Adrian Arthur Bennett

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John Fryer: The Introduction of Western Science and Technology into Nineteenth-Century China

Preface

Among the manuscripts deposited at the General Library of the University of California, Berkeley, are the papers of John Fryer, Louis Agassiz Professor of Oriental Languages and Literature at that university from 1896 to 1913. Fryer was not only a pioneer in American study of China. Before he went to Berkeley, he was for twenty-eight years a translator for a Chinese government arsenal in Shanghai, contributing in his lifetime a total of one hundred and forty-three publications in Chinese, mainly translations of English language works on technology and science. Among Fryer's papers, the most valuable are his journals and letters which are fully preserved up to 1871. But his papers also include numerous unpublished essays, published articles, catalogues, and newspaper clippings of various dates which make it possible to reconstruct his activities during the entire period that he was in China, from the time that he left his home in England in 1861 to his departure for the United States in 1896.

The East Asiatic Library at Berkeley houses the John Fryer collection of books in Chinese, originally Fryer's own library. Included in the collection are one hundred and twenty-five books in Chinese produced by Fryer himself, which are, except for twelve missing items, a complete set of the books translated or written by Fryer. Also in the East Asiatic Library is the complete file of *Ko-chih hui-pien*, a Chinese scientific magazine edited by Fryer, from 1876 to 1896. The materials in Chinese are of great interest to any student of the advance of modern science, technology, and scientific thought in China and may even be of interest to philologists and linguists concerned with the comparative study of Chinese and Western languages.

My contribution in this volume, however, is limited to a reconstruction of John Fryer's life and thought while he was in China and an analysis of the scope of his translated works. I hope also to point out the influence of Fryer's publications on the literati of late nineteenth-century China. The appendices contain various lists useful to a study of the sources and the nature of translations done by Fryer and his colleagues. The most valuable list, Appendix II, is based, however, not on my own research, but on that of Dr. Richard G. Irwin of the East Asiatic Library, Berkeley. I am deeply thankful to Dr. Irwin for permission to use his list, to consult his own manuscripts, "John Fryer's Legacy of Chinese Writings" and "John Fryer and the Modernization of China" from which I learned a great deal, and for his help in preparing the manuscript for publication.

I acknowledge most gratefully my indebtedness to Dr. K.C. Liu, who not only suggested the original idea for this study and read over the manuscript in its various stages of completion, but also provided continuous aid and inspiration throughout its development. I wish to thank Dr. J.P. Lo for valuable bibliographic suggestions and Dr. Donald C. Swain whose comments and criticism were extremely helpful in rewriting. I also wish to thank Mr. J.R.K. Kantor of the General Library of the University of California, Berkeley, and the staff of the Bancroft Library for their help and cooperation.

Two of Dr. Knight Biggerstaff's publications have been most helpful in my research. His *The Earliest Modern Government Schools in China* provides valuable background for this study, while his article on the Shanghai Polytechnic Institute furnishes the essential material on John Fryer's role in that organization. I am grateful to Dr. Biggerstaff for lending me his copy of a 1910 catalogue of the Kiangnan Arsenal publications.

I wish especially to thank my wife, Cynthia, for her help and encouragement throughout the research and writing of this study.

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Introduction

In 1896, a fifty-seven-year-old Englishman crossed the Pacific Ocean from Shanghai to California to become the University of California's first Professor of Oriental Language and Literature. John Fryer (1839-1928) was well versed in Chinese, for he had lived thirty-five years in China, spending twenty-eight years as an English-Chinese a Chinese government arsenal. At Berkeley, he was to have a distinguished teaching career until his retirement in 1913, pioneering in Chinese studies in the United States. Before he came to this country, however, he had concentrated on the difficult task of translating Western scientific and technological works into Chinese. Through his translation and his many other efforts to promote Western learning, Fryer had a profound influence upon China.

In the West, science and technology were in a state of development. Darwin's theory of evolution created the necessity for a new approach to biology. Lyell's concepts of the earth's age and its continuing transformation created new dimensions of time and space. There were new developments also in chemistry and in the study of electricity.

The nineteenth century also saw the spread of the Revolution. In Britain, between 1850 and 1900, the revolution entered a new phase. There was a growing specialization of production, a beginning of direct application of science to industry, further development of mass production techniques, improvement of agricultural technology, and a new emphasis on university instruction in science and technology. In other Countries, the Industrial Revolution also gained momentum. As early as 1830 Belgium's textile mills were competing with Britain's. By 1848 the industrial capacity of France was diversified and growing. Germany, once unified, industrialized rapidly. The United States, borrowing heavily from Europe, made giant strides after the Civil War, narrowing the industrial gap between herself and Britain. Thus concepts of science and technology were multiplying and becoming enormously more sophisticated. It was against this background that John Fryer began introducing Western scientific ideas into China.

John Fryer's career is a striking example of the interchange of knowledge between the Western world and China. What led Fryer to go from England to China and what prompted him to join the service of the Chinese government? For twenty-eight years he occupied himself with the exacting task of translating Western technical literature into a difficult and exotic language, day in and day out. What made him go on? Was it merely a matter of earning a livelihood? What did he really hope to accomplish? What were Fryer's views on the strengths and weaknesses of Chinese civilization and what was his concept of the value of modern science? These are fascinating biographical questions which may be answered on the basis of Fryer's record.

One may also inquire into the contributions Fryer made to China. What were the extent and nature of his translations and what was their impact on the Chinese of that time? Since Fryer worked for a Chinese government establishment, was his choice of

subjects dictated by government officials? Was Fryer mindful of the needs of the Chinese people, as well as of the government?

It should be noted that Fryer's contribution to China was not confined to the work of translation itself. He had many personal contacts with an incipient Chinese scientific community. Prior to 1868, Fryer was primarily involved with teaching jobs in Hong Kong, Peking and Shanghai. Soon after he came to Shanghai he was, for two years, the editor of a Chinese-language newspaper. Although an employee of the Ch'ing government from 1868 on, Fryer was active in an individual capacity and in association with others, both foreign and Chinese, in promoting science and technology in China. He was friend and advisor to a group of talented Chinese mathematicians and scientists who helped him in the translation work. He was editor of a major Chinese-language journal, called *Ko-chih hui-pien* (The Chinese scientific magazine) from 1875 to 1891. He was secretary to a library called the Shanghai Polytechnic Institute and Reading Rooms from 1875 to 1896, and general editor of the School and Textbook Series Committee attached first to the General Missionary Conference and later to the Educational Association of China, another missionary organization. Fryer was also founder of the Chinese Scientific Book Depot, a personal, non-profit enterprise inaugurated in 1884. He was involved, therefore, in several aspects of the introduction of Western science into modern China.

The first part of this study deals briefly with Fryer's background in Britain and his early experience in China. The last two parts concentrate on the period 1868-1896, when he was increasingly involved in his diverse private endeavors. My treatment is chiefly biographical, but it is hoped that this account will serve to illuminate certain general issues in the cultural relations of the West and China.

Chapter I

The Early Years: 1839-1868
From English Schoolboy to Translator in Shangai

John Fryer was born on August 6, 1839, in Hythe, England. He acquired his early education at Prospect House Academy in Hythe and at St. James School in Bristol. As the oldest child in a poor clergyman's family, Fryer worked part-time to help meet his school expenses. Fryer described his early education as being "of a most imperfect description…" He continued: "I was an apprentice to a National School in Bristol which was attended only by the lowest of the low, and the master himself was not an educated man." On the basis of this education, however, Fryer received a First Class government scholarship to enter Highbury Training College in London, a school which specialized in training teachers.

Upon graduation in 1860 Fryer was offered the headmaster's position at St. Paul's College in Hong Kong. He accepted the offer, apparently because of a long-standing family interest in China. Fryer claimed that in his youth some returned missionaries and merchants from China impressed his parents. As a result his father subscribed as much as he could while his mother "for a time adopted rice as a considerable part of her diet." Whatever the merits of his parents' response, their interest in China apparently influenced their son, John. In his boyhood he read as much as he could on China and in school he always composed themes on China. In fact, his school-fellows nicknamed him "Chin-chong Fy-ung." Because of his long-standing interest in Chinese history and folklore, Fryer accepted the Hong Kong position. This position, according to one source, was Fryer's second choice and one that he accepted only after his first choice, a position in England, was filled by a fellow-student.

Fryer departed for Hong Kong early in 1861. He wrote on board the ship taking him to China: "I am often thinking of what lies before me in China, and expect I shall find it rather strange at first, but I mean to make the best of it come what may." After a long and exhausting journey John Fryer arrived in Hong Kong in August 1861 to begin his career in China.

Hong Kong and Peking

Although Fryer remained at St. Paul's for two years very little is known about those years or of the school. The school apparently trained native Chinese who were interested in becoming Episcopal ministers. According to one of Fryer's letters, it suffered from mismanagement and was therefore not very productive. Besides his duties as headmaster of the school, Fryer also taught English.

In 1863 Fryer accepted a position as a teacher of English at the Peking T'ung-wen kuan. He stated that he went to Peking "in order to learn the official Chinese language [Mandarin]… " Fryer probably had become familiar with the Cantonese dialect in Hong Kong, but realized that this was only one dialect of China. In Peking, Fryer laid the foundation for his knowledge of Mandarin. At the Tung-wen kuan Fryer replaced J.S. Burdon, an English missionary, and in 1864 William A.P. Martin succeeded Fryer. Fryer worked two hours a day for which he received a salary of one thousand taels per annum. While in Peking he met many of the people who played a significant part in Chinese history of the late nineteenth century. He worked with Wen-hsiang who helped to establish both the Tsungli Yamen and the T'ung-wen kuan. Mingling with the diplomatic corps, Fryer met Sir Frederick Bruce, Sir Thomas Wade, Anson Burlingame and Samuel Wells Williams. He also met the customs officials H.N. Lay and Robert Hart and the missionary S.I.J. Schereschewsky.

In his spare time, Fryer recorded his early views about China. His first impression of the Chinese people included such observations as their indifference, their willingness to do anything for money, their feigning of ignorance when circumstances necessitated it, their teetotaling and their dishonesty. On this last item he wrote that "one need be very sharp to deal with them." Fryer also recorded his early impressions of Chinese religions. At one point, after listening to some elderly Chinese complain about a corner of a new mission house being taller than a tomb, which apparently was causing sickness in the dead man's family, Fryer wrote: "this is about all their religion is worth… Religion is with them merely a custom, and a dead letter." After talking to a Buddhist monk Fryer was surprised at the man's willingness to learn Christianity if Fryer would but feed and clothe him.

Fryer criticized the Chinese educational system as being:

> ...the greatest folly imaginable. No Chinaman in less than ten years is supposed to be able to know the meaning of the characters. Many learn five years and only know the sounds.

Fryer himself, however, was learning to read Chinese and could use it with advantage in daily life. A little over a year after he had arrived in Hong Kong he recorded:

> I had some fun among the Chinamen on the wharf by buying about twenty oranges. A whole crowd gathered around, and as I spoke Chinese to them, it was fine fun. The fellow tried to cheat me right and left; so I said to him and those around: He sees I am a foreigner and so he wants to get the advantage over me. Then I took his ticket from the basket and read "All these oranges six cash each (without the peel)." So I said: "Now you all see his ticketed price, and yet he wants me to pay more than double, because he thinks I cannot read Chinese. Now what shall I do to him?"

Evidently Fryer observed Chinese life with a critical eye, but the tone of his remarks on China and her people was to change in later years.

The Anglo-Chinese School, Shanghai

In 1865 Fryer agreed to take charge of a new Anglo- Chinese School in Shanghai, a position he held until May 20, 1868. He never fully explained why he left Peking. On one occasion he wrote that he "found it adviseable for various reasons to resign his post at the Tung-wen college and to remove to Shanghai where he was promised the headmastership of a large public school." Another source claims, however, that he went to Shanghai because "the education of the Chinese was the subject in which he was most interested." Whatever his reasons, Fryer took up his duties probably in October of 1865 and wrote his first report on the school in December of that year.

Fryer was proud of the fact that by December the school had already attracted ten students. He noted that if one considered how careful the Chinese were in giving their confidence to foreigners, how shrewd in not paying for anything until they saw the end result, and how educational arrangements commenced and terminated at their New Year, it was surprising to have so many pupils under instruction. The Anglo-Chinese School concerned itself primarily with teaching English to the Chinese. For this reason, it attracted members of the merchant class, a wealthy but theoretically low social class, whose businesses would benefit by their ability to speak English. While Fryer knew that his students were the sons of bankers, compradors and merchants he failed to recognize the social level of his students, whom he found to be "decidedly of a far better social class of society than any scholars I have had at either Hong Kong or Peking…"

Another goal of the school was to introduce Christianity to the students. Fryer planned to accomplish this gradually by introducing readings from the Bible into the daily lessons only after the students possessed a solid foundation in English. Fryer, fearful of frightening students away from the school by emphasizing Christianity, continued this gradual approach throughout his tenure. He believed that Christianity had to be introduced slowly for it to be tolerated and appreciated. He thought that if Christianity were prominently displayed "the Chinese would be likely to misunderstand entirely the designs which the Committee have in view in establishing the school." It may have been this very plan which made Fryer's tenure so insecure. Both the committee and the Church Missionary Society, which took over the school probably early in 1868, thought that Fryer was too secular. For this reason, neither group offered Fryer a long-term contract and he felt dissatisfied with the power vested in him.

By May of 1866 Fryer had twenty-two day students and twenty evening students, ranging from ten to eighteen years of age. Again, they were apparently from the wealthy merchant families. The school now offered three English classes which began at nine in

the morning. The classes were divided according to the dialects of the students, who came from Shanghai, Canton, Alloy, Soochow, and Ningpo. Fryer wrote of this situation:

> It is a perfect Babel. To give you some idea you would have to get some English, Irish, Scotch, French, Spanish, Italian, German boys and put a Russian among them, and then try and teach them to speak and write Chinese.

By this date, the curriculum included instruction in Chinese, which was given in the afternoon from two to five. Fryer probably offered this course to attract more students. He took part in these courses, learning Chinese along with his students which helps to explain his ability with the language when he began translating two years later.

By March of 1867, Fryer had become depressed over his work, especially the problem of his tenure. He wrote: "It is a wretched kind of life to lead in the midst of such uncertainty, my father's consolation to me is 'It is good for a man to bear the yoke in his youth' but I really think I have had a little too much of it, one way and another." During the same month he admitted that he was "perfectly sick of teaching English." He also predicted that he would not be at the school beyond May of 1868.

Fryer decided by March of 1867 that he would remain in China. "I think that my lot is fixed in China… having studied six years at Chinese, and having acquired some facility in their dialects and the general written language, it would be like throwing away so much time if I gave it all up." In the same letter he held out hope that he would be able to obtain a good position in China. He claimed that China was just opening up to Western civilization, with rapid advances being made every year and believed that in "a year or two more… my knowledge will be invaluable and people say I will be worth my weight in gold."

In July of 1867 Fryer wrote his second report on the school, which was much broader in scope than the first. Less than four months after he had written his complaints about the uncertainty of his job and his growing dislike of teaching English, he wrote of a desire to remain at the school because he had started it and worked so closely with it for two years. He felt that the Anglo-Chinese School should be continued since the Chinese obviously needed Western education. He noted that "the Imperial Government is gradually becoming conscious of the deficiencies of its educational system." At the same time, Fryer told the committee that the insecurity of his own position jeopardized the effectiveness of his teaching:

> It is almost too much to expect that a sense of duty alone will enable a teacher month after month to pursue his monotonous task under such circumstances and surrounded only by Chinamen. In the long hours of tedious and wearisome lessons it would be a consolation to know and feel that one had the approbation, the sympathy, the countenance and the

> support of those Foreign residents who are known to take an interest in the various means employed for the advancement of the Chinese.

After writing of himself, Fryer considered the origins, diligence, and progress of his students. He reaffirmed his earlier findings on the students' origins; they were still from the wealthy, merchant class. In addition, he found that most of the students were not natives of Shanghai. Their families had moved there "for purposes of trade or were driven here as refugees during the Tai-Ping Rebellion and have preferred to remain." Fryer accounted for the lack of native Shanghai students at the school by claiming that "the natives of this place [Shanghai], whether considered physically or intellectually contrast very unfavourably with the men who have settled here from Canton, Ningpo and other places."

Fryer complained in his second report about the narrow appeal of the school, which he did not like. He felt that the committee should initiate a middle course of admitting qualified members of the middle and lower classes of China so that "the few who receive the benefit of the institution may be the most eligible and deserving that can be found."

On the subject of the progress of the students Fryer commented that "it is generally supposed that the Chinese are naturally a painstaking and industrious people, but their diligence is mostly to be attributed to absolute necessity on their part…the Chinese acknowledge the truth of this themselves…" The progress of the school discouraged Fryer because he believed that it would take two or three years of constant study of English before results could be "expected to afford any great satisfaction or pleasure to those who feel an interest in the intellectual and moral improvement of the Chinese." Even though Fryer had been teaching for nearly two years he apparently could not see any marked progress. His most persistent problem was that as soon as a Chinese student acquired elementary English, he would quit school for gainful employment. This was a problem that also afflicted other missionary schools. Another problem was that the students would spend their time almost entirely on English, even though they were supposed to divide their attention between English and Chinese. They found the courses preparing them for the traditional examinations unimportant.

Fryer realized the purpose behind the students' desire to learn English, but he hoped that this situation would soon change:

> The day is not far distant when the various European languages will be learnt [sic] upon a large scale and not merely for purposes of trade, but also because the Chinese will begin to appreciate the value of the treasures in literature, science and art which they enfold. But still even now, it is surely a matter of importance how [and] under what auspices the knowledge of Western languages and ideas is acquired.

The problem of teaching Christianity continued to occupy Fryer, but by now he had optimistic views on the subject. He observed that "a new era seems to have begun in the

course of Chinese History and new avenues are opened by which the light of Christendom is penetrating the darkness of this heathen land." Fryer, of course, spoke primarily from his own experience at the school. He did notice that "a feeling of curiosity" prevailed regarding the "foreign religions" which expressed itself in the form of many questions on Christianity. Fryer wrote: "Such questions have been carefully dealt with and in several instances have apparently been afterward discussed at the Scholar's house and other questions have arisen out of them." Fryer continued to maintain his gradual approach to the teaching of Christianity, but he claimed that there would be no objection to introducing the Bible in the school if this were judiciously managed. He mentioned as proof of this claim that from twelve to fifteen of his pupils who could read English sufficiently would come every Sunday to read with him and hear explanations of the Scriptures. Although this indirect method of introducing Christianity to China may have been unacceptable to the sponsors of the school, it was probably much more acceptable to the Chinese than the more direct methods utilized by most missionaries.

By November of 1867 Fryer realized that his position at the school was even less secure than before. He believed he had three possibilities for other employment. One was with the Government School in Shanghai, a second was as an interpreter at the Municipal Council at $200 a year, and the third was as a secretary and interpreter at the Kiangnan Arsenal at around $800 a year. He noted that he didn't "care which of them I get into." In addition to these possibilities, Fryer thought he also had a chance to become a missionary. He argued that since he came to China originally in a missionary capacity, he would not feel satisfied to enter purely secular work if a permanent position could be found where his "time could entirely be devoted to the work of Christ." The bishop, however, regarded Fryer's methods of spreading Christianity as too secular and refused to have anything to do with him.

Fryer began looking for new employment when it became obvious that the Church Missionary Society did not want him to remain at the school. He informed the society that he would be leaving on May 20, 1868, and the school closed on that date, since no replacement was available.

In July of 1868 Fryer wrote of his happiness at being relieved of teaching duties:

> It is really a great relief to be free from the full monotonous task of pedagogue and especially to Chinese boys who want so much more time and patience, I have had seven years of it in China and seven in England It has been difficult to get free from the toil of cramming knowledge into narrow skulls where there was no room for it.

Thus, John Fryer ended his teaching career in China on a discouraged and bitter note. But if he really had disliked teaching English to Chinese students to this degree, why did he remain at this job for seven years? One possible explanation of his

willingness to remain was the pleasure and intellectual excitement he derived from editing a local newspaper.

Editing the Chiao-hui hsin-pao (1866-1868)

John Fryer took over what apparently was the Chiao-hui hsin-pao (Mission news) in November of 1866. Previous to Fryer's editorship, little is known about this paper, which Marquis Lafayette Wood started in 1862. Fryer regarded the opportunity as a "Godsend" not because of the money involved (50 taels a month), but for the "pleasure and relaxation" it gave him. He wrote: "After four hours in the school it is with no little feeling of relief that I go to my office and translate my articles and news every day."

Fryer hoped to be able to expand the circulation within China and even to Japan. The paper seems to have relied a great deal upon missionaries both as contributors and as a means of widening its circulation. In March of 1867 Fryer wrote that "it is hoped that the paper will not be found unsuitable for circulation among the converts at the different mission stations; and missionaries are invited to contribute articles calculated to interest and at the same time benefit all classes of Chinese."

Fryer also offered editorial opinions on some imperial government actions. In March of 1867 he received a copy of a memorial to be inserted in the paper in respect to a new school in Peking; he suggested that in addition to establishing a school, the imperial government should give the most promising of its graduates under twenty years of age "a good drilling in English or other European languages for say three years and then send them to Europe for a thorough University Education, as the Japanese are doing to a considerable extent." In another commentary Fryer continued with his suggestion, but on a more general level:

> ...within the last century kingdom after kingdom starts off at full speed in a race to see which shall be the greatest in the end. Japan has lately heard the noise of the struggle and has begun to follow in the wake of other nations. China has this year just awoke from a long long dream and seeing the champions far in the front she has just made a desperate struggle and finally got into motion and has joined the race, but she must exert herself or she will be left very far behind.

These statements, although contained in letters, according to Fryer originally appeared as editorials in his *Chiao-hui hsin-pao*. This type of commentary did not seem to damage the circulation. In fact, Fryer thought he noticed a growing desire among intelligent Chinese to study foreign politics, science, and general ideas. He found, in addition, that these subjects presented difficulties to anyone who attempted to explain them in Chinese, "because of the time required to get their ideas into a teacher's head, and then in the difficulty which a teacher finds expressing such ideas in such a stiff barren language as Chinese." He estimated that the paper reached perhaps as many as five

thousand readers since his articles were reproduced in three other Chinese newspapers in Canton and Hong Kong. He also believed that the paper was enjoyed not only by the heads of families but by the women and children, whose curiosity was roused by the illustrations. Although it is doubtful that his articles were read by as many as Fryer estimated, the news- paper obviously influenced a number of Chinese. Thus, "Western ideas and also Christian ideas [found]…their way where no missionary [could]…go."

Once Fryer began work as a translator at the Kiangnan Arsenal, he had to leave his editorship in the hands of Young J. Allen, because, as Fryer stated: "The officials are afraid of the consequences if they were to let me become a recognized servant of the Government while acting as editor…"

As a result of his experiences as a teacher at the Anglo-Chinese School and as editor of the *Chiao-hui hsin-pao*, John Fryer became fully aware of China's relative backwardness and convinced himself of the necessity of the Chinese being able to read about Western ideas in their own language. But even more important, his years as a teacher and editor allowed him to develop a proficiency in the Chinese language, which in turn enabled him to provide the Chinese with Western scientific and technological literature translated into their own language. It was this task which occupied Fryer for the next twenty-eight years.

Chapter II

Translator for the Chinese Government

As a translator for the Kiangnan Arsenal beginning in May 1868, John Fryer eventually became deeply committed to the goal of introducing Western knowledge and ideas, especially those in the field of science and technology, to the Chinese in the medium of their own language. This chapter will describe Fryer's ideas and attitudes toward his work, his methods of translation, and the actual products of his labor.

The Kiangnan Arsenal

The Kiangnan Arsenal (Chiang-nan chi-ch'i chih-tsao chü) was much more than an armament factory, since it actually comprised four institutions, three of which were educational. There was a translating department (Fan-i kuan), a school for training translators and linguists (Kuang fang-yen kuan) and a school for training skilled workmen for the arsenal, in addition to the machine shop where arms and ammunition were manufactured. The school for training translators and linguists originally was the Shanghai T'ung-wen kuan, which, when attached to the arsenal, became known as the Kuang fang-yen kuan. Although this actually was the last institution to become part of the arsenal, it was the first to be founded. In 1861 Prince Kung, Kuei-liang,and Wen-hsiang advocated the establishment of a school in Peking for training translators and interpreters. In the following year the throne authorized such a school, known as the Peking T'ung-wen kuan. Meanwhile, Feng Kuei-fen, a prominent scholar in Kiangsu, proposed a similar school for Shanghai in an essay dated 1861 entitled "On the Adoption of Western Knowledge." Feng deplored the dependence of the Chinese government upon "general frivolous rascals and loafers called linguists." He went beyond the Tsungli Yamen, however, in suggesting that the students should also be taught mathematics, "so that China might be better prepared to deal with Western powers."

Li Hung-chang, the governor of Kiangsu, became acquainted with both the plan for the T'ung-wen kuan and with Feng's proposal, and early in 1863 he submitted a memorial based chiefly on Feng's ideas. Li proposed to recruit youths under fourteen years of age who would be taught a foreign language by foreigners and given a classical Chinese education by selected Chinese degree holders of character and learning. Li expressed hope that instruction in foreign languages would ultimately lead to China's revitalization by making Western knowledge (mathematics, physics and technology) available to promising Chinese students. On April 11, 1863 the throne authorized the establishment of

the Shanghai T'ung-wen kuan. From that time the school continued an independent existence until the fall of 1869.

The machine shop of the Kiangnan Arsenal was established in 1865 when Li Hung-chang and Ting Jih-ch'ang rented a small foreign-owned plant in Shanghai and ordered additional machinery. Yung Wing, the first Chinese who had a college education in the United States, purchased part of the machinery in America. In 1867 Tseng Kuo-fan visited the shop and it was during this visit that Yung Wing claims to have succeeded in persuading Tseng to annex a mechanical school to the arsenal, in order to teach Chinese youths the theory and practice of mechanical engineering and allow Chinese to be eventually independent of Western mechanical engineers and machinists. It seems more likely that Hsü Shou and Hua Heng-fang deserve most of the credit for the expansion of the machine shop. These two men, closely associated with Tseng Kuo-fan since the early 1860's when they helped to build a steamship for him, were responsible for introducing Yung Wing to Tseng. In any case, the machine shop incorporated a mechanical school in 1867.

The idea of adding a translation department to the Kiangnan Arsenal also originated with Hsü Shou and Hua Heng-fang, together with Hsü Chien-yin (the third son of Hsü Shou). Prior to 1867 these three men had read and discussed various earlier translations of Western writings on mathematics and science; they were probably "the leading Chinese students of Western technology of their time." In 1867 the three men settled in Shanghai in order to carry on their studies in proximity to foreigners who could help them. By the close of 1867 they had successfully helped to initiate the translation department of the Kiangnan Arsenal. Their plan called for the translation and publication of a series of treatises in the various branches of Western learning. By this method they hoped "not only to instruct themselves, but to diffuse the knowledge they had acquired with so much pain, among their fellow countrymen." In the autumn of 1868 Tseng Kuo-fan proposed in a memorial to the throne that the arsenal be officially enlarged to include the translation department and a school to train Chinese youths as translators.

> Now translation is the foundation of modern manufacture. Mathematics is used by foreigners as the mother of manufacturing science. Its wonder is explained by works and drawing. Being handicapped by the difficulty of language, although we know how to manufacture things, we are unable to understand the principles of manufacturing… When the translation bureau is set up, capable and intelligent students will be selected to be trained as translators…

Although the throne did not authorize this project until November I, 1868, John Fryer already had been put to work as a translator in May of that year. Shortly after the project received imperial approval, three other Westerners, Alexander Wylie, Dr. John MacGowan and the Reverend Carl Kreyer were added to the staff. Fryer and his Western

colleagues were given to understand that they were free to choose books for translation without direction from the imperial government. The significance of this fact will be seen later.

Motives for Entering Chinese Government Service

Although the translation department was established ostensibly for the purpose of spreading Western knowledge in China, it is doubtful whether John Fryer had this objective in mind when he began work at the arsenal. In the first place, Fryer needed a new position since the Anglo-Chinese School did not renew his contract. This, of course, suggests that he took the translating job primarily for practical reasons. In a letter dated January 10, 1868, four months before he began at the arsenal, Fryer wrote that his new job would provide him with "a fine chance to distinguish myself among those who are struggling for a position in China." In another letter of the same date, Fryer wrote of his qualifications for the job: "My knowledge of Chinese and the fabulous rumours as to my proficiency will enable me to command a good position." As late as May, 1868, Fryer still thought in terms of his own advancement rather than of serving China's needs through his work. He wrote to his brother George that "I hope to make it [his new job as translator] a stepping stone to a high position in China...my ambition knows scarcely any bounds..."

There is little reason to believe that Fryer had an absorbing interest in science when he first arrived. It was only in March, 1868, after six years in China and two months before he started work for the arsenal that Fryer recorded his first interest in science by ordering scientific materials from England for "the sake of showing experiments to the Chinese." After working at the arsenal for two months, however, he mentioned that he always loved science but never had the means of pursuing it. Now he found he could "go at it in real earnest," even though he would never make a scientist.

While Fryer joined the arsenal's service initially for personal reasons, it may be stated, nevertheless, that he was aware of the influence his new work might have on China. We have seen that after 1866 Fryer, as editor of the *Chiao-hui hsin-pao*, often expressed the view that Western ideas could penetrate China more rapidly through publications than through schools. While it may have been an accident that he came to be a translator of scientific literature, the idea of spreading Western knowledge through translations was certainly not new to him. Among his papers are two clip-pings of different dates from an English newspaper published in Shanghai. One, dated May 1867, states:

> The translation of scientific works into Chinese has undoubtedly been one of the most efficient among the philanthropic schemes by which Foreigners have sought to benefit the Middle Kingdom. The translations already published have gradually increased in popularity among the

> literary classes for the simple reason that they supply one of the greatest wants of the nation.

Another, which appeared in the January 16, 1868 issue of the *Shanghai Court and Consular Gazette* declares:

> There is an evident desire among the thinking part of the nation to shake off the trammels of centuries of mental serfdom… We have heard that one department is devoted to the translation of Foreign scientific books, and shall be glad to see the announcement of the completion of such works.

Fryer, at least, regarded the contents of these clippings as significant enough to justify keeping them in his files.

Increasing Commitment to Work

In July 1868, after having spent two months at his new duties, Fryer expressed complete contentment with his employment as a translator. He wrote that "I never was more happy in my life than I am in my new situation of Translator of Scientific Books for the Chinese Government." In the same letter, Fryer wrote how deeply his work involved him: "I have begun by studying and translating three subjects at once. In the morning I take coal and coal mining in all its details, in the afternoon I dig into chemistry and in the evenings Acoustics." While his translation efforts were productive, he questioned his own competence and skill as a translator: "There are many difficulties which besett [sic] me at the outset, but a year or two of practice will I trust enable me to be of some service in this department."

It was not until May,1869, a year after he started translating for the Kiangnan Arsenal, that Fryer actually committed to paper his ideas on the significance of his work at the arsenal. By this time his position meant more to him than just a "stepping stone" to further his career. He now saw his work as being almost the only means of effectively awakening China. In addition, he believed that the Kiangnan Arsenal was a significant element in helping China to modernize:

> Looking at it [the Translation Department] in a philanthropical point of view it seems to me to be second to none of the various means that are now employed by Missionary societies–especially as it gives [access to Western ideas] to the class of Chinese who form the most important part of the nation and who can be reached in no other way.

A month later Fryer wrote again of the department:

> The Translation Department of the Kiangnan Arsenal... bids fair to become a powerful means for helping forward this venerable old nation, and bringing it somewhat into the track of the "March of civilization" which the Foreigners like generally to boast about.

With this philosophy Fryer moved ahead into his work. By July 1869 he made chlorate of potash for gun caps and tubes for firing cannon at the request of the officials at the arsenal. By September 1869, he concluded a three-year contract with the Chinese government which would terminate in June 1871. His self-confidence as a translator had so increased that we find him writing on September 28, 1869, in a frivolous vein:

> I have no competitors for a very simple reason that none can be found up to the mark. I wish I had two or three that I might be stirred up a little and curred [sic] of my laziness. Sometimes I only do an hour's work in a day.

Although he sometimes claimed to be bored with translating, actually he worked very hard. He felt more than ever that he had a good chance to succeed in China. He wrote: "as I am the first on the list there is the possibility of my eventually obtaining a tolerably high position in China."

The translation department of the Kiangnan Arsenal–especially after absorbing the Shanghai T'ung-wen kuan in 1869–also aimed at providing students in the arsenal with a practical guide to methods of manufacturing. Fryer's work now included translating books for the new school. These books covered the fields of engineering, navigation, military and naval affairs, chemistry and mineralogy. Fryer wrote of his new task: "as I am only a half-educated man I have to study pretty hard to keep pace with my duties." His work load must have increased considerably after September in order for him to write that he was now (November 1) almost overburdened. In March 1870, he again complained of the pace he had to maintain in order to produce the necessary translations. This is the only suggestion in all of Fryer's papers that he had to produce a certain quota. His work load, however, did not discourage Fryer from signing another three-year contract with the Chinese government to last until June 1874. Indeed, Fryer also accepted additional responsibilities in the form of heading up the new college of the arsenal. He expected, however, to shift this new responsibility off "on some one whom I must get out from home."

In this same letter Fryer wrote of his desire to depart from China, but he wanted to leave a good name behind him. In addition, he hoped "to be named among those who are foremost in enlightening and Christianizing the Great Empire." This letter, along with several others, is obviously self-centered and leaves little doubt that Fryer was in China primarily for his personal advancement. Yet, on other occasions, he could produce thoughtful lines on his purpose in China as he did in the letters of 1869 quoted above. Later, in an article published in 1880 Fryer recalled what faith had urged him on all these years:

> Nothing but a strong sense of duty, and a firm belief that this kind of labour is one of the most effective means under Divine guidance for bringing about the intellectual and moral regeneration of this great

> country has suffered to render endurable to the translator the long and weary years of close and continuous application which it has involved.

He pointed out the educational value of the department's work as demonstrating "the fact that knowledge is confined to no nation or country." In the same article Fryer it was China's willingness to learn that was important:

> She is therefore willing to be taught even by the "Foreign barbarian" such useful things as she feels she is ignorant of. But she must do this of her own accord, and in her own way, or not at all. This willingness to be taught and to pay for being taught is one of the most hopeful features that has appeared in her intercourse with foreign countries and is deserving of the highest commendation.

But Fryer was also conscious of the role he himself played as a cultural transmitter; he was not entirely free of a feeling of noblesse oblige common among the Europeans of the time. In 1886, in an article for the *Journal of the North China Branch of the Royal Asiatic Society*, he wrote:

> Against her [China's] will she has been brought into contact with Western nations, whose knowledge and civilization it is very much to her advantage to adopt as it would be fatal to her interests to ignore… It is impossible to shut one's eyes to the fact that the Teutonic elements seem to be acting under a Divine commission to spread Western civilization and the English language all over the world…

As Knight Biggerstaff emphasizes, Fryer wanted the Chinese to learn of the West in their own language because this was "the only medium by which Western thought could penetrate China." Undoubtedly Fryer had great faith in what the West could offer to China, but he was increasingly convinced that Western knowledge and ideas had to be transmitted through the Chinese language. He based his argument for the use of Chinese as the medium of communication on three points. The first stated that the Chinese language could grow, the second concerned the demand among the Chinese for Western knowledge. The third point emphasized that Chinese was the only way to reach the literati, who would "never consent to learn of the Barbarian whom they despise… in his own language."

Chinese Colleagues

A brief sketch of Fryer's relationship with his Chinese colleagues will help provide an introduction to his work at the arsenal. Part of Fryer's success and long stay at the arsenal can be attributed to his close relationship with his colleagues. In July 1868, he mentioned that he and his Chinese assistants got "on capitally well together so far." In November 1869, he noted how well he was treated by the mandarins who showed "far more kindness and fairness than the Europeans I have been connected with in China…"

His contacts with the Chinese were not only business, but social as well. He struck up a close friendship with Hsü Chung-ku whom Fryer invited to dinner quite often. Indeed, Fryer wrote of this particular individual that he was the "Cleverest Chinamen I ever met, and I am but a child compared to him in many respects."

Fryer's letters provide data which indicate that the Chinese translators and teachers were very interested in Western knowledge. As early as March 1869, he ordered books and materials from England specifically for his colleagues. An analysis of the orders shows that the books covered very diverse topics and fields. Of over 148 books ordered, twenty-nine were in the military area, twenty-eight were in the field of and navigation, twenty-eight in the field of manufacturing, thirteen in geology, ten in chemistry, six in mathematics, three in medicine and thirty-one on general scientific topics. At least fifteen of the books ordered were later translated into Chinese at the arsenal. In August 1868, Fryer wrote to a publishing house in England that "the officials of the Arsenal are very anxious to obtain particulars and statistics respecting the management [and] working of the Arsenals in England…" In April 1869, Fryer wrote to another publishing firm requesting catalogues with as many illustrated lists of merchandise as possible. For it was "by looking over such lists that they [the Chinese] come to know about Foreign invention and eventually purchasers."

Method of Translating

The method of translation employed by John Fryer and other foreigners at the Kiangnan Arsenal was the same as that used by the Jesuits in their translation work of the seventeenth century. It required two men, one Chinese and one Westerner. The Westerner would read the Western book in rough Chinese translation to his Chinese co-worker. The latter would take down the rough translation in Chinese, until there was something he failed to understand. Then the two men would discuss the point until it was clear and then proceed. Upon completion, the Chinese would take his rough translation and smooth it out and then, in some cases, the Westerner would read the translated work. In this manner, translations materialized through joint effort, and it might take almost a year to complete one work. However, since translators worked on several translations at the same time a number of works could be produced in a single year. Obviously, this technique required both the Westerner and the Chinese to be acquainted with the subject matter. As a consequence, some of the Chinese became the leading authorities in the country on the subjects they helped to translate.

John Fryer believed that the Chinese language presented no serious problems for purposes of translation. "It must be borne in mind," he wrote, "that the Chinese language like other languages is capable of growth." He used several methods to assist this growth. When he needed a new Chinese phrase for a Western chemical term, for example, Fryer would either look for existing nomenclature, coin a new term, invent a descriptive term or

phoneticize the foreign term. These methods produced a vocabulary, however, which did not meet with universal approval from other individuals, especially missionaries, who were also translating. Fryer, himself, expressed dissatisfaction with the existing scientific vocabularies in 1869. In fact he suggested that the willing sinologues in China should write up a scientific vocabulary in order to "supply the need which all translators experience." Faced with this necessity for a list of scientific terms, Fryer himself compiled one. In the June 187l issue of *The Chinese Recorder* mention is made of such a list. In reviewing a book on chemistry by Dr. John Kerr, head of the largest missionary hospital in China, the reviewer spoke of Kerr's Chinese vocabulary and said "the names of some of the Elements have been taken from a list supplied by Mr. J. Frier [sic]."

Later, at the Missionary Conference held in Shanghai in 1890, John Fryer read a portion of an essay he had written entitled "Scientific Terminology: Present Discrepancies and Means of Securing Uniformity." This essay essentially restated his ideas of 1869 and asked the conference to put them into effect. He pointed out the existing confusion even among the books published by the Kiangnan Arsenal and stated that "the value of a series of scientific or other books for the Chinese depends greatly on the extent to which definite rules for terminology are maintained throughout." In fact, Fryer condemned Westerners for their total disregard of the Chinese language:

> We must carefully avoid standing in our own light if we want the Chinese to respect our Western learning. Our systems have no more right to universal use than the Chinese. Their ancient and wonderful language which for some reasons is more suited to become the universal language of the world than any other, must not be tampered or trifled with by those who wish to introduce our Western sciences.

In concluding his essay, Fryer listed nine steps for developing standardized vocabularies in the various sciences. He wanted a committee to be established which would gather all existing terms used by translators including the Jesuits and Protestants of the sixteenth and seventeenth centuries and then draw up a list of generally acceptable terms. He specifically requested that "all writers of technical books already published be communicated with and asked to alter their terminology in all future editions to conform to the fixed standard." Fryer also felt that:

> Every term can only stand or fall on its own merits or demerits, in popular estimation or use. If a term is radically wrong, misleading, inconvenient or inappropriate, it is certain eventually to be supplanted by a better one, never mind who invented it.

Apparently with Fryer's essay as a foundation, the Missionary Conference established such a committee sometime after 1890 which sent out requests for ideas on how to standardize the scientific vocabulary. In this request, the committee showed the confusion in chemical nomenclature. They gave as an example of the existing confusion

John Fryer's use of six elements all called *shi* and three called *ti*. Calvin Mateer and W.M. Hayes wrote specifically of Fryer's vocabulary:

> If Dr. Fryer's chemical names and terms had been all that the occasion demanded they would no doubt have vindicated their place in the public estimation. They have had ample time and opportunity, and the fact that they have not done so is the patent proof that changes are needed.

Fryer's reply was arrogant and uncooperative:

> Your committee ought not to change my terms unless they are radically wrong and impossible to be used. Should any terms of mine be shown to be erroneous, absurd, or otherwise unserviceable and another be… without defects I will gladly yield to it and not otherwise.

Mateer and Hayes' argument against Fryer's terms was almost identical to Fryer's original proposal on developing a standardized vocabulary. It is revealing to see Fryer's response when his own advice was applied to his work. Also, the fact that missionaries, who were themselves engaged in translating, were on the terminology committee should not be forgotten. These missionaries, quite naturally, desired to see their publications spread throughout China, and not those works translated by a layman. Fryer did not agree with the missionaries' approach, because he felt that with so many faiths represented the Chinese could not help but be confused. Thus, there may have been more at stake than just the issue of confusing scientific vocabularies. Nevertheless, the committee's response to Fryer's statement pinpointed the entire problem of finding a universally acceptable scientific vocabulary for China:

> Conformity to such a diction as this [Fryer's reply] would make it impossible for us to do anything but adopt Dr. Fryer's system *in toto*. The same principle carried out in Mathematics, Physics, Astronomy, Medicine... would make short work of the whole business and leave our committee without any reason for their existence. The spirit of Dr. Fryer's remarks is in fact, just what has stopped all progress in the matter of terminology for the past twenty years.

Other interested individuals intervened and resolved the dispute. John Ferguson, a colleague of Fryer, wrote in a 1928 obituary of Fryer that once the issue was settled Fryer "was a loyal worker on the Executive Committee and as Editor of Textbooks."

Scope of Translations

John Fryer's translations for the Kiangnan Arsenal cover many fields, although his choice of subjects for translation was at first rather haphazard. In his article, "An Account of the Department for the Translation of Foreign Books at the Kiangnan Arsenal, Shanghai," dated 1880, Fryer himself criticized the range of the topics selected for translation at the arsenal. He wrote that "in most cases a translator and a Chinese writer

seem merely to have selected such subjects as suited him [sic] best without regard to the symmetry and harmony of the entire collection." He also believed that some of the topics covered were of such a specialized nature that those translations appealed to relatively few people.

Nevertheless, Fryer's translation efforts did cover the main branches of Western technology and science of the time. His published works up to 1880 totaled thirty-four volumes. The translations can be grouped by category, as in the following table:

Topics	Published 1871-1880
Manufacturing*	8
Mathematics	7
Military**	6
Engineering surveying	4
Navigation	4
Chemistry	2
Physics	2
Medicine	1
Total	34

* Manufacturing includes such topics as coal and coal mining, gunpowder, the history of iron, boring and blasting, lithography, metallurgy, and one work on the steam engine.

** Military includes gunnery instructions, fleet maneuvering, fortifications, coast defense, and gatling gun drill instructions.

Although the above totals show a heavy emphasis on manufacturing and mathematics, no particular pattern of concentration seems to emerge in an analysis of the yearly production. In 1871, for instance, Fryer translated two works on manufacturing, one on mathematics, and two on chemistry. In 1873 he did two works on military techniques (military surveying, and fleet maneuvering), two on engineering, and one on manufacturing. In 1879 he finished two works on mathematics and one each on physics, engineering, and navigation.

After 1880 it seems that Fryer followed a more carefully conceived plan in his translations. The table on p.36 gives the breakdown of Fryer's translations published between 1880 and 1896. The new pattern after 1880 was a greater concentration on natural sciences as opposed to technology (including applied science and "military and naval science"). Fryer expanded into new fields of the natural sciences and he even translated a few works on Western history and the social sciences.

Between 1880 and 1885 Fryer published nineteen translations of which twelve (or sixty-three per cent) were in the natural sciences and five (or twenty-six per cent) were in

the applied sciences. Of the nineteen works, five were in geology, geography, and mineralogy, three in chemistry, three in manufacturing, two in physics, two were vocabularies and one each on drawing, government, medicine, and etiquette.

Between 1886 and 1889 eighteen of Fryer's translations were published, of which fifteen (or eighty-three per cent) were in the natural sciences, and three (or seventeen per cent) were vocabularies and none in the social or applied sciences. Of the eighteen works, the largest number was in physics, with six books translated, while five were in mathematics, three were vocabularies, and one each in astronomy, chemistry, drawing, and etiquette.

During Fryer's last years in China the gap between natural science and applied science closed somewhat. Of the forty-one translations that appeared between 1890 and 1896, sixteen (or thirty-nine per cent) were in the natural sciences, fifteen (or thirty-seven per cent) were in the

Topic	Total Number
Physics	14
Chemistry	7
Geology, geography, meterology	7
Manufacturing*	7
Mathematics	6
Vocabularies**	5
Medicine, health	5
Military+	4
Engineering, surveying	3
Botany, zoology	3
Law	3
Drawing	2
Political Economy	1
History	1
Physiology, anatomy	1
Government	1
Navigation	1
Miscellaneous++	7
Total	78

* Manufacturing includes works on metallurgy, the working of silver ores, marine steam engines, nickel plating and a work on "docks."

** Vocabularies are works which Fryer produced establishing the terminology for chemistry, mineralogy, steam engine and materia medica.

+ The heading includes works on "military railways," tactics, fortifications and one on the "Armies of the Great Powers."

++ This heading includes works on the Columbian Exposition, "coinage," mental photography, "money," an item on the state and its relation to trade, "Western Etiquette" and "Scientific Handicraft."

applied sciences, six (or fifteen per cent) in history and social science and four (or nine per cent) in military and naval science. Among the sixteen in the natural sciences, six were on physics, three on chemistry, three on botany and zoology, and one each on physiology and anatomy, mineralogy, political economy, and mathematics. Of the fifteen works in the applied science area, Tour were in manufacturing, three in engineering and surveying, four in medicine and one each in navigation, the Columbia Exposition, coinage and "mental photography." In the history and social science category six works were published, three on international law, and one each in "money," history, and the state and trade. The four works published in the military and naval science area covered explosives, railways, engineering, and the "Armies of the Great Powers."

The total number of publications for the period 1880-1896 was seventy-eight, with forty-three works (or fifty-five per cent in the natural sciences, nineteen works (or twenty-six per cent) in the applied sciences, seven works (or eight per cent) in history and the social sciences, five vocabularies (or six per cent) and four works (or five per cent) in the military and naval sciences.

Fryer's total contribution of 129 translations may be divided into the previously suggested five categories: natural science, applied science, military and naval science, and history and social science. (Of this total, seventy-seven were published by the Kiangnan Arsenal including fourteen released between 1896 and 1909, when Fryer was in California. The remaining thirty-eight books were published by the School and Textbook Committee and the Chinese Scientific Book Depot.) Of the 129 books fifty-seven were in natural science, which break down as follows:

Topic	Total
Physics	17
Mathematics	15
Chemistry	9
Geology, geography, meteorology, and astronomy	7
Botany and zoology	3
Drawing	2
Physiology and anatomy	1
Miscellaneous	3
	57

Fryer's translations in physics were concentrated in the decade 1885-1894, when he did fourteen. He had published only two before, and was to publish only one after this period. Between 1887 and 1888 Fryer produced five works in mathematics, and during the period 1871 to 1879 he completed seven. Fryer translated works on chemistry throughout his stay in China. Translations on geology, geography, and mineralogy, and astronomy were all produced after 1880, the last one in 1893. The three works in botany and zoology were all published in 1894 and 1895, the two on drawing were done in 1885 and 1888 and the one on physiology and anatomy in 1894. The miscellaneous works include: "Western Etiquette: What To Do" (1885), "Western Etiquette: What to Avoid" (1886), and "Scientific Handicraft" (1894).

The forty-eight works in the applied science category break down into five areas:

Topic	Total
Manufacturing	18
Surveying, engineering	10*
Medicine, health	8
Navigation	5
Agriculture	2
Miscellaneous	5
	48

*One work on naval architecture was completed but never published.

In the manufacturing category Fryer produced eight translations between 1871 and 1877. Between 1880 and 1899 ten works were completed, and in 1902 one more was added to the list. In the category of surveying and engineering five items were translated between 1872 and 1880 (one was never published), three were added in 1894, and two more in 1899. Six of the seven works on medicine and health were produced between 1892 and 1899, with one early production done in 1872. Four of the five works on navigation were published relatively early in Fryer's career, one in 1870, two in 1876, one in 1879; the final work appeared in 1895. The two works on agriculture were published quite late, one in 1901 and the other in 1903. The miscellaneous items include: a work on the Columbian Exposition (1896), rearing silk worms (1898), and a prospector's handbook (1899).

Fourteen works were in the military and naval science category, with six completed between 1872 and 1876, and four between 1893 and 1895. (Three translations have no date of publication and one was translated by 1880 but never published). Of the fourteen three were on gunnery instructions, three on defense, one each on maneuvering, tactics,

military surveying, military railways, and the naval examinations of Russia, Britain, and the United States, plus one general account of the "Armies of the Great Powers."

It was not until 1885 that Fryer began translating works on history and social science, producing a total of ten works. Four of these translations were on international law, one on political economy, one each on history, trade and money. One work was a description of the University of California, Berkeley, and another was an item dealing with "teaching the blind." Perhaps the most significant work produced in this category was one called *Tso-chih chu-yen* (Homely words to aid governance), published in 1885 which, as will be seen, was to exert an influence certainly beyond Fryer's expectations.

From the above analysis, it is evident that the emphasis in Fryer's translations shifted to natural or pure science after 1880, and especially after 1885. Moreover, of all the books he translated between 1871 and 1909, more were on science than on technology. This trend may reflect the growing need for books in pure science in the Chinese government schools and in the missionary schools. Since, as we have shown above, Fryer was given complete freedom by the Kiangnan Arsenal to choose the works to be translated, the trend also shows Fryer's own progress in his scientific studies and his awareness of China's needs for the more basic scientific knowledge. The fact that Fryer branched out to translate works on history and social science suggests that he realized what were the weaknesses of China's "self-strengthening movement."

Influence of Translations

It must be remembered that John Fryer's principal occupation was to translate books for the Kiangnan Arsenal, as an employee of the Chinese government. At least up to the 1880's, however, the Kiangnan Arsenal did not always make use of the books, despite the fact that courses in naval architecture, marine engineering, and military science were taught at the arsenal. Fryer expressed disappointment in this failure to use his translations and stated that "like many other things in China it is difficult to account for." Perhaps the failure of the arsenal to use his translations prompted Fryer to seek other ways to spread Western knowledge and ideas. As we shall see, Fryer was to make use of his translations in many of his other endeavors in China.

Even though his books were not utilized by the arsenal to the degree Fryer had hoped, they were nevertheless available in print to Chinese outside the arsenal. In fact, it may be argued that the chief beneficiaries of Fryer's translations were the Chinese literati who were, beginning in the 1870's and 1880's, showing a real interest in Western learning.

Between 1870, when the first translations by Fryer were published, and 1880, the date of Fryer's report, more than 30,000 copies of books were sold. (These sales figures do not include those sold at other translation bureaus located in Peking and at missionary presses. It is also impossible to find the distribution figures of the pirated editions, which

according to Fryer were "copied by photolithography in small characters and sold at absurdly small prices.") Between 1880 and 1896, when Fryer left China, he completed thirty-one works for the Kiangnan Arsenal and forty-six works in connection with his other projects. The sale of these, both in authorized and pirated editions, must have raised the total to a rather high number, though I have been unable to determine what it was. From Fryer's own testimony in his letters of 1897, in connection with the Chinese Scientific Book Depot (which he established in 1884), 'it is certain that there was a great spurt in the sale of books in the 1890's.

Some figures on the circulation of individual publications are available. A work on Krupp's guns translated by Carl Kreyer in 1872 sold nine hundred and four copies in eight years. In nine years, a work on coast defense, first published in 1871, sold 1,114 copies, which is not surprising, since many Chinese were interested in the problem of military "self-strengthening." But works on mathematics and mineralogy also had a comparatively large sale. A Treatise on Practical Geometry (1871) sold a thousand copies in eight years. In seven years A Treatise on Algebra (1873) sold seven hundred and eighty-one copies. Fryer's work on coal mining published in 1871 sold eight hundred and forty copies in nine years. These figures, of course, are very small when compared to book sales in Western nations. Fryer wrote of the difficulties of making China aware of these publications:

> The sales that have taken place up to the present time, though considerable, are nothing when compared with what might have been expected among such an extensive population. But with no regular means of communication, no postal or railway arrangement, no agencies and no advertisements or other means of bringing them into general notice, or distributing them it is easy to understand why more of the books have not already been disposed of.

While it is difficult to say precisely where the volumes were going and to whom they were appealing, there are several specific examples of the influence of Fryer's works that can be documented. When the young K'ang Yu-wei went through Shanghai in 1882, he purchased all the works published by the Kiangnan Arsenal, including the translations of Fryer, as well as the Chinese publications of the missionaries. Richard C. Howard, in his study of K'ang's early thought, has concluded that "from information supplied by his biographies and by K'ang himself, it appears that a large part of the translations studied by K'ang in the early 1880’s were concerned with such subjects as science, technology, and mathematics." Although K'ang himself many years later wrote in his autobiography that "the Western works translated by Fryer all deal with such unimportant studies as military science and medicine," K'ang's readings on scientific subjects undoubtedly had an effect on his thinking at the time, as seen in the scientific terminology he frequently used. Moreover, there is evidence that K'ang was very much influenced by one of Fryer's

non-scientific books. In 1885 Fryer published *Tso-chih chu-yen* (Homely words to aid governance), which according to S.L. Tikvinsky contributed to K'ang's thought in the latter's *Ta-t'ung shu* (The book of great unity). In fact, Tikvinsky believes that K'ang made use of certain portions of "Homely Words" when he wrote the *Ta-t'ung shu*.

Between 1890 and 1892 K'ang's disciple, Liang Ch'i-ch'ao, and his brother purchased many of the Kiangnan Arsenal publications and the *Ko-chih hui pien*. Then in 1896 Liang compiled a recommended reading list which he hoped would provide interested Chinese with an introduction to Western topics. Of this list of approximately three hundred and twenty-nine published works, as many as one hundred nineteen (or thirty-six per cent) were translations by Fryer. This fact itself shows the importance of Fryer's translations in the transmission of Western knowledge and ideas to the Chinese of the time. Liang's bibliography praised Fryer's *Tso-chih chu-yen* as "the best book on politics," and listed four works by Fryer on law, two on commerce and two on history. Like K'ang, Liang pointed out that too few works on non-scientific subjects had been translated into Chinese. But Liang emphasized that knowledge of science and technology was the source not only of national strength but also of civilization (*wen-ming*) itself. He wrote that physics, chemistry, metallurgy, and other studies were far more complex than the textual and literary studies of the Chinese and therefore more advanced. He appealed to his contemporaries to read all the books he listed. Works which Liang particularly recommended were marked by an asterisk-like sign. Except for eighteen items, all of Fryer's one hundred and nineteen works, were marked in this way. (For a breakdown of the works listed by Liang, including those translated by Fryer, see Appendix IV.)

Another reformer, T'an Ssu-t'ung, wrote in 1894 on such topics as astronomy, chemistry, geography, zoology, and globes, which means he must have had some previous acquaintance with these subjects. While it is difficult to attribute all his ideas to Fryer's translations, T'an did specifically mention an 1877 edition of the *Ko-chih hui-pien*. In 1893, T'an had visited Fryer's home in Shanghai and he wrote to a friend that Fryer showed him many new things including fossils and photographic equipment. While in Shanghai, he also bought many scientific works published by the Kiangnan Arsenal. Another source mentions that T'an "read omniverously in translation all of the Western books which he could lay his hands on." T'an himself wrote in the introduction to his *Jen-hsueh* (On love): "One should know the New Testament, as well as works on mathematics, science and the social sciences."

K'ang, Liang and T'an are only three examples of the literati of the time who read Fryer's work. K'ang had attracted disciples even before 1895 and after that date all three reformers had large followings. It may be assumed that through the influence of K'ang, Liang, T'an and other reformers, many more Chinese became acquainted with Fryer's translations toward the end of the nineteenth century.

Chapter III

Promotion of Western Knowledge through Private Effort

John Fryer's contribution to China lies chiefly in the more than seventy-five works rendered by him into Chinese and published by the Kiangnan Arsenal. But in the years that he was employed by the arsenal he developed several activities on the side, all of which were related to the introduction of Western knowledge to the Chinese. We have seen that when he first entered the arsenal's service, he did so perhaps primarily for the sake of a secure and promising employment. But only a few years after he started, he became so convinced of the value of his work that he made efforts on his own to help the diffusion of Western knowledge in China. In 1875 Fryer participated in establishing China's first public library of scientific books, the Shanghai Polytechnic Institute. In the same year, he founded the Ko-chih hui-pien. Beginning in 1877 he cooperated with the missionaries in the work of the School and Textbook Committee, endeavoring to improve scientific books used in Christian and other schools, and in 1884 he established the Chinese Scientific Book Depot, a firm dealing chiefly in Chinese-language books introducing Western knowledge.

These endeavors of Fryer's are reviewed in this chapter. While the Polytechnic Institute's library and its Saturday night lectures chiefly benefited the Chinese in Shanghai, the essay contests it sponsored aroused interest elsewhere in China. The Ko-chih hui-pien, especially, created considerable interest among the Chinese literati in several parts of the empire. Through the Book Depot, translations done by Fryer and others became available at least in seven cities on the China coast.

The Shanghai Polytechnic Institute (Ko-chih shu-yüan)

The idea for a Shanghai Polytechnic Institute and Reading Room grew out of the Society for the Diffusion of Useful Knowledge (Kuang-hsüeh hui) in China founded in Peking in 1872. The goals of this society were to introduce modern science and liberal thought into China. It was hoped that new ways of thought would help to overthrow ancient superstitions which constituted the main barriers to material and social improvement within China. Upon the establishment of the society, the *North China Herald* published an editorial which urged the founding of a similar organization. in Shanghai. Two years later Walter H. Medhurst, the British consul in Shanghai, reiterated the *Herald*'s proposal.

With this encouragement from the British consul a group of interested people met on March 24, 1874. The group approved the establishment of an organization with goals similar to those of the society in Peking. The plan was to organize a reading room which

would be open to the Chinese. The reading room would also have items of Western manufacture on display.

At the original meeting on March 24 a discussion took place about the inclusion of religious material within the reading room. The nonmissionary members of the group felt it should be excluded since it might keep interested Chinese away. John Fryer was probably among those who opposed having religious materials included. He lacked sympathy with missionary endeavors, except in truly educational projects, because "he was convinced that they estranged two people [Westerners and Chinese] who could otherwise find common ground through shared interest in the less personal and emotional realm of science…"

After debating this question, resolved in favor of the nonmissionary members, the group appointed a committee to solicit funds from both Chinese and foreign sources. The committee consisted of Medhurst, F.B. Forbes (an American merchant and part-time botanist), Alexander Wylie, John Fryer and Tong King-sing (Director of the officially-sponsored China Merchants' Steam Navigation Company). Later, three more Chinese joined the committee: Hsü Shou, Hsü Chien-yin, both of the Kiangnan Arsenal, and Wang Kin-tang (an interpreter to the Intendant of Shanghai). This committee, with some changes in membership. controlled the institute until it ceased operations in 1917. The dominant figures of the committee, according to Biggerstaff, were John Fryer and Hsü Shou, until the latter's death in 1884. Medhurst spoke of Fryer at the opening ceremonies in the following manner:

> Mr. Fryer to whose exertions (I am happy to have the opportunity of saying thus publicly) is due all the success that has been already attained, thereupon suggested that the proposed institution should be something more than a mere reading room, and that an endeavor should be made to form it into a Polytechnic institution and school of art as well.

From the moment of the opening of the reading room Fryer became the secretary of the organization and remained at this post until he left China in 1896. As secretary, Fryer issued at least four reports on the institute, of which only the fourth report can be found. However, the China Review commented upon the second report in which Fryer apparently complained of the lack of enthusiasm with which the Chinese received the institute. The China Review attributed their indifference to dissatisfaction over the small number of books in the library. The same article, however, did conclude by saying that "we think the Institute has done very well so far and deserves the warmest support of the public." Biggerstaff explains the apathy of the Chinese as due both to the disappointingly small number of objects displayed and the poor management of the reading rooms.

In addition to his job as secretary, John Fryer was responsible for the exhibition of Western articles. Displays of needle and fish hook manufactures, a collection of telegraphy apparatus, a pyrometer, voltameters, celestial and terrestial globes,

astronomical equipment, photographs of locomotives, firearms, iron-framed houses, and artillery were to be seen in the reading room. This might appear as an impressive display, but apparently the Chinese were not interested.

John Fryer's Fourth Report of l885 discussed at some length the problem of lack of attendance. Fryer concluded that the difficulty lay primarily with the management of the institute and not with the contents of the reading room. As a result this report the institute was reorganized and joint Sino-Western control of its affairs replaced what had become almost exclusively Chinese. The institute then sponsored two projects calculated to attract attention: a series of essay contests and public lectures. John Fryer played a major role in promoting and establishing both these schemes for helping to introduce Western topics to the Chinese.

Editing the Ko-chih hui-pien

In addition to his active participation in the affairs of the institute, Fryer helped stimulate Chinese interest in it through journalism. Although this venture was not directly connected with the Polytechnic Institute, it grew out of Fryer's association with the organization. Previously he had edited the *Chiao-hui hsin-pao* in Shanghai from 1865 to 1868. From that experience, he realized that newspapers and periodicals could reach those who otherwise might not listen to Westerners. It was this realization that prompted him to publish the *Ko-chih hui-pien*. In November l875, he issued a handbill announcing that he intended to found a scientific journal. The general objective of the periodical, which would be published monthly, was "to meet the growing desire that now exists among Chinese for Western Scientific Knowledge." The handbill stated Fryer's hope that the magazine would:

> ...do much to foster the spirit of enquiry and to disseminate useful and popular scientific information throughout the Empire. It will serve as an introduction to the translations of Scientific Books already existing in Chinese; it will contain notes of courses, of lessons, or lectures on Scientific subjects; and it will be a medium by which the educated classes of natives can ask for and obtain specific information on such subjects connected with the Sciences as they may be interested in… The Magazine will contain as many illustrations and engravings as can be procured…

Fryer had one other purpose for the magazine which he did not mention in his handbill–to compensate for the limited scope of the translations of the Kiangnan Arsenal. In other words, *The Chinese Scientific Magazine* was to provide material which would be of more general interest than the Kiangnan Arsenal translations.

Before Fryer had time to publish the first edition of his magazine, he received help from the Society for the Diffusion of Useful Knowledge. Just as he began operations, the

society decided to close down its organization in Peking. The committee for the institute decided that Fryer should amalgamate the society's magazine, *Chung-hsi wen-chien lu* (The Peking magazine) with his venture. Accordingly the *Ko-chih hui-pien* gained both readers and contributors from Peking.

The first number of the *Ko-chih hui-pien* appeared in February 1876, identified as "A Monthly Journal of Popular Scientific Information with which is Incorporated The Peking Magazine." During the second year of publication Fryer changed the English title to *The Chinese Scientific and Industrial Magazine* and the sub-title to "A Monthly Journal of Popular Information Relating to the Sciences, Arts and Manufactures of the West.

Essays on various significant scientific and technological subjects appeared in the journal. Among the contributors were Dr. J. Edkins, Dr. John MacGowan, Dr. Alexander Williamson and Rev. William Muirhead. Dr. William A.P. Martin devoted an article to the typewriter; an analysis of certain Chinese iron-ores came from Professor Anatole Billequin, a chemistry professor at the Peking T'ung-wen kuan; a series of articles on feeling the pulse and examining the tongue from Shu Kao-ti (Dr. V.P. Suvoong); and on mathematical problems by members of Peking University. The magazine was "freely illustrated and devoted principally to translations from British and American magazines of a similar nature, though longer treatises were often published in installments…"

The shorter articles covered a broad range of topics, including Japanese use of Western technology, suggestions regarding Chinese silk culture, the manufacture of lime, of leather and aluminum, treatments of linens in the West, European cotton-processing machinery, calculating machinery, microbes, medical treatment and drugs, dentistry, mathematical measurement in map making, the Krupp Armament Works, the explosive "Romite" in railroads, and biographies of Columbus, James Watt, Benjamin Franklin, Richard Cobden, Matteo Ricci, Adam Schall, Li Hung-chang and Hsü Shou.

The longer articles, issued in installments, also covered a variety of fields and subjects. An introductory series on modern science provides a good example. It included information on astronomy, laws of matter and motion, geology, geography, heat, light, electricity, chemistry, botany, and physical anthropology. Later series concentrated on scientific apparatus, Western horticulture, chemistry and health, sanitation, lessons in elementary drawing, photography, naval warfare, the manufacture of gunpowder, and Russian history. Judging from these randomly selected articles, the main emphasis was on the scientific and technological aspects of Western learning.

In addition to articles, the magazine contained illustrated advertisements, placed primarily by British manufacturers. Descriptions of Western goods undoubtedly helped to create curiosity and awareness of Western products on the part of the Chinese. Fryer also advertised the Polytechnic Institute and the essay contests in the magazine.

As in the case of the books Fryer translated, it is difficult to estimate the influence of the *Ko-chih hui-pien* because statistical evidence is lacking. In the first place, there was no way of keeping track of the customers. Fryer mentioned that his "customers [were] scattered all over China, and generally unknown." Various bookstores probably distributed the magazine, which accounts for the anonymity of the purchasers. One scholar has estimated that the circulation of the magazine was as high as four thousand a month during the early 1890's.

The editor's correspondence section offers a clue to the popularity of the magazine. This section kept Fryer so busy that he had to hire an assistant. *The Celestial Empire* found that the number of inquiries to the *Ko-chih hui-pien* was a hopeful sign for the usefulness of the magazine. These inquiries covered many subjects, according to the *Empire*, and the answers should have been particularly illuminating for the readers of the magazine. In addition, the *Empire* believed that this access "to the knowledge contained in Western books is a privilege which but few Chinamen can understand or appreciate." That such a section could receive so many requests from various parts of China reveals that there was indeed a growing desire within China to learn more about the West. Fryer's willingness to devote much of his free time to the task of answering these letters clearly indicated his eagerness to promote Western learning in China. The number and type of responses reveals not only that the readers were attentive but also that some educated and influential Chinese read the *Ko-chih hui-pien*.

Western newspapers and journals published in China during this period also credit the magazine with possessing a wide influence. In the 1877-1878 issue of *The China Review*, the editor was very optimistic:

> This Chinese Scientific Magazine has been the one great success achieved by the Polytechnic Institution. Two volumes are now lying before us, formed of articles, on all branches of science written in intelligible easy style, copies have found their way all over China and, supplied as they are with illustrations, are to pave the way for the introduction of European science into China.

Perhaps the longest and most complete of the magazine appeared in *The Celestial Empire*:

> The educators of the Chinese are their real conquerors, and it is in the works of foreign scholars translated into the vernacular and the triumphs of Western civility brought to the notice of the self-satisified people of China by means of scientific people and literary publications, that we cannot but recognize the most powerful engine in the regeneration of the country. Of the latter class we have a really bright example in the Chinese Scientific and Industrial Magazine.

The editors continued with an appeal for foreign support for the periodical because of its potentials. They claimed that:

> If China is ever to be regenerated and her vast natural resources developed we believe it will be to a great extent through the publication of periodicals of this kind whose "continual dropping" must eventually "wear away the stone." Where the foreign merchant or missionary cannot or perhaps dare not go, these messengers of enlightenment find a welcome, and make their silent though powerful appeal to many a feeble intellect obscurred [*sic*] by the dust and cobwebs of hundreds and even thousands of years…

These same editors, however, declared that the articles were somewhat too advanced for ordinary readers and that more popular subjects could be added. This criticism is revealing in view of Fryer's hope that the articles would have a general appeal. The editors also found that the translations were sometimes rather confusing, but they also pointed out that Fryer was doing the job of editing in his leisure hours, so that the obscurities and typographical errors should be overlooked. Although specific evidence is a little scarce, one may conclude that the *Ko-chih hui-pien* was influential in introducing Western science into China.

The magazine appeared at regular intervals in 1876 and 1877, then suspended publication for two years, part of which time Fryer was on leave in England. From 1879 to 1881 the periodical was once again published regularly. Three numbers came out during 1890 and 1891, then publication ceased altogether. In a letter written by Fryer's son in 1896 to an interested party in Chicago, mention was made of the magazine: "the publication of *The Chinese Scientific and Industrial Magazine* we regret to say, is discontinued at present for various reasons among which may be mentioned that the chief editor is absent on furlough for some months. We hope, however, to republish the paper before a great while…" With John Fryer taking up permanent residence in California in 1896 the *Ko-chih hui-pien* never resumed publication.

Essay Contests

According to Biggerstaff the most successful undertaking of the Polytechnic Institute was the essay contests, which began in 1884. The objective of the contests was "to try and induce the Chinese literati to investigate the various departments of Western knowledge with the view to their application in the Middle Kingdom." The idea behind the contests was to take advantage of the examination-taking habits of the literati and encourage them to write essays on foreign subjects. In essence Fryer hoped to make the literati "read, think and write on foreign subjects of practical utility and thus carry out one of the main objects for which the Polytechnic Institute was founded." In 1887 he was able to report that the plan succeeded to a degree far beyond the hopes of the originators.

Topics for the essay contests were usually selected by a high official who would judge the completed essays and award a sum of money and sometimes a position on his staff to the best essayist. The contests were held every quarter and during the first four years there were from twenty-six to eighty-one participants in each contest. For the 1886-1887 period the essay topics were: "Chen-tang and Kan-yen-shou (two famous generals of the Han dynasty whose doings and plans are to be compared)"; "A discourse on the naval defense of China"; "What ought China at the present time to regard as of foremost importance in her endeavor to improve wealth and power?"; "What advantages and disadvantages would China realize by establishing railroads?"; "Compare the sciences of China and of the West, showing their points of difference and similarity"; "How can the evils attending the introduction of telegraphs and steam boats in China be removed and the benefits rendered permanent?"; "What is the cause of the present unprofitable state in silk and tea and how is it to be remedied?" With such topics, the contestants had to acquire some technical knowledge in order to produce effective essays.

An outline of the winning essay on "What ought China at the present time to regard as of foremost importance?" will provide an example of the type. The contestant considered the following points as most important to improve China's wealth and power: respect the holy religion (of Confucianism), renew the various branches of learning, promote the discussion of public affairs, give weight to the statutes and laws, facilitate promotion to official position, reform military administration, extend mercantile pursuits, encourage agricultural industry, improve internal communication, and revise treaties with other nations.

The originator of the question, the customs taotai of Tientsin, criticized the answer because of its lack of originality although he did say these points showed a thorough understanding of the problem. Wang Tsz-ching [*sic*], another critic, thought that while these points did bring in much of Western methods, they were still within reason. He continued: "If they could all be carried out in China there is not one of them advantageous." Fryer's criticism of the essay was that it contained erroneous material; the sentiments put forth were not complimentary to foreigners and a conservative element often appeared.

Fryer stated that some of the writers attempted to show off their broad knowledge of statistics and facts on foreign countries, while others added maps and diagrams to their essays. All of the essayists, he found, possessed an "astonishing amount of general knowledge, compared with what might have been expected, and show that they have read more or less extensively of what has been published in the Chinese language, whether in newspaper serials or translated works of a scientific or political character. Fryer, however, did not continue to see the essays in the same light. In 1896, the year he left China, he noted in *The Chinese Recorder* of which he was education editor, that at least one-half of the competitors were connected with mission schools and colleges. In

addition, he found that while the stories were up to an expected standard, there was "a great paucity of new ideas among the Chinese and hence many of these attempts are merely old literary rubbish and poetry worked up in a form under a new name…" Although Fryer had second thoughts about the quality of the essays after almost ten years' experience with them, he concluded his report on an optimistic note. He stated the contests were:

> The insertion of the thin edge of a wedge that may eventually aid in the great work that yet remains to be accomplished of opening up the hitherto inaccessible mind and heart of the nation, and letting in the light of Western truth in all various ramifications.

John Fryer played more than one important role in connection with the contests. He not only urged that they be organized but provided the incentive to keep them going. Biggerstaff states that in 1897, after Fryer left China and Wang T'ao, who supported the institute, died, "the prize essay contests were no longer promoted with the same energy as formerly." Fryer apparently arrange for the winning three essays of each quarter to be published in a book, with the criticisms of the judges attached. In view of his long journalistic associations, he may also have been the one who released the prize essays to the newspapers. It seems clear from these facts that John Fryer's support was a major factor in the success of the prize essay contests.

Lecture Series

It was not until 1894 that the committee of the Polytechnic Institute authorized the establishment of classes and a lecture series to be conducted in Chinese. Little is known of the classes except that they and the lectures covered scientific and technological subjects. The curriculum included six fields of science: mining, electricity, surveying, construction engineering, the steam engine, and manufacturing. None of the applicants for the classes possessed a satisfactory background in mathematics to pass a qualifying examination. Therefore, the institute started a class in elementary arithmetic which rapidly grew.

The lecture series was entitled Magic Lantern Lectures presumably because a slide projector was used. Fryer delivered most of the lectures on topics such as mines and coal mining operations, human physiology and anatomy, zoology and one on the Chicago Exposition. Fryer's familiarity with the subjects and with the Chinese language probably made him a satisfactory lecturer. In February 1896, Fryer wrote that it looked as though the Polytechnic Institute was at last "about to realize through these science classes and lectures some of the original intentions of its founders, and 'become one of the centres for imparting the light of Western knowledge about the Middle Kingdom."

Although the reading rooms of the Polytechnic Institute themselves did not attract many Chinese, the institute as a whole attracted enough attention to merit its

continuation. The essay contests, the lecture series, the classes and the *Ko-chih hui-pien* helped stimulate continued Chinese interest in the institute. And all of these endeavors, except the classes, were under the guiding hand of John Fryer.

The School and Textbook Committee

In 1877 a General Missionary Conference was held in Shanghai. Besides the many missionaries, there were several nonmissionaries, John Fryer included, in attendance. His presence at this conference is an example of Fryer's willingness to cooperate with the missionaries in purely educational undertakings. The committee called the School and Textbook Committee, with Fryer as secretary. Its purpose was to prepare a series of elementary school books which would provide the Chinese with an opportunity to learn both their own language and Western knowledge and ideas at the same time.

At a later meeting the committee decided to prepare two series of textbooks, elementary and advanced, covering ten subjects: mathematics, surveying, astronomy, geology, chemistry, zoology, geography, history, language, and music.

At its meeting in October 1879 Fryer resigned as secretary of the School and Textbook Committee, but accepted the post of general editor of the entire series. He took this new position with the stipulation that he would edit only secular works and, furthermore, he requested each writer to act, as far as possible, as his own editor. As for the secular books mentioned by Fryer, he proposed that "as the books were easily divided into religious and secular… they should remain so, so that Chinese who might object to subscribe for religious works might be enabled to do so for secular ones only." The committee deemed this proposal inadvisable.

At this same meeting in 1879 the committee announced that fifty-one books were in preparation. It is not known what stage any of the work was in or who was participating in it. But by 1886 a total of one hundred and four books had been published, of which Fryer had contributed nearly a quarter. Twelve of his books dealt with such subjects as astronomy, geography, chemistry, electro-metallurgy, meteorology, history, photography, scientific vocabulary, and iron manufacture. Five were wall charts accompanied by handbooks on botany, mechanics, mineralogy, drawing, and the properties of matter. Eight were in an outline series covering acoustics, arithmetic, astronomy, chemistry, geography, geology, and pneumatics. Fryer also had in preparation a book on "The Industries of the West," ten items in the outline series on such topics as heat, light, electricity, hydraulics and hydrostatics, and eight items in a wall chart series. The outline series was "condensed from the best English and American originals procurable and... [was]... carefully prepared and arranged so as to serve the double purpose of the most elementary school books or Primers, and of Outlines of the Sciences for general reading."

All of the books deal with the basic sciences. Since the books were aimed at school-age children, few of Fryer's translations done for the arsenal, because of their technical

nature, were appropriate for the series. Nevertheless, his professional work undoubtedly provided him with an excellent background for producing outlines and wall charts plus actual textbooks in the fields of chemistry, geography, and mathematics.

In 1870 the General Missionary Conference became the Education Association of China and retained the School and Textbook Committee as part of its program. In July 1893 the association appointed John Fryer, in addition to his other duties, educational editor of the *Chinese Recorder*. This post he held with the assistance of John C. Ferguson. Fryer wrote in the *Chinese Recorder*, as part of his first editorial, that the pages "will be filled monthly with the discussion of such subjects as are of interest and value to the large number of fellow laborers engaged in educational work in China." He either had little to write or lacked time for his column was irregular and rather brief when it did appear. He discussed chemical terminology in one editorial. He made comments on John Kerr's discussion of terminology which had taken place earlier, reviewed the Christian College of Canton's First Annual Report and wrote some book reviews in other columns.

Upon Fryer's departure from China in 1896, the editors of the *Chinese Recorder* stated that most of their school books had been printed under Fryer's direction, and that these were only a portion of the work he had "done to provide a basis for the acquisition of new knowledge by the Chinese." Thus, John Fryer had achieved his goal of providing a translated literature through which the Chinese could learn of the West and of Western ideas. If the Chinese took advantage only of the textbook series they would have acquired a broad background in Western science and certainly an introduction to other areas of Western thought. If upon completion of this series interested Chinese desired to pursue a topic further, Fryer's more advanced translations might well have them with an opportunity to do so.

The Chinese Scientific Book Depot

In 1885 John Fryer established the Chinese Scientific Book Depot for the purpose of facilitating "the spread of useful literature among the Chinese…" The phrase "useful literature" seems to have meant all books, either written or translated by missionaries, laymen, Westerners or Chinese. An 1886 catalogue of the depot provides the only clue to the contents of the store. It lists a total of three hundred seventy-one books, maps, charts, or globes for sale which may be tabularized as follows:

	Western Authors	Chinese Authors	Total
Science	44	15	59
Language (training materials)	19	6	25
China	5	44	49
Medicine	17	7	24
Military (defense, armaments and war)	14	8	22
Mathematics	16	19	35
Charts/Handbooks	19	--	19
Manufacturing	9	--	9
History	5	14	19
Navigation	4	--	4
Diplomacy/Law	5	7	12
Education	3	3	6
Maps	1	18	19
Illustrations	--	28	28
Accounts of Travel	--	6	6
Miscellaneous	14	21	35
	175	196	371

A complete listing of the titles under these categories appears in Appendix V. The category "Science" includes all works dealing with the basic sciences, chemistry, botany, metallurgy and zoology. "Manufacturing" contains items on the steam engine, coal and coal mining, boring and blasting, and mechanics. "Illustrations" cover those items which were listed as illustrations of birds, Chinese painting, pictures of noted subjects and various picture books. The "Accounts of Travel" column contains those works which were presumably travel reports from various countries. The miscellaneous category includes all works which were difficult to classify.

Although Chinese authors produced only a few books on mathematics and even fewer on science, their works on China, including the classics and commentaries on them, were numerically second only to science. Such heavy emphasis indicates that a large demand for this type of material existed within China. John Fryer's Scientific Book Depot was well stocked in books dealing with traditional aspects of Chinese culture, as well as with works on modern Western ideas. The catalogue included forty-four works which Fryer translated, twenty-eight of them done for the Kiangnan Arsenal. The depot had for

sale an additional sixteen translations published by the arsenal, thirteen by Carl Kreyer, two by Alexander Wylie, and one by Young J. Allen.

By 1888 there were six hundred and fifty titles on Western topics and two hundred and twenty-eight original Chinese works in the depot. Moreover, branches had been established in Tientsin, Hangchow, Swatow, Peking, Foochow and Hong Kong, and more than $17,000 (Chinese dollars) worth of books and maps had been sold, representing a total sale of about 150,000 *chüan* of Chinese books. Fryer accounted for the number of sales by claiming:

> What the Chinese really want they are prepared to pay for at its full cost. The better classes, at least, are too proud to receive eleemosynary aid even in obtaining books that would impart useful knowledge. Self-support was therefore the motto which was placed first and foremost in the organization of this depot…

The *Chinese Recorder* corroborated this statement by asserting "that books of useful Western knowledge can now be circulated in China with little but indirect aid from Western scholars and philanthropists."

After the Sino-Japanese War of 1894-1895 the book business boomed. Fryer wrote in 1896 that the demand for books was so great all over China that the printers could not keep pace with it. Books and articles on the war were of special interest. In April 1896, Fryer wrote to Young J. Allen about an article the latter had written on the war, inquiring into the possibilities of obtaining five hundred copies of the work for the depot. These copies must have sold out quickly for by August 1896, the depot requested an additional one hundred copies and in September ordered still another hundred copies.

Fryer never lost sight of his original hopes for the depot. In 1897 during a summer in Shanghai, he wrote to Dr. William A.P. Martin in Peking that the depot "is all helping forward the good cause of educational progress in China, which we both have so much at heart." The significance and influence of the depot, like Fryer's other endeavors, must be pieced together. The *Shanghai Times* wrote in 1911, the year Fryer withdrew from the depot, that it "was for years the Mecca of the young students of China." The large number of books sold provides further evidence of its influence. To establish and maintain an organization such as the book depot, dedicated to helping the Chinese become aware of Western ideas, must have taken a considerable amount of time and energy, yet Fryer seems to have enjoyed it. Even in later as Professor of Oriental Language and Literature, he strove to widen avenues of international understanding and communication by teaching young Americans about the Far East.

Conclusion

Fryer’s Contribution in Perspective

At Berkeley, John Fryer held the Louis Agassiz Professorship of Oriental Languages and Literature for seventeen years from 1896 until his retirement in 1913. The aim of the professorship had been stated as the:

> ...education of American young men looking forward to business relations in China and Japan,… the benefit of the young men of the Orient who may seek our higher education courses, and... the scholarly understanding of the history and thoughts of their interesting countries.

The University of California *Register* for 1898-1899 lists the variety of courses Fryer offered: the language, history, literature, government, laws, and social conditions of China and Japan, the commerce of China and Japan with Europe and America, the philosophies and religions of China and Japan, Chinese classical literature, elementary and advanced study of both *kuan-hua* (Mandarin) and *wen-li* (literary style). By 1904 he added an Oriental Seminar, part of which dealt with the philological problems relating to "Chinese and Japanese studies." The other part included "international problems relating to commerce, diplomacy, education and other branches of intercourse with the Far East."

Although his new career obviously absorbed him until his retirement, Fryer managed to keep up close contacts with China. While in California, he continued to translate scientific works into Chinese, producing fourteen books for the Kiangnan Arsenal between 1896 and 1909 and bringing his total contribution to seventy-seven works in over three hundred and three Chinese volumes. In 1899 the Ch'ing government conferred upon him the Order of the Double Dragon, Third Degree, First Honor (*san-teng ti-i*). He remained the proprietor of the Chinese Scientific Book Depot until 1911. The fact that he established several schools in China for the physically handicapped reveals Fryer's concern for the Chinese people. In 1911 he started a school for the blind in Hankow and he also founded the Fryer School for the Deaf and Dumb in Shanghai. His will of 1928 established a school for blind Chinese girls and provided buildings, land, and an initial endowment for the General Institute for Chinese Blind in Shanghai, which his son, George B. Fryer, managed until 1950.

As we have seen, Fryer’s early training was in teaching, and he also had a missionary interest, since he was attached to a British missionary school in Hong Kong. During his first few years in China, he taught English in missionary or Chinese government schools. However, while he taught he developed a new skill, proficiency in the Chinese language, which eventually enabled him to make his particular contribution to China.

John Fryer was by no means the first Western translator in China. In the sixteenth century the Jesuits had begun translating Western works into Chinese and since the early nineteenth century Protestant missionaries had been engaged in the task. It has been estimated that the Jesuits translated no less than four hundred works, half being related to Christianity, one-third being scientific literature, and the remainder touching upon humanities and Western institutions. The Protestant translations were even more numerous, but no single missionary did as much as John Fryer in introducing Western scientific literature to the Chinese.

In the course of his work at the Kiangnan Arsenal Fryer became convinced that China needed to acquire Western knowledge, especially in science and technology, if she were to become an equal member of the family of nations. He also recognized the existence of an "atmosphere of Chinese intellectual self-satisfaction," resulting in few Chinese being willing to learn the Western languages. It was the realization that Western ideas had a much greater opportunity of penetrating the Middle Kingdom in the native language that drove Fryer on in his work and involved him in the various schemes to help awaken China.

Fryer's pleasant relations with his Chinese colleagues, the esteem he enjoyed at the Kiangnan Arsenal (he received the official status of the Third Brevet Rank as early as 1872), and his widening contacts among missionary educators must all have given him satisfaction in his twenty-eight years as a translator. But it was undoubtedly a conviction that "translation is not only a science or an art, but also a practical tool of international communication in the world wide exchange of ideas" that made him such a vigorous and tireless worker. Other Westerners who worked at the arsenal endured the drudgery of translation for shorter periods of time. Alexander Wylie remained there for eight years, Carl Kreyer for nine years. Young J. Allen worked as a translator and a teacher for a total of ten years.

After some years of work at the arsenal, Fryer realized that his translations would actually reach very few Chinese. In fact, he discovered that his translations were largely ignored (at least until 1880) by the very people who employed him. The fact that his books were not fully utilized by the Ch'ing government prompted Fryer to branch off into his other projects, which were designed to popularize Western knowledge in China. Even if his arsenal translations were too technical for general Chinese consumption, the knowledge Fryer gained through his employment at the arsenal provided him with a substantial foundation in the various sciences. He utilized his scientific knowledge in writing introductory textbooks, outlines and articles and in giving lectures. He worked for the spread of scientific literature in China through the Shanghai Polytechnic Institute, the magazine *Ko-chih hui-pien*, and the Chinese Scientific Book Depot. He was a man of incredible energy who endured the extremely tedious job of translating while undertaking many organizational tasks.

Fryer was, of course, only one of the Europeans and Americans who helped to introduce Western knowledge to China during the nineteenth century. The teachers in missionary schools and colleges (which increasingly emphasized secular learning after the 1870's) had more contact with Chinese youths. Another missionary teacher who joined the service of the Ch'ing government, W.A.P. Martin, performed more direct service to Chinese education. Among missionary publicists, Young J. Allen and Timothy Richard brought a greater range of Western knowledge and ideas to the attention of the Chinese literati. Fryer, however, made a solid contribution by rendering a large number of difficult scientific works into Chinese. It may also be suggested that more than either Allen or Richard, Fryer was sympathetic toward China's "self-strengthening" and the regaining of her full sovereignty and independence. In an unpublished essay dated 1909 entitled "Our Relations with the Reform Movement [in China]," Fryer recalls that:

> The sole object of these measures [arsenals, schools and colleges] was not, it must be remembered, the enlightenment of China; but to enable China to understand all about Foreigners and to be able to fight them successfully; so as eventually to drive them away altogether.

Like Allen and Richard, Fryer worked for the "enlightenment of China." But he did so in the belief that technology and science could advance China's sovereignty and independence. He differed from the missionaries in being unconcerned as to whether or not her people were converted to Christianity.

There is little doubt that John Fryer's translations influenced many members of the Chinese literati. His books were sold in the widely scattered book stores in China and the scientific magazine he founded attained large circulation. These publications undoubtedly opened a new dimension of knowledge to young Chinese literati seeking the secrets of Western strength and increasingly curious about the workings of nature and the cosmos. Two of China's leading reformers of the late nineteenth century, K'ang Yu-wei and Liang Ch'i-ch'ao, acknowledged their debt to Fryer's work.

As the scientist, Tseng Chao-lun, testified in 1951, translations made by Fryer and his colleagues at the Kiangnan Arsenal were of excellent quality. It should be pointed out, however, that Fryer's choice of subjects for translation was at first haphazard and, especially during his first fifteen years at the arsenal, he emphasized works on technology (applied science as well as military and naval subjects) over pure science. Later, however, the majority of his translations were in such basic fields as physics, chemistry, electricity, and geology; In addition, he published a few works on Western government and institutions, which, as it happened, had a profound influence on K'ang Yu-wei and Liang Ch'i-ch'ao.

Like most Westerners who contributed to China's modernization, Fryer was not completely altruistic in his motives. He went to China and later took employment with the Kiangnan Arsenal partly because these were the best opportunities open to him at that

particular juncture. It remains true, however, that for nearly thirty years Fryer devoted himself to the introduction of Western knowledge to China for the good of China and the Chinese. Serving a government primarily interested in Western technology, Fryer brought to the Chinese in their own language works in basic science as well as those of practical value. Chinese of the Republican era might not consider Fryer's translations adequate and would understandably choose to learn modern science directly from up-to-date works in Western languages or in Japanese. But at least for the last three decades of the nineteenth century Fryer rendered signal service to the Chinese literati by providing new vistas of learning and stimulating new ideas.

Source: Adrian Arthur Bennett, *John Fryer: The Introduction of Western Science and Technology into Nineteenth-Century China*, The East Asian Research Center, Harvard University, Harvard University Press, Cambridge, Mass., 1967, p.vii-72.