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John Fryer's Contribution to Standardization of Translated Scientific Terminology in Modern China

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Abstract
John Fryer was a British missionary in the late Qing Dynasty who came to China and was employed by The Translation Department of Kiangnan Arsenal. He has been engaged in the translation work for over 28 years, not only having translated a great deal of Western scientific works into Chinese, but also having contributed greatly to the standardization of the scientific terminology translation. This paper first attempts to probe into Fryer's scientific translation practice and his translation ideas, and then points out that Fryer's major contributions to the standardization of the scientific terminology translation in Modern China are that the magazine *Ko-chih-hui-pien* he established had helped greatly with the popularization of modern scientific knowledge, that the book *Mirroring the Origins of Chemistry* he translated had paved the way for the term translation of modern chemical elements, and that various lists of bilingual technical terms he made, to a great degree, had standardized the translation of scientific terminology.

Key words: John Fryer; Scientific translation; Standardization of terminology translation

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INTRODUCTION
John Fryer (1839-1928) was an English missionary and a great translator in the late Qing dynasty (1840-1912). Driven by his intense interest in China, Fryer came to Hong Kong in the year of 1861 to serve as the dean of St. Paul's College. And in 1868, Fryer was employed by The Translation Department of Kiangnan Arsenal as an editor and chief translator. During the 28 years on his job, with the help of his colleague Xu Shou (1818-1884), Fryer translated a great deal of Western scientific works and illustrated his translation ideas. As a foreigner, Fryer adopted the Buddhist technique of oral instruction. Namely, sitting with his Chinese assistant, Fryer dictated to him sentence by sentence, while the Chinese assistant would transcribe what Fryer said into literary Chinese, revise the manuscript and correct errors. By this means, Fryer translated more than one hundred of Western books that made him the most productive one among the foreign translators of that time (Wang, 1998). For Fryer, translating Western scientific books into Chinese was a noble work which could help accelerate the process of people's enlightenment of science (Chen, 2000, p.83).

In addition to his achievements in translation, Fryer also paid much attention to the dissemination of Western science and the standardization of translated scientific terms in Modern China. He set up the first scientific magazine *Ko-chih-hui-pien* (1875), and donated for the establishment of Shanghai Deaf-mutes School. Another contribution made by Fryer was that he translated a series of chemistry books which filled the blanks of chemistry in Modern China.

An American scholar Dagenais (2010) published *The John Fryer Papers*, which collected a great deal of travel notes, letters and essays written by Fryer, providing a lot of valuable information for the latter studies. In *John Fryer: The Introduction of Western Science and Technology into Nineteenth-Century China,* another

American scholar Bennett (1967) gave a brief review of Fryer's achievements and sorted out his translation works. In China, Liang (1896) listed most of the books translated by Fryer and gave short comments. In the 1980s, the studies concerning John Fryer sprang up in China, covering mainly four parts: Fryer and translation studies in Modern China; Fryer and Western Learning; Fryer and educational career in Modern China; Fryer and newspaper industry in Modern China (Gao, 2011, p.108). As for Fryer and translation studies in Modern China, Yuan (1984) studied Fryer's views on translation, highly commenting Fryer's contribution to the development of modern science in China. Chen and Yin (2016) collaboratively analyzed Fryer's attitude towards the Chinese culture, pointing out Fryer's belief in the equality of Western and Chinese cultures and the translatability of Western scientific terminology from English to Chinese. Jin (2011) elaborated on Fryer's contribution to the standardization of terminology translation, asserting that Fryer's views on translation and his translation practice brought instruction and inspiration to the work of standardizing the translated terminology; With regard to Fryer and Western Learning, Wang (2000) analyzed Fryer's contribution to the dissemination of Western scientific knowledge by focusing on Chinese people's scientific enlightenment brought along by Fryer's translation. Yu (2008) discussed Fryer's catalytic role in the renewal of Chinese people's scientific knowledge by taking Fryer as an ambassador who helped to introduce Western learning into China; In terms of Fryer and educational career in Modern China, Sun (1991) elaborated on Fryer's contribution to the establishment of the Gezhi Academy which played an active role in cultivating talents of modern science. Xu (2011) studied the Chemistry books translated by Fryer, which served as textbooks in missionary schools, and Fryer's contribution to the introduction and popularization of the knowledge of modern chemistry; as to Fryer and newspaper industry in Modern China, Sun (1994) studied the first scientific magazine in modern China—*Ko-chih-hui-pien* established by Fryer by focusing on the purport, characteristics, contents and influence of this magazine. Wang (1994) examined the compilers of *Ko-chih-hui-pien*, pointing out their great contribution to the standardization of the modern scientific magazines and newspapers.

On the contrary to the huge influence of Fryer's contribution to the standardization of translated scientific terminology in Modern China, relevant researches are not so many as expected. This paper, therefore, is to study John Fryer's contribution to the standardization of the translated scientific terminology in Modern China by first probing into his translation practice and his views on translation, then analyzing the magazine *Ko-chih-hui-pien*, the book *Mirroring the Origins of Chemistry* and the 4 bilingual lists of scientific terminology which are all Fryer's works. In this sense, this paper will help us gain a deeper understanding of John Fryer and his major contributions, which are of great significance.

1. FRYER'S SCIENTIFIC TRANSLATION AND VIEWS ON TRANSLATION

1.1 Fryer's Scientific Translation

Most of Fryer's translations were scientific ones, among which the most remarkable one was *Mirroring the Origins of Chemistry* (1871) translated by Fryer and Xu Shou. Based on David Ames Wells's *Well's Principles and Applications of Chemistry: For the Use of Academies, High School, and College* (1858), this book systematically introduced the knowledge of modern Western inorganic chemistry, elaborating the properties and usage of 64 chemical elements, and illustrating some basic chemical principles for Chinese readers. In *Mirroring the Origins of Chemistry*, Fryer innovatively translated the terms of chemical elements by combining English syllables and the components of Chinese character which profoundly influenced the naming work of the chemical elements in Modern China. After *Mirroring the Origins of Chemistry*, individually or cooperatively, Fryer translated *Huaxue Fenyuan* (1871), *A Sequel to Mirroring the Origins of Chemistry* (1875), *A Supplement to Mirroring the Origins of Chemistry* (1875), *Huaxue Yizhi* (1881) and *Huaxue Xuzhi* (1898). His translation of Western chemistry works brought into China the modern knowledge of chemistry, and they were used as the textbooks in missionary schools. Fryer himself, therefore, was regarded as the pioneer of the Modern Chinese Chemistry (Xu, 2001, p.56).

In addition to *Mirroring the Origins of Chemistry* and other translation of chemical works, Fryer also established the first scientific magazine in Modern China —*Ko-chih-hui-pien* which was aiming at popularizing the scientific knowledge for common people, involving the knowledge of Physics, Chemistry, Medicine, Astronomy, Geography, History etc. (Sun, 1994). More than two-thirds of the anonymously-authored articles published in *Ko-chih-hui-pien* were from Fryer. He translated the essays in Western scientific magazines or books, and had them published so as to help the common people gain access to modern scientific and technical knowledge. Moreover, all of his essays published in *Ko-chih-hui-pien* involved no religious preaching which made this magazine the first scientific one in Modern China.

1.2 Fryer's Views on Translation

1.2.1 Translatability of Scientific Terminology

The missionaries who came to China in the 19th century with the purpose of "disseminating civilization" were actually aiming at spreading the Western and Christian culture which made what they did tinge with colonial color. With a sense of superiority, most of the missionaries

thought the Chinese language is too vague to carry the precise meaning of Western scientific terminology and doubted whether Chinese characters, contrasting so sharply with modern European languages possess the capacity of dealing with the terminology of science and technology. As a result, some missionaries even proposed replacing Chinese with English (Chen & Yin, 2016, p.20). While in Modern China, the underdeveloped modern science and technology provided less or no equivalence for the scientific terms in English-Chinese translation, which frustrated most of the translators of that time. Different from those having passive attitudes towards the Chinese language, Fryer (1890) had a great confidence in Chinese and thought the Chinese character, characterized by its graphic indication, flexibility and conciseness, enjoyed a certain advantage in scientific translation, and "the problems that arose were largely lexical rather than structural" (Wright, 1998). Fryer insisted that, in scientific translation, the translator should not only focus on the existing Chinese words in dictionaries, but also needs to seek words beyond the books and even to coin some words for their translation (Fryer, 2009, p.284). In other words, for Fryer, it was impossible to carry out the translation work if the translators only pick up the words in dictionaries for their translation. Therefore, what the translators needed to do was to find words beyond the dictionaries or coin new words to translate Western scientific terms. Fryer believed that like other Western languages, the Chinese language could enlarge its vocabulary and develop itself by introducing or creating new words.

1.2.2 Principles of Scientific Terminology Translation

In order to settle the disordered translation of scientific terminology, in the year of 1880, Fryer made a report entitled *A Brief Report on Translating Western Works at the Kiangnan Arsenal*, elaborating his translation ideas as follows: Firstly, he held that if a scientific term has already existed in the Chinese language but could not find in dictionaries, the translator needs to look into scientific and technical books written by Chinese or foreign missionaries, or to consult merchants, manufacturing workers who were supposed to know the terms. Secondly, if there were no equivalent scientific terms in Chinese, the translator needs to coin new words mainly by the three means: (a) Combining a pronunciation-denoting character with a radical which gives generic meaning of the new word, such as the characters 镁 (mei, Magnesium) and 矽 (xi, Silicon) , or giving new meanings to the rarely-used characters in Chinese, thus making them new ones, such as 钾 (jia, Kalium), 锌 (xin, Zinc) and 铂 (bo, Platinum). (b) Taking the Chinese explanation of a certain chemical element as a new term, but it is advisable to use as few words as possible in the explanation, like 养气 (Oxygen), 轻气 (Hydrogen) and 火轮船 (Steamships). (c) Translating English words into Chinese characters similar in phonetic sound to the English ones. Thirdly, all the newly-coined words should be collected in the lists of bilingual technical terms and attached as an appendix to the translated works (Luo, 2009, p.285). Among these three principles, the first one was proposed for gentry class and conservative literati in Modern China. It's easier for the conservatives to accept the translated works in which the Western scientific terms were translated into Chinese with which people were familiar. The second principle provided a feasible way for translators to establish new terms, and under the guidance of this principle, Fryer successfully translated lots of chemical elements. The third principle emphasized that the translator should make bilingual lists for readers and other translators' reference. Fryer himself also followed this rule, and while cooperating with his colleagues, he made several bilingual lists, such as *A Chinese-English Vocabulary of Mineralogical Terms* (1883), *A Chinese-English Vocabulary of the Names of Chemical Substances*(1884), just to mention a few.

1.2.3 Standardization of the Translated Scientific Terminology

As the first one who advocated to standardize the translated scientific terminology in Modern China (Zhang, 2014, p.53), Fryer attached great importance to the translation of scientific terminology and summarized the chaotic situation in the translation of scientific terms at that time: an English scientific term may vary greatly in Chinese from translator to translator; an English scientific term may be transliterated differently according to different translators; even for the same English term, some translators may adopt the free translation, while others choose transliteration; in the translation of chemical works, some translators use old chemical symbols, some use the new ones, and others even choose numbers or dots (Sun, 2006, p.137). Fryer blamed the translators for this chaos, pointing out that the foreign missionaries who undertook most of the translation works had little idea about the Chinese language and the translation; these translators lacked a profound and all-round knowledge in what they had translated, especially when it involved science and technology; some of the translators had no intention to examine and use the already-translated terms; owing to the lack of communication, these translators tended to be indifferent to others' translation works; there had been no generally-accepted translation theory for the translators to follow; there had been no authorized organization to collect and compile the newly-translated scientific terms; and the bilingual lists of translated scientific terms which could offer reference for translators were also short (Ibid.). Facing with the frustrating reality, in the year of 1890, Fryer delivered his report entitled *Scientific Terminology: Present Discrepancies and Means of Securing Uniformity* in the Second General Conference of the Protestant Missionaries of China, summarizing his translation experience in Kiangnan Arsenal, insisting

again standardizing the translation of scientific terms, and further illustrating his views on translation. He pointed out that: (a) the translators should adopt free translation rather than transliteration; (b) choosing the proper Chinese words to translate the terms, and systematizing the translation of elementary morphemes in transliteration; (c) the newly-coined words should follow the formative rules of Chinese character; (d) the translated terms should be concise; (e) the translated term should carry the preciseness of its meaning; (f) the translated terms should correspond to the original; (g) the translation of scientific terms should be somewhat flexible (Wang, 2000, p.67).

In the translation of scientific terminology, Fryer held that the descriptive translation was more acceptable in China and that the free translation was preferred, then came the combination of free translation and transliteration, and transliteration alone was ranked the third (Jin, 2011, p.109). He also provided the reasons for this ranking as follows: Firstly, the Chinese people were accustomed to see hieroglyphic and meaning-denoting words, while the transliteration would require several Chinese characters in translating one English term, which made it difficult for the term to read and remember. Secondly, Chinese readers would not quickly figure out what the transliterated terms denote and these terms would not necessarily enrich the Chinese vocabulary. Thirdly, because of various Chinese dialects, it could be rather difficult to standardize the transliterated words, and different translators might choose different Chinese characters in translating the same English term, which made the situation of terminology translation even worse. Therefore, transliteration could be adopted only when other translation methods were invalid (Sun, 2006, p.136).

Fryer's views on scientific translation were in line with his translation practice, strongly refuting cultural hegemonism held by some Western missionaries of that time, and greatly contributing to the development of translation theory and practice as well as the scientific enlightenment in Modern China.

2. FRYER'S CONTRIBUTION TO THE STANDARDIZATION OF THE SCIENTIFIC TERMINOLOGY TRANSLATION

2.1 Compilation of *Ko-Chih-Hui-Pien*: Popularizing Modern Scientific Knowledge

In the course of the development of modern science in China, the method of translating Western books into Chinese which was adopted by most of the foreign missionaries of that time could no longer meet Fryer's "ambition" of popularizing modern science knowledge in China. Fryer (2009) held that the books translated in Kiangnan Arsenal were too abstruse to be understood by common people and the best way to popularize modern science should be a gradual progress that was from elementary to profound. Based on this consideration, Fryer established *Ko-chih-hui-pien* (the English name of this magazine originally was *The Chinese Scientific Magazine* and then was renamed as *Chinese Scientific and Industrial Magazine*), the first scientific magazine in Modern China, in which the scientific essays and articles were translated in a more straightforward way and were accessible to the ordinary readers. What's more, Fryer established this magazine all at his own expense, aiming at introducing modern Western science for his Chinese readers and thus helping to accelerate the development of modern science and benefiting the Chinese people.

Ko-chih-hui-pien, was established in 1876 and kept its popularity until 1892. During the 16 years, it published 60 volumes, with each one consisting mainly of scientific translations and three columns respectively entitled "Arithmetic Problems" (算学奇题), "Readers' Inquiries" (互相问答), and "Scientific Knowledge" (格致杂说). Most of the essays and articles published in this magazine were from Fryer; partly from Fryer's colleagues, such as Xu Shou, Xu Jianyin; partly from the foreign missonaries of that time, such as D. J. MacGowan (1814-1893), W. Muirhead (1822-1900) and C. Mateer (1836-1908); and some unknown contributors also made their contributions (Wang, 1994). The essays in *Ko-chih-hui-pien* concerned primarily with science and technology, partly involved the knowledge of Chemistry, Mechanology, Hygienics, Aeronautics, and Manufacturing techniques and these essays could be classified into six categories: (a) the treatises that would be serialized; (b) articles published to introduce new technical skills; (c) readers' inquiries; (d) the history of science and technology and brief introductions of scientists; (e) the reports of monographic studies; (f) book reviews and the recommendations of new books. With a view to popularizing scientific knowledge in China, *Ko-chih-hui-pien* focused on the fundamental knowledge of science and technology and in order to avoid repetition, Fryer published more articles on Scientific Instruments, light industry and hygienics which were rarely translated. Before the establishment of *Ko-chih-hui-pien*, there had been no translators who tried to systematically introduce the scientific experiments and instruments, and some curious readers might write to consult how to do experiments and where could they buy these experimental equipment (Wang, 1996). In this way, Fryer helped his readers buy some equipments, and later posted some advertises of experimental equipments in *Ko-chih-hui-pien*. He also translated user's guides of those equipments and added lots of pictures in the magazine to help readers have a better understanding. In this regard, Fryer also helped, to some degree, bring in modern experimental facilities for China.

What distinguished *Ko-chih-hui-pien* from other scientific magazines in Modern China was that it just

focused on the spreading of modern science and never involved any religious preaching (Sun, 1991). Unlike other scientific magazines propagating Christian culture under the guise of modern science, most of the published articles in *Ko-chih-hui-pien* were only aiming at introducing Western scientific theories and knowledge, making it the first scientific magazine in Modern China. Besides, these essays were translated from scientific magazines in the Western world and some were edited by imitating Western scientific magazines, which enabled the editors and translators to attach greater importance to format and the standardization of their language (Liu, 1988, p.50). *Ko-chih-hui-pien*, established and edited by Fryer, made a great contribution to the development of modern science and the standardization of the scientific terminology translation in the 19th century of China. Liang (1896) remarked *Ko-chih-hui-pien* as "extremely important" in his published book *Western Bibliography Table*. And Yu (2008, p.313) also confirmed Fryer's contribution like this: "Among the foreigners who came to China in the late Qing Dynasty, Fryer is the one who profoundly influenced the standardization of scientific and technical language."

2.2 Translation of *Mirroring the Origins of Chemistry*: Laying the Foundation for the Chinese Translation of Modern Chemical Elements

Mirroring the Origins of Chemistry, translated by John Fryer and his collaborator Xu Shou, was published in 1871. It consisted of 6 volumes including 410 parts, giving a systematic introduction of the 64 chemical elements which were already known at that time (Wang, 1990). In Part 3, Volume 1, Part 3 of *Mirroring the Origins of Chemistry*, Fryer gave a brief introduction about chemical elements and divided them into two parts: one was metal elements, and the other was nonmetal. Among the 64 chemical elements, five belong to gas, two liquid, and the rest exist in the state of solid (Fryer & Xu, 1871, p.161). Due to the complexity in the form and pronunciation of the English names of substance, it was difficult to find Chinese characters that could fully match the original foreign ones, Fryer thus abandoned transliteration and managed to use one Chinese character for translating a chemical element, which made his translation particularly successful. In *Mirroring the Origins of Chemistry*, Fryer kept the names of chemical elements which were already existed in Chinese, for instance, 金 (jin, Aurum), 銀 (yin, Argentum), 銅 (tong, Cuprum), 鐵 (tie, Ferrum), 鉛 (qian, Plumbum), 錫 (xi, Stannum), 汞 (gong, Mercury), 硫 (liu, Sulfur), 燐 (lin, Phosphorus) and 炭 (tan, Carbon). The same was true with the terms that had already been translated appropriately, such as 養氣 (Oxygen), 輕氣 (Hydrogen), 淡氣 (Nitrogen) and 綠氣 (Chlorine). The other 50 chemical elements were translated by combining a pronunciation-denoting character with a radical which was able to distinguish its classification. Thus, for instance, the chemical element "Magnesium" was translated into "鎂" which was built of a radical "金", indicating the word's classification, and a freestanding character "美" suggesting the word's pronunciation and presenting the first sound of its English term "Magnesium". Without any idea of the meaning of the character "鎂", any literate native speaker could also figure out what it represents, and guess that it might denote a kind of mental and could be pronounced something like "mei" (美). The same is true with the rest 49 new characters coined by Fryer with the method of adding "金" (mental), "石" (stone) and "水" (water) to a character similar in sound to the first or the second sound of its English pronunciation. Moreover, it's worth mentioning that among all the 50 coined characters, 38 terms are still in use today, such as钠 (Natrium), 铝 (Aluminum), 锰 (Manganese) etc.

Table 1
Names of Chemical Elements Translated by John Fryer

Carbon	炭	Oxygen	養氣	Cadmium	鎘	Thorium	釷	Niobium	鈮
Kalium	鉀	Hydrogen	輕氣	Indium	銦	Yttrium	釔	Stibium	銻
Natrium	鈉	Nitrogen	淡氣	Plumbum	鉛	Erbium	鉺	Arsenic	砷
Lithium	鋰	Chlorine	綠氣	Thallium	鉈	Terbium	鋱	Mercury	汞
Cesium	銫	Iodine	碘	Stannum	錫	Cerium	鈰	Argentum	銀
Rubidium	銣	Bromine	溴	Cuprum	銅	Lanthanum	鑭	Aurum	金
Barium	鋇	Fluorine	弗氣	Bismuth	鉍	Didymium	鐝	Platinum	鉑
Strontium	鍶	Sulfur	硫	Uranium	鈾	Ferrum	鐵	Palladium	鈀
Calcium	鈣	Selenium	硒	Vanadium	釩	Manganese	錳	Rhodium	銠
Magnesium	鎂	Tellurium	碲	Wolframium	鎢	Chromium	鉻	Ruthenium	釕
Aluminum	鋁	Phosphorus	燐	Tantalum	鉭	Cobalt	鈷	Osmium	鋨
Glucinum	鈹	Boron	硼	Titanium	鐽	Nickel	鎳	Iridium	銥
Zirconium	鋯	Silicon	矽	Molybdenum	鉬	Zinc	鋅		

This set of rules for translating chemical terms not only brought Fryer a great success in translation but also reflected the flexibility and creativity of the Chinese characters. By the radical, readers can easily figure out what classification the chemical element belongs to and how it is pronounced and thus it could be accepted and remembered easily. This chemical nomenclature has a profound influence on the naming of chemical terms and scientific terminology translation in Modern China.

2.3 Collection of "Lists of Bilingual Scientific and Technical Terms": Standardizing Scientific Terminology Translation

In the late Qing Dynasty, lots of Western scientific works had been translated into Chinese by missionaries. Meanwhile, the chaotic situation of scientific terminology translation also hindered the development of translation cause and the popularization of modern science in China. It, therefore, became the top urgency for the translators to standardize the scientific terminology translation. In the year of 1877, missionaries in China set up an organization called School and Textbook Series Committee for the purpose of helping standardize the translated terms of textbooks used in missionary schools. As a member of this committee, Fryer participated in the compilation and publication of two sets of Chinese textbooks. In order to unify the translated terms in these textbooks, the leaders of this committee required the translators and compilers to provide bilingual lists for reference, and divided the various terminologies into three classes: (a) the terminology of science, technology and manufacturing; (b) the terminology of Geography; and (c) the terminology of proper nouns. Due to his rich translation experience in Kiangnan Arsenal, Fryer was assigned to collect and sort out the terms in the first class (Zhang, 2011, p.22). Until 1890, Fryer had successively published 4 bilingual lists of scientific terminology: (a) *A Chinese-English Vocabulary of Mineralogical Terms* (1883) collected all the translated mineralogical terms appearing in *Jinshi shibie* (1871) written by D. J. MacGowan (1814-1893); (b) *A Chinese-English Vocabulary of the Names of Chemical Substances* (1884) listed all the chemical terms used in *Mirroring the Origins of Chemistry*, *A Sequel to Mirroring the Origins of Chemistry* and *A Supplement to Mirroring the Origins of Chemistry*; (c) *A Chinese-English Vocabulary of the Names of Materia Medica* (1887) sorted out all the translated names of drugs and chemical material translated in *Xiyao dacheng* (1879); (d) *A Chinese-English Vocabulary of Terms Relating to the Steam Engine* (1890) collected engineering words used in *Qiji faren* (1871), *Qiji biyi* (1872) and *Qiji xinzhi* (1873). The terms collected in Fryer's bilingual lists provided reference for other translators and thus helped standardize the translation of scientific terminology.

The unification and standardization of the translation of scientific and technical terminology is a long-term hard work, Fryer made his unceasing efforts to call for attention to this work, summarized the related problems, set up theoretical rules for the terminology translation, and made bilingual lists of scientific terminology for other translators' reference. Even in 1896, the year of his departure from China, Fryer made a speech entitled *The Present Outlook for Chinese Scientific Nomenclature* in the Second Triennial Meeting of the Educational Association of China held in Shanghai, emphasizing again the importance of the standardization of terminology translation which generated a heated discussion. Among all the translators in the late Qing Dynasty, Wang (2006) took Fryer as the most remarkable figure and the one who contributed most to the standardization of scientific translation.

CONCLUSION

As a translator in the 19th century, Fryer made his contribution not only by translating Western scientific works, but also by helping standardize the translation of scientific terminology. This paper first discussed Fryer's views on translation and his translation practice, then analyzed Fryer's contribution to the standardization of the scientific terminology translation, and finally pointed out that Fryer's major achievements were related to *Ko-chih-hui-pien*, *Mirroring the Origins of Chemistry* and Lists of Bilingual Scientific and Technical Terms, which profoundly influenced the popularization of modern science, the translation of chemical elements and the standardization of the translated scientific terminology in Modern China.

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