, genetics or botany, and not only by the hand of Germans but also of Swiss, Austrian or Czech scientists. To name but a few examples: Swiss biologist Johannes Friedrich Miescher isolated the nucleic acids in 1869.[1] Gregor Mendel (an Austrian friar born in 1822 in today's Czech Republic) is considered the founder of modern genetics. Theodor Schwann (1810-1882) developed the cell theory together with Matthias Schleiden. Nobel Laureate Robert Koch identified the causative agent (commonly referred to as *Koch's bacillus*) of tuberculosis in 1882. Wilhelm Conrad Röntgen produced the X-rays in 1895 (and was awarded the first Nobel Prize in Physics in 1901 for it). These advances gave rise to new scientific disciplines such as genetics and biochemistry. Eduard Buchner, together with

[1] Miescher's work was conducted 75 years prior to the identification of the molecular structure of DNA by Watson and Crick; see Dahm (2008).

his bacteriologist brother Hans, took the first steps in the latter field, with the discovery of non-cellular fermentation (Eduard Buchner was awarded the Nobel Prize in 1907 for his biochemical investigations).

In this context, the aims of this paper are to locate and to describe – in terms of textual features and translation techniques – scientific articles published in German during the 19th century and translated into Spanish, at the time or afterwards. For this purpose, I shall focus on the fields of microbiology and biochemistry, since they group the most relevant discoveries of the time. The importance of the German language for the sciences in the period in question, and its repercussions in the Spanish context will also be examined.

2. Translating science: prior research

Scientific translation has recently drawn researchers' attention, as can be seen in the special issues published by *Meta* (Vandaele & Boulanger, 2016), *The Translator* (Olohan & Salama-Carr, 2011) or *Annals of Science* (Dietz, 2016). Traditionally paired with technical translation both in publications and in university syllabi, the translation of scientific texts now gains momentum on its own from a diachronic (history of science translation) and a synchronic (science nowadays) viewpoint. As Olohan (2018) points out, contributions on the translation of science range from the first practical guides in the 1960s-1980s to historiographical works such as Montgomery's (2000); case studies (Sánchez, 2014, 2011); collected works on specialised translation or more theoretical approaches; and specific studies on popular science or the dominance of English and its consequences. For the purpose of the present work, Montgomery and Sánchez are of special relevance, as are Olohan's reflections on the history of science and of translation (2014).

Montgomery provides a historiographical account of translations of scientific works from and into the classical languages as well as Persian, Hindu, Arabic or Japanese, among others. Throughout history, the status of translators has varied greatly; often, like the early translators of the eighth and early ninth centuries (Montgomery, 2000, p. 119), they were not really craft professionals and their methods were correspondingly diverse, with an at times flexible attitude towards the rendering of texts and terms (*ibid.*). Some acknowledge a surprising degree of intervention in translated texts, as in the case of Arab translator Thabit ibn Qurra, who in a foreword to Ḥunayn's *Almagest* confesses to: "commentary, summary, expansion of the text, explanation, simplification, explication for the sake of clearer understanding, correction, allusion, improvement, and revision." (quoted in Montgomery, 2000, p. 120). As Byrne summarises, "At the time, translating lacked the standards of accuracy and quality that we expect today with the result that mistranslations or even omissions of difficult passages were common" (Byrne, 2014, p. 4). Besides the abovementioned techniques of translation, Montgomery mentions nativisation and displacement (that is, erasing or diminishing any overt signs of debt to the source culture – for example by glossing, reorganisation, substitution of indigenous names, titles or terms), as well as summarising a famous work into a handbook or breaking it up into a series of segments for inclusion in a number of new works on more specific subjects. Moreover, translated texts often underwent subsequent revisions and changes from paraphrase to literalism, or vice versa (Montgomery, 2000, pp. 280-281).

As to the specific text genre studied here – scientific articles – , it has been described by Gläser (1998, pp. 482-488) and Göpferich (1995, pp. 244-251) in terms of superstructure and textual conventions, as well as by Olohan (2016, pp. 137-172), and also by Byrne (2014, pp. 74-82) who describes scientific papers as "a hybrid of science and technology, as they usually combine theoretical information with practical, applied information." (p. 63). Byrne also

lists distinguishing features and potential problems in the translation of scientific papers (pp. 81-82); whether all of these apply to 19th-century scientific literature as well as to current research papers will also be a point of interest in the present work.

There is much research to be done in the field of scientific translation, which "is still to acquire its *lettres de noblesse* and to be given its share in anthologies of translation studies" (Salama-Carr, 2013, p. 20). Furthermore, Olohan (2014, p. 20) concludes that translation scholars would make ideal interlocutors for historians of science as both may engage in conceptualising and studying the transnational character of science. Along these lines, the present work aims to tackle the relatively unexplored area of Spanish translations of German 19th-century science and their significance in Spain from a translation perspective. The method of choice is historiographical (to locate translated articles in the fields of microbiology and biochemistry) complemented by a translation and text genre analysis of techniques of translation[2] and typical features of scientific articles, following Montgomery's and Byrne's works.

3. German science and translation: diachronic research

The role of German as a lingua franca for the sciences and research in the past centuries, albeit shared with French and English, has been highlighted by several authors: "As late as the beginning of the 20th century, medical science still used three languages to a roughly equal extent: German, English, and French." (Baethge, 2008, p. 37).

German was indeed a common language of publication in the period of our study, with prestigious journals such as Felix Hoppe-Seyler's *Medicinische-chemische Untersuchungen* (wherein Miescher's work "Über die chemische Zusammensetzung der Eiterzellen" was published), *Zeitschrift für physiologische Chemie* (which printed Buchner's "Über den Einfluss des Sauerstoffs auf Gährungen"), *Berichte der Deutschen Chemischen Gesellschaft* (see Buchner's "Über alkoholische Gärung ohne Hefezellen") or *Die Naturwissenschaften* (founded in 1913 by German physicist Arnold Berliner). The shift to the current predominance of the English language is apparent in the case of the last-named, which changed its title to *The Science of Nature* in 2015 (Thatje, 2015). Formerly however, German was so popular among scientists that there were scientific journals edited in this language even in other countries: *St. Petersburger Medicinische Wochenschrift*, *Pester Medizinisch-Chirurgische Presse* in Budapest, *Prager Medicinische Wochenschrift* in Prague, *Archiv für Japanische Chirurgie* in Kyoto, etc. (Navarro, 1997, p. 71).

The importance of German publications was such that the Spanish Nobel Laureate Santiago Ramón y Cajal, in his induction speech at the Academy of Exact, Physical and Natural Sciences pronounced on the 5th of December 1897, advised Spanish scientists to keep up to speed with these journals: "Las revistas alemanas serán consultadas a cada momento, pues por lo que toca a la Biología, es forzoso reconocer que Alemania sola produce más hechos nuevos que todas las naciones juntas" (Ramón y Cajal, 1971, p. 68).[3]

Ramón y Cajal's colleagues must indeed have read Teutonic journals, judging from the presence of German borrowings in papers written by Spanish

[2] For the sake of clarity, I will use the classifications of translation techniques proposed by Byrne (2014, pp. 118-131): literal translation, borrowing, calque, equivalence, transposition, modulation, adaptation (cultural substitution, paraphrasing, omission), expansion/contraction, generalizing/ particularizing, compensation, restructuring, iconic linkage.

[3] "German journals shall be consulted at all times, since in the field of Biology one must admit that Germany alone produces more new facts than all the other nations put together." (My translation).

scientists at the time, as explained by medical translator and lexicographer Fernando Navarro:

> Para los médicos actuales, incapaces en su mayoría de leer el idioma de Goethe, de Koch o de Freud, resulta sorprendente comprobar en las antiguas revistas médicas españolas cómo nuestros colegas de comienzos del siglo pasado utilizaban hasta 1940 germanismos del tipo de *Halbwertschicht, Difussionsgefälle* [*sic*], *Landmannshaut, Umstimmung des Stoffwechsels, Wucherungsatrophie, Melkernknot, mitgeborene* o incluso *hereditäre Neigung zur Blasen Bildung*, que no consideraban necesario aclarar ni traducir entre paréntesis porque, aseguraban, «todo el mundo los entiende sin problemas». Toda una lección, me parece, para quienes hoy abusan de las expresiones tomadas del inglés. (Navarro, 2015, pp. 253-254).[4]

Whether the use of borrowings from the German in Spanish journals was due to the rapid creation of neologisms or to the actual cross-fertilisation of the scientific production remains to be seen. Ramón y Cajal seems to think that Spanish researchers should be fluent in four languages at least: "al español le bastará traducir las cuatro siguientes, que se ha convenido en llamar lenguas sabias, y en las cuales aparecen publicados casi todos los trabajos científicos: el francés, el inglés, el italiano y el alemán." (1971, p. 70).[5] Notice the word "translate" in the previous quote, which should be understood in the broader sense of the term – namely, reading and writing papers in order to keep up with the latest publications and to publish their own research, respectively.

Despite this alleged contact between both languages, to the best of my knowledge, no intensive research has been conducted so far into the translation from German into Spanish of scientific production printed in the abovementioned period. With a terminological approach only, Navarro (1997, p. 71) does discuss the creation of new words by German-speaking scientists from Latin or Greek, where no actual influence of the German language remains. This would be the case for *allergy*, coined by Clemens von Pirquet (*Münchener Medizinische Wochenschrift*, 24th July 1906) from the Greek αλλος (other) and εργον (work). The same applies to *antibody*, *bacterium*, and *aspirin*. By contrast, some neologisms do show Germanic roots, such as *ester* (from *Essigäther* or ethyl acetate), *mandelic acid* (from *Mandel*, almond) or *vaseline*, from *Wasser* (water). Similarly, *vitamin K* takes the letter from the German *Koagulation*.

From the point of view of translation, a lexicographic perspective is provided by Gutiérrez and Quijada (2017, 2016, 2015), who study the translation and adaptation of German medical dictionaries in the 19th century. In turn, Sánchez's research (2011) explores a translated treatise by German neurologist Paul Julius Möbius, but focuses on the paratexts and reception (letters, reviews) rather than on the translation of the text itself.

There is however some recent work on the Spanish editions of Sigmund Freud, which already belong to the 20th century: in a section dedicated to the Austrian psychiatrist, Wolfson, Hanns and Hassan (2011) explore the terminological and translation issues encountered in the several editions in Spanish (the first language into which Freud's complete works were translated) and Portuguese. It should be noted that these authors do not focus on the purely

[4] "Physicians today, mostly incapable of reading in the language of Goethe, Koch and Freud, find it astounding that in old Spanish medical journals our colleagues used German borrowings until 1940, such as *Halbwertschicht, Difussionsgefälle* [*sic*.], *Landmannshaut, Umstimmung des Stoffwechsels, Wucherungsatrophie, Melkernknot, mitgeborene* or even *hereditäre Neigung zur Blasen Bildung*, which they deemed not necessary to clarify or translate in brackets since they claimed that «everybody can understand them without a problem». Quite a lesson, I believe, for those who resort in excess to English borrowings today." (My translation).

[5] "For Spanish physicians it shall suffice to translate the four so-called languages of knowledge, in which most scientific works are published: French, English, Italian and German." (My translation).

scientific linguistic features of Freud's writings, but rather the opposite: it is precisely the fact that Freud wrote with an accessible style, with a view to disseminating knowledge of psychoanalysis, that makes translating him all the more challenging. Hanns (2011, p. 318) points out that Freud is the German-language author whose translations attract most controversy, due to the fact that his work is analysed and interpreted from within a broad range of specialised fields (Philosophy, Art, Semiotics…). This applies specifically to terms such as *Trieb*, *Versagung* or *Abfuhr*, which can have different equivalents, and it is remarkable that Freud's texts have often been subject to terminologisation in the course of translation (Hanns, 2011, pp. 324-236).

In turn, Martín Arias and Gallego Borghini present an account of the different editions of Freud's works in the Spanish language, with special focus on the figure of his first translator, Luis López-Ballesteros. The author himself congratulated López-Ballesteros on his fine translations despite the fact that he was no specialist in the field: "Me admira, sobre todo, cómo no siendo usted médico ni psiquiatra de profesión ha podido alcanzar tan absoluto y preciso dominio de una materia harto intrincada y a veces oscura." (Martín Arias & Gallego Borghini, 2011, p. 313).[6]

Although the issues found around Freud's translations can be considered somewhat exceptional due to a combination of factors – the controversy of the topic itself and the peculiar literary style of the author – , they do show how fascinating and insightful diachronic research on science and translation can be. All the more reason to wonder why this field remains largely unexplored by linguists and translation researchers to date. By contrast, the studies dealing with the period in question have been carried out from the perspective of the medical sciences: Pedro Laín Entralgo and José María López Piñero have written extensively about the history of science and medicine in Spain, and more specifically about the contact with European scientists and its repercussions.[7] For the purpose of my study, Báguena's work on the dissemination of the European scientific production in Spain by means of translation is of particular interest.

4. Translated works and papers from German into Spanish

Báguena (1984b, p. 29) highlights the lack of Spanish specialised journals in microbiology in the 19th century; most papers on this topic were published in the last 25 years of the century due to the consolidation of the germ theory of infectious diseases. In her doctoral thesis supervised by López Piñero, the author conducts a bibliometric analysis of books and papers on microbiology published in Spain during the 19th century. Regarding translated books, Báguena (1984a, pp. 113-116) lists a total number of 16; of these, the following are translated from German:[8]

- Avervek, Heinrich (1881) *Sobre la vacunación y la obligación de vacunarse*. (Translation by Juan Cruz y Vázquez). Madrid: E. Teodoro.
- Eberth, Carl Joseph (1883) *Sobre el bacilo tífico y la infección intestinal*. (Translation by R. Varela de la Iglesia). Santiago: Imp. de la Rev. de Medicina.

[6] "Above all, I admire that you are not a physician or a psychiatrist by profession and yet you have achieved such an absolute and precise command of a field which is rather complex and at times obscure." (My translation).

[7] See Laín Entralgo's *History of Medicine* (1978), López Piñero's *The scientific revolution* (1989) and *The introduction of modern science in Spain* (1969).

[8] As to the remaining books, one is translated from Portuguese, one from Italian, seven from French and two from English.

- Flügge, Carl (1888) *Los microorganismos estudiados especialmente desde el punto de vista de la etiología de las enfermedades infecciosas*. (Translation by Luis Marco). Madrid: E. Teodoro.
- Griesinger, W. (1884) *Tratado de las enfermedades infecciosas*. (Translation by Mariano Salazar). Madrid.
- Koch, Robert (1884) *El cólera*. (Translation by Pascual Garín and Vicente Navarro). Valencia: P. Aguilar.[9]

Báguena points out that the low number of translated texts is due to the lack among Spanish authors of sufficient knowledge in microbiology to face the translation task (p. 31). Other causes could be the strict political regime at the time (p. 37), and the fact that the few Spanish scientists either read the books in the original language or managed with the scarce reviews printed in medical journals (p. 56). On the other hand, 7 out of the 16 translations correspond to reference books with instructions for treatment, due to the absence of practical texts authored by Spanish scientists (p. 32). Many source texts are French, while German is the second most translated original language (see note 3). It is not surprising that most books were published in the last decades of the century, following the rise of microbiology as a discipline.

As to translated papers, they are even more scarce. Báguena (1984a, pp. 181-183) lists 15 translations out of a total number of 426 published papers on microbiology. Only one of them is a translation from German:[10]

- Hufeland, Christoph Wilhelm (1827). Reflexiones sobre la vacuna. *Diario General de las Ciencias Médicas*, 4, 76-86. In the case of translated papers published in journals, the name of the translator is not included. The original paper by Hufeland has been traced to the author's own *Journal der practischen Heilkunde* (Hufeland, 1826).

In a later work (2011b), Báguena quotes two more translated papers by Robert Koch published in Spain:

- Koch, Robert. (1890). Nueva comunicación sobre el tratamiento de la tuberculosis, in *Crónica Médica*, *13*, 681-690.
- Koch Robert. (1891). Tercera comunicación sobre el tratamiento de la tuberculosis. Composición y preparación de la linfa, in *Crónica Médica*,[11] *14*, 41-46.

The translation of Koch's paper from 1891 was also printed in *Semanario farmacéutico*, with a reference to the original German publication: "Del

[9] On the translation of Koch's work, see Báguena (2011a):
Amalio Gimeno, catedrático de terapéutica de la Facultad de Medicina de Valencia dio noticia de las mismas en las sesiones del Instituto Médico Valenciano y prologó la traducción que de la obra de Koch *El cólera* realizaron sus discípulos Pascual Garín y Vicente Navarro. En ella se recogía la conferencia que su autor había dado ante el Consejo Imperial de Sanidad de Berlín y la discusión habida a propósito de sus trabajos en Egipto, India y Tolón.
[Amalio Gimeno, a professor of Therapy at the Faculty of Medicine in Valencia, announced these at the sessions of the Valencia Medical Institute and wrote the prologue to the translation of Koch's work on cholera made by his students Pascual Garín and Vicente Navarro. This was a translation of the conference Koch gave to the Imperial Department of Health in Berlin and the discussion regarding his works in Egypt, India and Toulon.] (My translation).

[10] The remaining papers are translations from the French; in two papers on trichinosis the name of the author and original language are not specified.

[11] The journal *Crónica Médica* often printed translated papers – mostly from French – , according to Báguena (2011b): "*La Crónica Médica* (1877-1894) (1907-1919) (1928-1939): (…) Incluía un gran número de artículos originales, así como artículos traducidos, que se reproducían en su totalidad desde las revistas originarias, sobre todo francesas." ["*La Crónica Médica* (1877-1894) (1907-1919) (1928-1939): (…) Included a large number of original papers, as well as papers translated in full from their original publications, specially from French journals."]. (My translation).

Deutsche med. Wochenschrift del 15 de Enero") which allows us to locate the original paper in German. The same number of *Semanario farmacéutico* includes a paper by Emil Fischer[12] translated with the title *Síntesis en el grupo de los azúcares*; however, a reference to the *Journal de pharmacie et de chimie* reveals that it is translated from the French version. The original paper appeared in *Berichte der deutschen chemischen Gesellschaft* in 1890.

The reason for this low number of published translations is, according to Báguena (1984a, p. 59), the low demand: the first Spanish scientists working on microbiology read foreign papers in French and German or the reviews published by some medical journals. For instance, the review quoting the works by Davaine, Lasegue, Kestner and Virchow on trichinosis, published in *Boletín del Instituto Médico Valenciano* (Báguena & Gener, 1984). Trichinosis was a cause for concern among researchers in the 19th century; in Spain the first related reports appear in the press in 1860 and the interest rose with the epidemic in Villar del Arzobispo in 1877 (see Báguena, 1984a, p. 378; Báguena & Gener, 1984), but elsewhere in Europe this human disease caused by a microscopic parasite was already well-known. A translation of the works by French professors Reynald and Delpech on the trichinosis outbreaks in Germany was published in the journal *Anales de la Real Academia de Medicina* by Prieto y Prieto (1879) as part of a lecture given in May 1879 at the Academy.

Besides the reviews and the inclusion of translated fragments in lectures, cross-references are common in specialised journals. Thus, in a translated work by Isidore Straus (one of Pasteur's collaborators) printed in *El siglo médico* in 1870, Straus refers to Hermann Eberhard Richter's paper on parasitic fungi published "en el volúmen CXL de *Schmidt's Jahrbücher*" (Straus, 1870, p. 451). The reference is precise enough to locate the original paper (see Richter, 1868), but this is not always the case – Straus also references works by Schurz, Klob, Roser and Huter, Letzerich, and other researchers without specifying the source. In this sense, the location of original and translated papers turns into a sort of archaeological work with varying success. For instance, Báguena (1984a, p. 392) mentions a translation of a paper by Richter that appeared in 1870, but without further reference it could not be located. Given the length and detail of Richter's paper, however, it is possible that it was only partially translated, or perhaps integrated into a larger book or lecture, as this was a common practice.

If microbiology was underdeveloped in 19th century Spain regarding the number of specialised publications, biochemistry would not start gaining attention until well into the 20th century. One of the first and principal scientists in this field was Eduard Buchner, as attested by the official web site of Nobel Media AB: "[Buchner] was awarded the Nobel Prize in 1907 for his biochemical investigations and his discovery of non-cellular fermentation". Despite the importance of Buchner's work, only one translation into Spanish can be found online and it dates to 1997: *Fermentación alcohólica sin células de levadura*, as translated by J.M. López Piñero from the original paper *Alkoholische Gärung ohne Hefezellen* (Buchner, 1897).

Regarding the profiles of the abovementioned translators, the books give their names only. All of them are physicians – unlike Freud's translator, Luis López-Ballesteros, who was a tax inspector by office and a translator by profession (Martín Arias & Gallego Borghini, 2011, p. 313). By contrast, the very first translation of a Freudian text was also anonymous (*ibid.*, p. 310), seemingly a common practice in scientific journals at the time. The translation corresponds to the first chapter of Freud's first book *Studien über Hysterie* (1895), written in collaboration with Josef Breuer, which had been published in the Berlin medical journal *Neurologisches Zentralblatt* (1 and 2, January 1893). Only a month later, the Spanish translation was printed first in *Revista de*

[12] German chemist who won the Nobel Prize in 1902 for his work on sugar and purine syntheses.

Ciencias Médicas de Barcelona (10-25 February, XIX, 3 and 4) and then in *Gaceta Médica de Granada* (15 March, XI, 232 and 233). As Martín Arias and Gallego Borghini point out, this swiftness was due to the public obsession with hysteria at the time, and all interest in Freud's work faded when the author stopped writing on this issue (*ibid*.).

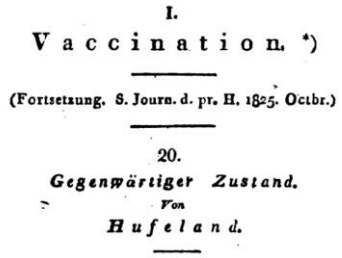
Although they were not translators by profession, some of the physicians who authored translations in the 19th century did carry out an intense activity in this field. Such is the case of Vicente Peset y Cervera, who translated the work by C.R. Fresenius (1835-1887) on chemical analysis and published numerous papers in generalist and specialised journals, with a view to disseminating the contemporary knowledge on chemistry, microbiology and discoveries such as X-rays (see Báguena, 1984a, pp. 407-408). The same applies to physician researchers on the history of medicine working in the 20th century, such as Laín Entralgo and López Piñero.

5. Analysis of translated articles

In the following, the most relevant examples of translation techniques and textual features of papers translated from German into Spanish are explained. The texts subject to analysis are Hufeland's *Reflexiones sobre la vacuna* (1827), translator unknown; Koch's *Tercera comunicación sobre el tratamiento de la tuberculosis* (1891), translator unknown; and Buchner's *Fermentación alcohólica sin células de levadura*, in translation published by López Piñero in 1997. These articles are chronologically separated, which will provide us with an opportunity to observe possible diachronic variations in the translation techniques and features of the textual genre.[13]

5.1 Superstructure, and formal features and their translation techniques

The first issue that catches the eye is the absence of typical sections in this text genre:[14] Buchner's paper has no sections whatsoever; Koch presents no sections in the original paper but the following have been added in the Spanish translation: "Preámbulo", "Cómo hice el descubrimiento", "La composición de la linfa". This particular technique of expansion does not correspond to the superstructure described by Byrne (see note 13), and has almost a narrative tone in the first two sections ("preamble", "how I made the discovery"). As to Hufeland, a technique of restructuring has been applied throughout the translated paper. In Hufeland's original paper, the title reads as follows:



I.

Vaccination. *)

(Fortsetzung. S. Journ. d. pr. H. 1825. Octbr.)

20.

Gegenwärtiger Zustand.

Von

Hufeland.

Fig. 1: Title of Hufeland (1826, p. 3)

The literal translation would be: "I. Vacunación. (Continuación. Ver *Journal der practischen Heilkunde*, 1825 octubre). 20. Estado de la cuestión, por Hufeland". In the Spanish version, the main title has been expanded into

[13] The analysis is separated into superstructure or formal features and terminological features, following Byrne's description of scientific genres and language.

[14] See Byrne (2014, p. 63): abstract, introduction, materials (and methods), procedures, results, discussion, conclusions, references.

"Reflexiones sobre la vacuna" and the rest has been omitted, which has made it quite difficult to locate the original paper. Finally, it could be traced to Hufeland's own journal by searching for specific dates, proper names and other references in the text.

The footnote that accompanies the title has also been omitted:

Fragment 1

DE (Hufeland, 1826, pp. 3)	ES (my translation)
*Ich glaube, die Zusammenstellung mehrerer, bisher über diesen Gegenstand eingegangenen, Ausätze in einem Heft, wird den Lesern angenehm, und dem Zweck entsprechend seyn.	*Soy de la opinión que la recopilación de varios artículos recibidos hasta la fecha sobre este tema en un mismo número será del agrado de los lectores y cumplirá nuestro propósito.

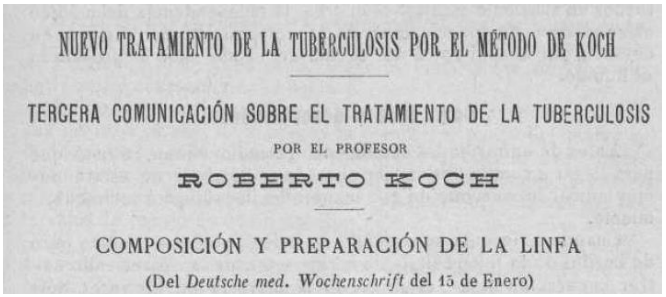
Further omissions concern the tables in pages 11 ff: the title "Thatsachen" ("Hechos", p. 80) is presented in the original text by means of data (vaccinated and newborn children per year in the German territories) organised in two tables. This information is interpreted in a written paragraph in the translation (presumably to avoid typing in the tables and numbers). It should also be mentioned that Hufeland's paper includes reports by Du Fresne (pp. 9-10), Coindet (pp. 6-7) and De Carro (13-19), which are presented with quotation marks with the references "Bibliothèque universelle April d.J" (Du Fresne), "Abhandlung in der Bibliothéque universelle August d.J., wovon folgendes das Wesentlichste ist" (Coindet), and "Ein Schreiben des Dr. J. de Carro an die Herausgeber der Bibliothéque universelle. Wien, den 50nsten Julius 1825" (De Carro).[15] It is surprising that these references are omitted in the Spanish translation (p. 77 and p. 81, respectively), as are further references in the original paper, leaving only the names of the authors. In the case of Du Fresne's report, the translation resorts to contraction of the contents without quotation marks (pp. 79-80). The same technique has been applied to the works of Stocker and Robinson and of Granville explained in pages 19-20. All of these interventions could be considered a strategy of displacement or nativisation, as described by Montgomery (2000, p. 280, see Section 2).

A final footnote has also been omitted which refers to a previous paper by Hufeland: "*Die Pockenepidemie in den Jahren 1823 und 24, nebst deren Resultaten*, Journal d. pr. H. 1824. Octbr.". As Byrne explains (2014, pp. 82-83), a scientific article contains frequent references to other publications, but all of this background information may be hard to access for the translator (especially at the time Hufeland published this paper), hence the multiple techniques of omission and contraction observed.

In contrast to Hufeland's paper, the translation of Buchner by López Piñero is quite meticulous and does not omit any footnote, table or reference, including the subtitle "Vorläufige Mittheilung. Eingegangen am 11. Januar" and the final remark on the ongoing investigations at the hygienisches Institut zu München. This can easily be explained by the fact that López Piñero's is a contemporary translation, which implies different standards of accuracy and completeness as argued in Section 2 of this paper.

In Koch's paper, it is quite interesting to see how the contents of the paper have been restructured in the translation, starting with the title: "Fortsetzung der Mittheilungen über ein Heilmittel gegen Tuberculose" which reads as follows in Spanish:

[15] In turn, De Carro's report starts with a quote from Du Fresne and references as a source "Biblioth. univ. T. XX, p. 328" (see Hufeland, 1826, p. 13).



NUEVO TRATAMIENTO DE LA TUBERCULOSIS POR EL MÉTODO DE KOCH

TERCERA COMUNICACIÓN SOBRE EL TRATAMIENTO DE LA TUBERCULOSIS

POR EL PROFESOR

ROBERTO KOCH

COMPOSICIÓN Y PREPARACIÓN DE LA LINFA

(Del *Deutsche med. Wochenschrift* del 15 de Enero)

Fig. 2: Title of the Spanish translation of Koch's paper (1891, p. 135)

An expansion that numbers Koch's communication (this is apparently the third) as well as a subtitle have been added: "Composición y preparación de la linfa", besides the further sections added in the text of the paper as explained above.

Furthermore, several omissions have been detected, starting with the self-reference to a previous work (Koch, 1890) in the first sentence. The prohibition against reproducing content without quoting the source is also ignored, while several fragments are omitted:

Fragments 2-3 (omitted)

DE (Koch, 1891, pp. 101-102)	ES (my translation)
So gewonnene Flüssigkeiten sind es gewesen, mit denen ich die weiteren Versuche an Tieren und schließlich am Menschen gemacht habe und welche zur Wiederholung der Versuche an andere Ärzte abgegeben sind.	Los líquidos así obtenidos son los que utilicé para los experimentos posteriores en animales y finalmente en humanos y los que entregué a otros médicos para la repetición de dichos experimentos.
Über die Art und Weise, wie wir uns die spezifische Wirkung des Mittels auf das tuberkulöse Gewebe vorzustellen haben, lassen sich selbstverständlich verschiedene Hypothesen aufstellen. Ich stelle mir, ohne behaupten zu wollen, daß meine Ansicht die beste Erklärung abgibt, den Vorgang folgendermaßen vor.	Sobre la forma en la que actúa específicamente el remedio en el tejido tuberculoso cabe plantearse, naturalmente, distintas hipótesis. Sin pretender que la mía sea la mejor explicación, me imagino el proceso de la siguiente manera.

Given the nature of the fragments, it is conceivable that the purpose of these techniques is to shorten the text and provide some background information for the Spanish readership, which is consistent with the added subtitle and sections. Nevertheless, from the current translation perspective it is striking that omissions should be so frequent in translated scientific texts, since in our times it is considered a rather exceptional technique to be used only occasionally.[16]

Besides this relative instability in the structure of papers, a note should be added on diachronic orthographical variations in the – often presumed universal and unchanging – scientific terminology. Both in the German and the Spanish texts, archaic spelling can be seen: *Gährung*, *concertrirten* (instead of *Gärung*, *konzentrierten*) in Buchner; *la viruela ó la vacuna* (tilde on ó*), á edificar nuevas hipóteses* (tilde on á, hipóteses instead of hipótesis), *sugetos* (instead of *sujetos*), *verisimil* (for *verosímil*); *Teuschland* (*Deutschland*) in Hufeland; *Mittheilung*, *Tuberculose* (instead of *Mitteilung, Tuberkulose*) and *obscuro*, *substancia* (for *oscuro*, *sustancia*) in Koch. This should be taken into account specially when citing or searching for works, for example in the title of Buchner's *Alkoholische Gährung ohne Hefezellen* or Koch's *Fortsetzung der Mittheilungen über ein*

[16] See Byrne (2014, p. 123):

(…) we can, in a limited number of cases, omit information. Extreme caution is required in such instances because, as we have seen in previous chapters, technical documentation is concerned first and foremost with information so the decision to omit information should only be a last resort and you must be able to justify it completely.

Heilmittel gegen Tuberculose. It should be noted that the names of German journals often display this very same feature: *Medicinische-chemische Untersuchungen, Journal der practischen Heilkunde*, etc.

It is not surprising that López Piñero's translation of Buchner does not present archaic spellings, as it was published in 1997. It does however display an unorthodox use of italics, which is shown in eponyms ("filtro de *Berkefeldt"*), at the beginning of some paragraphs as a call for attention ("Para obtener conclusiones acerca de la *naturaleza de la sustancia activa* del jugo"; "Para la *teoría de la fermentación"*), researchers' names ("*Moritz Traube"; "Felix Hoppe-Seyler"*), selected terms ("identificado como *anhídrido carbónico"*; "seis *placas de cultivo"*) or even descriptions of procedures ("*el jugo se pasó a través de filtros esterilizados de Bekerfeldt de polvo silíceo"*). Italics are also (correctly) employed in names of publications ("*Berichte"*) and in Latin or German terms ("*Monilia candida"; "Theorie der Gährung"*). This italicisation does not reflect the original text; indeed, Buchner does not employ italics at all, not even for the names of publications. Recalling that López Piñero is not a professional linguist, his use of italics would seemingly indicate an intention to highlight specific parts of the text, and conform to modern conventions in other instances.

In Hufeland's translation, italics are also present ("*Opiniones"*, p. 77; "*vice versa"*, "*Hechos"*, p. 80; "*á priori"*, p. 81; "*La viruela está aquí"*, p. 83; "*Conclusión"*, p. 84; "*variola hybrida"*, p. 85; "*variole"*, *"varicella"*, *"varioloide"*, p. 86). These fragments are not in italics in the original version; however, the German text does use italics in the names "*Fracastorius"*, *"Fernelius"*, *"Sennert"*, *"Amatus Lusitanus"*, *"Averrhoes"* and *"Heberden"* (p. 6), translated as Fracastor, Fernelio, Sennerto, Amato Lusitano, Averrhoes and Heberden without italics (p. 78). Further names in italics are *L. Hoffmann, Wedekind* (p. 7) and *Bibliothéque universelle* (pp. 5-6). In Koch's translation, only the reference to *Deutsche med. Wochenschrift* is in italics.

All in all, there is a lack of consistency in the use of italics to highlight specific words, names or phrases, which seems to be at the discretion of the author and the translator. This is a clear contradiction of contemporary standards for scientific journals, whose style guides require from authors and translators a painstaking observation of citation and spelling norms

Finally, it should be noted that in some translated papers, the foreign spelling is used in Spanish, such as *trichinas* and *trichinosis* (instead of *triquinas, triquinosis*) in Prieto y Prieto (1879), showing a lack of spelling standardisation of these terms at the time – or rather a calque as a translation technique.

5.2 Terminological features and techniques applied to them

No borrowings from the German can be found in the Spanish translations, only occasional Latin denominations (*variola hybrida* in Hufeland, *Monilia candida* in Buchner). In Hufeland's original text, some archaic or learned words have been detected: *Vaccination* (translated as *vacuna*), *Varicella* (*varicela*), *Varicellen* (*varicelas*), *Variolirten und Vaccinirten* (*sugetos que habian ya tenido la viruela ó la vacuna*), *Variola* (*viruela*), *Vaccine* (*vacuna*), *variolose Ansteckung* (*manifestación de la viruela*). In Spanish, none of these terms are learned or archaic; where there is no equivalent term for the German substantives derived from the past participle of verbs (*Variolirten*, *Vaccinirten*), the translation technique applied is description. Similarly, the adjective *variolose* is transposed into the noun *viruela*. Together with the formal denomination, the Germanic synonyms *Pocken*, *Pockenkrankheit* are also used, translated into Spanish as *viruela*. This translation technique is iconic linkage as defined by Byrne (2014, p. 130): "Minimizing variation and ensuring the same information is expressed in the same way".

Further linguistic variations can be observed in the following fragment:

Fragment 4

DE (Hufeland, 1826, pp. 7-8)	ES (Hufeland, 1827, pp. 78-79)
Allerdings kann auch durch Inoculation der Variola zuweilen Modification und Ausartung in der Form entstehen, wie wir solches ehedem bei der Pockeninoculation, jetzt durch Pockenansteckung nach der Vaccination sehen; Aber der Keim bleibt auch hier immer variolös, und die Ansteckung von einer solchen modificirten Variola bringt bei disponirten Subjekten wieder die wahre Variola hervor, und dadurch unterscheidet sie sich wesentlich von der Varicella, wo dieſs nicht der Fall ist. Daher nennen wir diese Abart nicht Varicella, sondern modificirte Variola oder Varioloide.	Seguramente puede ser tambien que la inoculacion de la viruela dé lugar algunas veces á modificaciones y degeneraciones en la forma, como se las veia en tiempos pasados en la inoculacion variolosa y se las ve ahora en la infeccion variolosa consecutiva á la vacuna. Mas el germen no queda menos siempre varioloso y la infeccion de esta viruela modificada produce la verdadera viruela en un sugeto bien dispuesto; lo que la distingue esencialmente de la varicela, en la que este caso no tiene lugar. He aquí porqué no llamamos á esta viruela varicela, sino viruela modificada ó varioloide.

In Fragment 4, many of the features mentioned in 5.1 are present: archaic spelling and tildes, spelling variation in the adjective *variolös* (translated literally as *varioloso* in this case). A slight incoherence has been detected in the translation of the phrase "der Keim bleibt auch hier immer variolös", where *immer* has been translated with a syntactic calque as *siempre*, when it should in fact have been omitted.

It is apparent that German has more terms and synonyms due to the use of Latin and of variations of the same word, a property which sometimes requires omissions in the translation:

Fragment 5

DE (Hufeland, 1826, p. 9)	ES (Hufeland, 1827, p. 79)
Du Fresne benutzte diese Gelegenheit um Versuche anzustellen, wie sich die *Variole consecutive* nach der Vaccine (das, was wir modificirte Pocken, Varioloiden nennen), zu der *Variole consecutive* nach den wahren Pocken verhalte.	Dufresne cogió esta ocasion de hacer experimentos dirigidos á descubrir cual relación existe entre la varioloide que sucede á la vacuna y la viruela consecutiva a la viruela comun.

In Fragment 5, the parentheses have been omitted since the German lists three possible terms: the Latin, the Germanic form and the learned form ("*Variole consecutive* nach der Vaccine", "modificirte Pocken" and "Varioloiden") where the Spanish only has the learned form "varioloide" and does not employ the Latin term (or italics).

Koch's paper also deals with vaccines, but this being a later text, fewer archaic words are used: *impfen, Impstelle, Impfwunde* are common Germanic terms. Occasionally, learned synonyms such as *Injektion, Injektionsstelle* are found. The Spanish translation also contains some learned words: *inocular* (instead of *vacunar*), *inoculación* (instead of *vacunación*), *punto inoculado*. Some of the German compounds have no equivalent and a description technique is applied: *Impfwunde* translates as "el punto en que se ha verificado la inoculación". Other learned medical words in German are *Bazillus/Bazillen, nekrotisch, Úlzeration,* which translate literally into Spanish: *bacilo(s), necrosada, ulceración*.

Regarding Buchner's text, the most important term in his theory is *zymase*:

Fragment 6

DE (Buchner, 1897, p. 120)	ES (Buchner, 1997, p. 35)
Für die Theorie der Gährung sind bisher etwa folgende Schlüsse zu ziehen. Zunächst ist bewiesen, dass es zur Einleitung des Gährungsvorganges keines so complicirten Apparates bedarf, wie ihn die Hefezelle vorstellt. Als Träger der Gährwirkung des Presssaftes ist vielmehr eine gelöste Substanz, zweifelsohne ein Eiweisskörper zu betrachten; derselbe soll als Zymase bezeichnet werden.	En primer término, se ha comprobado que para producir el proceso fermentativo no es necesaria una estructura tan complicada como la célula de levadura. Como vehículo de la acción fermentativa del jugo hay que pensar más bien en una sustancia soluble, sin duda un cuerpo albuminoide, que debe ser denominado *zimasa*.

Zymase was first isolated from the yeast cell by Buchner, thus proving that fermentation could occur without living cells (the discovery that earned him the Nobel Prize for Chemistry). The term was well-known by the time López Piñero translated the paper, but he chooses to write it in italics all the same. Otherwise the Spanish text presents no remarkable features, while the German text displays archaic spelling ("Gährung", "complicirten", "Eiweisskörper").

Not all terms are quite so straightforward to translate as *zymase* or *enzyme*, as shown in the following fragment with the case of *das Invertin*:

Fragment 7

DE (Buchner, 1897, p. 120)	ES (Buchner, 1997, p. 36)
Das Invertin lässt sich aus den durch trockene Hitze getödteten (eine Stunde auf 150º erhitzen) Hefezellen mittels Wasser ausziehen und durch Fällen mit Alkohol als in Wasser leicht lösliches Pulver isolieren. Auf die gleiche Weise ist der die Gährung bewirkende Stoff nicht zu erhalten. In den so hoch erhitzten Hefezellen wird er wohl Überhaupt nicht mehr vorhanden sein; er geht durch Alkoholfällung, wenn der oben angeführte Versuch einen Schluss gestattet, in eine in Wasser unlösliche Modification über. Man wird deshalb in der Annahme kaum fehlgehen, dass die Zymase zu den genuinen Eiweisskörpern gehört und dem lebenden Protoplasma der Hefezellen noch viel näher steht als das Invertin.	La invertina puede extraerse con agua de las células de levadura muertas por el calor seco (una hora a 150°) y aislarse por precipitación en alcohol en forma de un polvo muy soluble en agua. De este modo no puede obtenerse la sustancia con actividad fermentativa. En las células de levadura calentadas a tan alta temperatura no se encuentra en absoluto; del experimento antes expuesto puede deducirse que por precipitación en alcohol se convierte en otra sustancia insoluble en agua. En consecuencia, apenas cabe duda de que la zimasa pertenece a las sustancias albuminoides genuinas y que está mucho más cerca del protoplasma vivo de las células de levadura que la invertina.

Indeed, the current preferred term would be *invertasa* and not *invertina*, since the official Enzyme Nomenclature by the International Union of Biochemistry and Molecular Biology states that enzyme names should end in *-ase* (or *-a*sa, in Spanish).[17] In this case, the calque proves to be inadequate as a translation technique, since there is an equivalent term that could have been used instead.[18] Aside from the usual archaic spelling, the phrase "einen Schluss gestattet" has been omitted in the translation and the complete sentence should read as follows: "se convierte en otra sustancia insoluble en agua por precipitación en alcohol cuando el experimento antes expuesto llega a término".

[17] See the recommendations of the IUBMB at http://www.sbcs.qmul.ac.uk/iubmb/ and the corresponding entry for invertase at http://www.sbcs.qmul.ac.uk/iubmb/enzyme/EC3/2/1/26.html.

[18] Byrne (2014, p. 120) advises caution with this technique:

> The use of calquing is something to be approached with caution, as a calque is often a rather alien-sounding thing in the TL and, with the exception of the author (or in this case, the translator) and a few others, neologisms may confound most readers and ultimately prove as uninformative as retaining the original ST term.

5.3 A few remarks on stylistic features

A brief comment should be added here on the different writing styles of authors in the analysed papers. Although not the primary goal of analysis in this work, the following stylistic features could be noted during the examination of these articles.

Hufeland's and Buchner's works are quite different in their writing style: while Hufeland presents a narrative account of authors, dates and events with an appraising tone (there is even a plea "Gott Lob!", p. 19),[19] Buchner's paper reads more like a laboratory report or even a patent description. The starting remark exhibits typical patent phraseology: "Eine Trennung der Gährwirkung von den lebenden Hefezellen ist bisher nicht gelungen; im Folgenden sei ein Verfahren beschrieben, welches diese Aufgabe löst."[20] (p. 117). Following Göpferich's textographic glossary on patents (1995: 225-234), this sentence contains both a criticism of the prior art ("ist bisher nicht gelungen"), p. 228, and the solution ("Verfahren…welches diese Aufgabe lost") in the same terms quoted by Göpferich (p. 230: "Aufgabe", "lösen"), as well as "Verfahren" (one of the categories subject to patent according to the European Patent Office). [21]

Koch's paper, in turn, presents a mixed style combining the description of laboratory procedures with explanations about the development of his work and response of the scientific community: "So weit ich die bisher hierüber erschienenen Publicationen und die an mich gelangten brieflichen Mittheilungen übersehe, haben meine Angaben im grossen und ganzen volle Bestätigung gefunden." (p. 101). This is largely due to the fact that these papers or *Mitteilungen* are transcribed from the researcher's conferences to the scientific community, where Koch explained, justified and followed up his investigations in the first person.

These differences bear testimony to the evolution of scientific writing in the 19th century, moving on to a more precise and technical description of procedures as corresponds to the new (bio)chemical and technological investigations and establishing a phraseology that is still in use today, as discussed above. Indeed, these few observations call for an in-depth stylistic analysis of the texts, which for reasons of extension shall be resumed in future works.

6. Conclusions

In spite of the obvious limitations in the scope and the number of translations analysed, some recurrent translation techniques and features in the Spanish versions of German articles on microbiology and biochemistry in the 19th century could be detected and the following preliminary conclusions can be drawn.

The number of German 19th-century scientific articles translated and published in Spanish journals seems to be scarce by all accounts. Following Báguena's research in the field of microbiology, translations amount to approximately 3.9% of published papers (17 out of 426, with only the three articles analysed having been translated directly from the German). Regarding biochemistry, as a new discipline it is understandable that there are even fewer translated papers; only two could be located (Fischer, 1890, translated 1891, and Buchner, 1897, not translated until 1997). Naturally, further research is

[19] This is consistent with the narrative style I have observed in other papers such as Straus (1870) and Prieto y Prieto (1879).

[20] "A fermentation process independent from live yeast cells has not been accomplished yet; in the following, a process is described to provide a solution to this object." (My translation).

[21] According to the definition of Erfindung or invention in the Glossary by EPO, inventions can be "Erzeugnisse, Vorrichtungen oder Verfahren" (in the English version: product, process or apparatus), see https://www.epo.org/service-support/glossary_de.html .

needed as there may well be more, but at present it seems unlikely that the actual number of translated published papers would be much higher than already found. As explained in Section 4, the lack of sufficient knowledge in the field by Spanish scientists has been named as a reason for this low number of translated publications.

The primary criterion for translating a paper at the time seems to be a social and medical interest in the topic: European advances in day-to-day issues with a social impact were closely followed in Spain, as can be seen in the swift translation and publication of Koch's and Freud's papers. Infectious diseases, hysteria, vaccinations and epidemics such as trichinosis were some of the most popular topics. By contrast, some of the most relevant discoveries of the century remained unnoticed, such as Miescher's identification of nucleic acids. In this sense, many researchers have only been credited at a later point in history.

French was a popular source language and presumably more accessible for Spanish translators (who were almost exclusively researchers or physicians themselves and not translators by profession). However, the interest in German papers is also apparent. The source texts analysed here were modified and adjusted to the Spanish publications and readership; according to Báguena and Ramón y Cajal, Spanish readers were less knowledgeable about microbiology and biochemistry than German scientists, so translations must have been a welcome contribution to Spanish science – even if scientists were supposed to read the originals to some extent. Following Ramón y Cajal and my own analysis, it also seems that translation at the time was understood loosely as any kind of reading, interpretation or adaptation of the texts – which were often included in or taken from conferences, or inserted in further specialised books or papers. These observations are consistent with prior research by Montgomery in scientific translation.

Contrary to Navarro's claims, no borrowings have been detected in the analysed translations. The most frequent translation techniques identified here are adaptation by omission (13 occurrences), literal translation (5 cases), calque (4 examples) and expansion (4), followed by adaptation by description (3), contraction (2) and restructuring (2), and one instance of iconic linkage. Some of the omissions can be considered a result of a nativisation or displacement strategy after Montgomery, or of iconic linkage as described by Byrne; a few are due to language differences, as is the case with multiple variants of the same term in Latin, Germanic or learned forms that do not have an equivalent in Spanish.

Although the aim of this study was not to provide a quantitative analysis, the statistics above suggest that these translators were strongly interested in adapting the content to their Spanish readers, who as explained by Báguena were used to reviews rather than lengthy complete articles. In this context, some translation techniques can be inadequate, as is the case of lexical or syntactic calques. It should also be highlighted that omission is not a translation technique of choice nowadays, even less so for scientific and technical texts. However, translators at the time, who were presumably physicians or experts themselves and aware that readers probably would not have access to the original papers, may have felt more at ease making these decisions for the sake of clarity, readability or relevance. Piñero's contemporary translation is probably the most accurate and complete due to a higher awareness of scientific translation practice and its requirements nowadays.

As to the textual features of scientific articles in the 19th century and their translations, the lack of a consistent superstructure and of spelling and formal standardisation – even in López Piñero's contemporary translation – should be highlighted. This seems to be in line with the stylistic differences that I could discern in the analysed papers, suggesting that scientific articles were not consolidated as a genre and showed great variation. However, further research of discourse and style features applied to a wider corpus of scientific articles is

needed to confirm the findings from the few examples presented here. Another point of interest for future research is the combination of scientific and technical information in scientific papers, as has been previously described by Byrne, especially in new fields such as biochemistry.

Despite the difficulties in locating and recovering original and translated papers due to vague or missing cross-references, the interest in conducting this work is undeniable. In this sense, translation studies can complement the work of historians of science and medicine by recovering translated papers or providing new translations of signature papers. This kind of collaboration would pave the way for a further recognition of the long-standing role of translation in the dissemination of science.

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