

The China Prize Essay Contest and the Late Qing Promotion of Modern Science

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Prepared for the 7th conference on "The new significance of Chinese culture in 21st century"
organized by Thomas Lee and sponsored by the Himalaya Foundation

Held at National Taiwan University, December 28-31, 2003

Abstract:

The second half of the nineteenth century was the "seeding time" for the modernization of China. During the period from 1850 to 1870, many works on astronomy, mathematics, medicine and related fields of botany, geography, geology, mechanics, and navigation were translated by a core group of Protestant missionaries and Chinese co-workers in Guangzhou, Beijing and Shanghai. Parallel to the arsenals and official schools, private initiatives were also needed to popularize "modern science" (*gezhi xue* 格致學) in the treaty ports and among Qing officials and literati.

To attract the interest of the literati mainstream, John Fryer (1839-1928) and Wang Tao 王韜 (1828-1897) devised the "China Prize Essay Contest" (*Gezhi shuyuan keyi* 格致課藝彙編) in 1886. The essay writing contest was conceived by Fryer as a means to attract the many Chinese literati proficient in civil examination essay writing to write about foreign subjects, including science and technology. What is interesting about the China Prize Essay Contest, which lasted through 1893, is that it used the prestige of the imperial civil service examinations to aid missionary efforts to promote modern science during the late Qing, which in turn created a working partnership between Western translators and Qing high officials, particularly those in provinces with treaty ports.

After the civil examinations were abrogated in 1904, however, the Qing dynasty quickly lost control of its science policies, which increasingly fell under the control of local Chinese intelligentsia and overseas students in Japan and Europe. The political consequences of this loss of control were to be expected when the Qing bureaucracy gave up one of its major institutions that had for centuries successfully induced literati acceptance of the imperial system. The essay contest helped to popularize the new knowledge 西學 contained in the science translations from 1865 to 1885 by employing a traditional vehicle to valorize that knowledge. The Sino-Japanese War aborted such efforts and made them appear still-born, but had the Chinese won that war, which was not impossible, such efforts to spread the new sciences through traditional institutional forms might have been legitimated and expanded.

Translations at the Jiangnan Arsenal

In 1867, a Translation Department was initiated at the Jiangnan Arsenal (*Jiangnan zhizaoju* 江南製造局) in Shanghai. The initiative was led by Xu Shou 徐壽 (1818-1882), Hua Hengfang 華 蘅 芳 (1833-1902), and Xu Jianyin 徐 建 寅 (1845-1902), classical scholars with scientific interests. In addition to emphasizing foreign manufacture, Zeng Guofan 曾國藩 (1811-1872) and Li Hongzhang 李 鴻 章 (1823-1901) regarded translation as the foundation for learning the techniques of modern manufacture and the mathematics on which they were based. Their precedent was the late Ming and early Qing translation projects that had enabled the imperial calendar to be successfully reformed based on new techniques and models introduced by the Jesuits and used in the Astronomy Bureau.¹

Invited to join the Department in 1867, John Fryer (1839-1928) wrote in 1880, for instance, that the Jiangnan Arsenal had published translations of Western works since 1871. By June 30, 1879, some ninety-eight works were published in 235 volumes (*juan* 卷). Of these, twenty-two dealt with mathematics, fifteen were on naval and military science, thirteen covered the arts and manufactures. Fryer reported that another forty-five works in 142 volumes were translated but not yet published, and thirteen other works were in process with thirty-four volumes already completed.

Altogether, the Translation Office had sold 31,111 copies representing 83,454 volumes, and this had been accomplished without advertisements or postal arrangements. A work on the German Krupp guns translated in 1872 sold 904 copies in eight years. Another work on coastal defense published in 1871 sold 1,114 copies in nine years. *A Treatise on Practical Geometry*

¹ Knight Biggerstaff, "Shanghai Polytechnic Institution and Reading Room: An Attempt to Introduce Western Science and Technology to the Chinese," *Pacific Historical Review* 25 (May 1956): 127-34.

(1871) sold 1,000 copies in eight years; and *A Treatise on Algebra* (1873) sold 781 copies in seven years. Fryer's work on coal mining published in 1871 sold 840 copies in nine years. Publicizing these works beyond Shanghai, Beijing, and the treaty ports was difficult, and even for the latter venues such numbers were disappointing but not insignificant.²

For example, the controversial reformer and classicist Kang Youwei 康有為 (1858-1927) purchased all the Arsenal works when he was in Shanghai in 1882. Between 1890 and 1892, his disciple Liang Qichao 梁啟超 (1873-1929) also purchased many of the Arsenal's translations as well as Fryer's science journal entitled *The Chinese Scientific and Industrial Magazine* 致彙編. Liang developed an influential reading list based on these materials known as the "Bibliography of Western Learning" (*Xixue shumu biao* 西學書目表), which was revised and published in 1896. Of these 329 published works, 119 (36%) were translated by Fryer. Tan Sitong 譚嗣同 (1865-98) began writing on scientific topics in the 1890s and mentioned *The Chinese Scientific and Industrial Magazine* as one of his sources of scientific learning. Tan had visited Fryer in Shanghai in 1893 and bought many of the Arsenal's works.³

Shanghai Polytechnic and *The Chinese Scientific and Industrial Magazine*

The Shanghai Polytechnic Institution 格致書院 and Reading Room 書室, where *The Chinese Scientific and Industrial Magazine* 致彙編 was published, had been founded in 1874-75. Its programs promoted the sciences, arts, and manufactures of the West through exhibitions, lectures and classes, and a Chinese Library and Reading Room. Because the Polytechnic did not draw the expected interest hoped for, Fryer and Xu Shou also created the

² John Fryer, "An Account of the Department for the Translation of Foreign Books at the Kiangnan Arsenal, Shanghai," *North-China Herald*, January 29, 1880, pp. 77-81.

³ Adrian Bennett, *John Fryer: The Introduction of Western Science and Technology into Nineteenth-Century China* (Cambridge: Harvard University Research Center, 1967), pp. 42-44.

scientific journal in China to reach out to the Chinese in the treaty ports. In 1885, a project for classes and public lectures was finally implemented, and the scientific essay contest was initiated and became popular. Instructional plans included an appointment for a foreign professorship of science, which did not materialize.

Fryer's idea for the new journal immediately drew support from the Society for Diffusion of Useful Knowledge (*Guangxue hui* 廣學會) in Beijing, which was closing down in 1875 and ending its illustrated monthly known as *The Peking Magazine* (*Zhongxi wenjian lu* 中西聞見錄). The Society's members in Beijing transferred their subscriptions to the Polytechnic. Although the Shanghai journal was published and sold through the Polytechnic, it was a separate enterprise that Fryer and his Chinese assistant took responsibility for. Because Fryer's written classical Chinese was not good enough to produce the journal by himself, he employed Luan Xueqian 樂學謙 as his private secretary to help translate the unattributed Chinese articles in the journal. In the past it was assumed these unauthored pieces were all composed by Fryer. Luan was trained at Calvin Mateer's (1836-1908) Hall of the Culture Society (*Wenhui guan* 文會館) school in Shandong, where science and advanced mathematics courses were taught in Chinese.⁴

Fryer had worked with Luan since at least 1877 when *The Chinese Scientific and Industrial Magazine* commenced. Luan Xueqian, for example, prepared an account of a chemistry class at Shanghai Polytechnic before he collaborated with Fryer. Moreover, Luan was probably also involved in the *Science Outline Series* (*Gezhi xuzhi* 格致須知) and *Science Handbook Series* (*Gezhi tushuo* 格致圖說) that were published from 1882 to 1898. In addition,

⁴ See Biggerstaff, "Shanghai Polytechnic Institution and Reading Room," p. 144.

Luan managed the Chinese Scientific Book Depot (*Gezhi shushi* 格致書室) for Fryer from 1885, which Fryer eventually turned over to Luan in 1911.⁵

Copies of the Polytechnic' journal were available at first at twenty-four and then twenty-seven of the most important treaty ports and trading centers in China and Japan. There were thirty agents in early 1880, which increased to seventy by the end of the year. Although *The Chinese Scientific and Industrial Magazine* continued from *The Peking Magazine*, it went beyond the latter by focusing on the natural sciences and technology in Europe and the United States. With more Chinese participants in the production process, the translations in the Shanghai journal were much better.

The journal initially printed 3,000 copies and usually sold out in several months. Nine months later, the first nine issues were reprinted in a second edition to meet the demand. With 4,000 copies printed per issue at its peak in the 1880s and 1890s, it reached some 2,000 readers in the treaty ports. Fryer hoped that in this way, popular oriented presentations of mathematics and the industrial sciences would become more acceptable among literati and merchants. He expected that *The Chinese Scientific and Industrial Magazine* would also compensate for the limited scope of the Jiangnan Arsenal's translations, which were usually printed in runs of only a few hundred or more copies. Later in 1891, reprints of previous issues were sold.⁶

⁵ Wang Yangzong 王揚宗, "Gezhi huibian zhi Zhongguo bianjizhe kao" 格致匯編之中國編輯者考, *Wenxian* 文獻 63 (January 1995): 237-43. See also David Wright, *Translating Science: The Transmission of Western Chemistry into Late Imperial China, 1840-1900* (Leiden: E. J. Brill, 2000), pp. 319-25.

⁶ The venues to buy issues were advertised in the journal. Compare San-pao Li, "Letters to the Editor in John Fryer's *Chinese Scientific Magazine*, 1876-1892: An Analysis," p. 743. See also Ferdinand Dagenais, *John Fryer's Calendar: Correspondence, Publications, and Miscellaneous Papers with Excerpts and Commentary* (Berkeley: Center for Chinese Studies, University of California, Berkeley, 1999), Version 3, 1891:1, Bennett, *John Fryer*, pp. 50-55, and David Wright, "Careers in Western Science in Nineteenth-Century China," pp. 49-90.

Altogether, sixty issues were published intermittently over seven years. After 1880, the magazine shifted its emphasis from introductory essays on science to accounts of the basic fields of science. Moreover, Fryer increasingly paid attention to mathematics as the foundation of scientific knowledge. The Polytechnic's teaching program was most effective after 1885 when it pioneered the teaching of mathematics and science in late Qing China. According to a General Affairs Office (*Zongli yamen* 總理衙門) memorial of May 18, 1887, which advocated modifying the civil examinations to allow candidates to be examined in mathematics, the Shanghai Polytechnic was training half of the talented students of mathematics in the empire.⁷

In addition *The Chinese Scientific and Industrial Magazine* published some 317 inquiries sent in to the journal as "Letters to the editor." The letters and their context stressed the practical value of technology and showed less interest in pure science. About 123 letters (38.2%) showed some interest in or knowledge of scientific theories or abstract scientific models, which is a relatively high percentage for a journal more oriented to popular science or popular mechanics. The queries paralleled the technological interests of those involved in the Self-Strengthening movement 洋務運動. The large volume of letters to Fryer anticipated a more widespread awakening of interest in science after 1895 and paved the way for the general acceptance of Western science in China.⁸

Besides their use in the increasing number of missionary schools, such translations were also institutionalized as texts within a regional matrix of arsenals, factories, and technical schools that formed the nineteenth century roots of the twentieth century industrial revolution in China.

⁷ *Guangxu chao donghua lu* 光緒朝東華錄 (Records from within the Eastern Gate during the Guangxu reign) (Shanghai: Zhonghua shuju, 1909), 82.11a. See also Biggerstaff, "Shanghai Polytechnic Institution and Reading Room," pp. 148-49.

⁸ San-pao Li, "Letters to the Editor in John Fryer's *Chinese Scientific Magazine*, 1876-1892: An Analysis," *Jindaishi yanjiu suo jikan* (Academia Sinica, Taiwan) 4 (1974): 730-31, 762.

Hence, we should also acknowledge the scope and scale of scientific translation and military arsenals elsewhere in China after 1860.⁹

In his "Report of the Chinese Scientific Book Depot, Shanghai, 1887," John Fryer summarized the results of the first three years of its operations, which had aimed at "facilitating the spread of all useful knowledge literature in the native language throughout China, and especially of books, maps and other publications of a scientific or technical character." Branch depots were established in Tianjin, Hangzhou, and Shantou in 1886, and four more in Beijing, Hankou, Fuzhou, and Xiamen were added in 1887. Fryer noted that seventeen thousand dollars worth of books and maps had been sold since 1885. That translated into approximately 150 thousand volumes of scientific and educational literature that had "found their way to the most distant parts of China as well as to Japan and Korea."¹⁰

The 1886 catalog of the Scientific Book Depot, for instance, included mention of 371 works for sale. Fifty-nine titles were on science, forty-nine on Chinese studies, and thirty-five on mathematics. The catalog also included forty-four works that Fryer had translated, twenty-eight of them for the Jiangnan Arsenal. By 1888, there were 650 titles on Western topics at the Scientific Book Depot. Of these, 228 were original Chinese works. Books on the Sino-Japanese War were popular after 1895 when the Depot became a mecca for young Chinese students of the sciences and mathematics in China.¹¹

⁹ Ting-yee Kuo and Kwang-Ching Liu, "Self-Strengthening: the pursuit of Western technology," in Denis Twitchett and John Fairbank, eds., *Cambridge History of China*, Volume 10, *Late Ch'ing, 1800-1911*, Part 1 (Cambridge: Cambridge University Press, 1978), pp. 519-37.

¹⁰ For the 1887 "Report," see the *North-China Herald*, December 28, 1887, pp. 702-703.

¹¹ Bennett, *John Fryer*, pp. 64-66.

Another hopeful sign that Fryer included in his report was that a knowledge of mathematics and science was now required in the Qing civil service examinations. W. T. A. Barber from the Wuchang High School later reported in July 1888, for example: "At the recent examination for the Sin Ts'ai [*xiuc'ai*] degree held in Han-yang-fu, the district [prefecture] containing the mart of Hankow [Hankou, Hubei], three candidates presented themselves in mathematics." Two passed by answering questions dealing with four questions on right-angled triangles to find the sides and two questions on solid contents to find the dimensions. Barber regarded the answers as equivalent to the "Pass B. A." at Cambridge or Oxford. He added that three years earlier three of the sixty-six graduates had received their provincial degrees for mathematics in Hunan. Candidates for the local degree, he thought, were learning sufficient mathematical knowledge to pass. He was apparently unaware that these problems had long been solvable using traditional Chinese "four unknowns" notations for algebraic equations.¹²

Despite the considerable efforts Fryer, Xu Shou, and Wang Tao expended on maintaining the viability of the Polytechnic and its affiliated if irregular *The Chinese Scientific and Industrial Magazine*, as well as the Chinese Scientific Book Depot, they were aware of the limits they faced in reaching educated Chinese outside the exclusive audience of literati in Shanghai and the other treaty ports. The vast mainstream of Chinese literati were still drawn to what the Protestants belittled as the useless focus in the prestigious civil examinations on Chinese literature and poetry.¹³

¹² Mathematics questions had been allowed in civil examinations by an 1887 imperial edict. See W. T. A. Barber, "A Chinese examination paper," *North-China Herald*, July 7, 1888, p. 15.

¹³ See Fryer's "Report" in the *North-China Herald*, December 28, 1889, pp. 702-03. See also Elman, *A Cultural History of Civil Examinations in Late Imperial China* (Berkeley: University of California Press, 2000), pp. 584, 728, on the 23 per cent increase of gentry with regular degrees to 920 thousand after 1850.

Contest Procedures and Official Patronage

To attract the interest of the literati mainstream, Fryer and Wang Tao 王韜 (1828-1897) devised the "China Prize Essay Contest" (*Gezhi shuyuan keyi* 格致課藝彙編) in 1886. The essay writing contest was conceived by Fryer as a means to attract the many Chinese literati proficient in civil examination essay writing to write about foreign subjects, including science and technology:

To popularise Western knowledge among the *literati* it is necessary to take advantage of all such existing national characteristics; and hence it was conceived that in essay writing there existed a most powerful means for inducing the better classes of Chinese to read, think, and write on foreign subjects of practical utility, and thus carry out one of the main objects for which the Polytechnic Institution was founded.

Fryer failed to add, however, that numerous prize essays solicited by the Royal academies in London, Paris, and Berlin had similarly been of strategic importance to focus interest on specific issues in the development of the sciences and mathematics during the seventeenth and eighteenth centuries in Europe. Moreover, school examinations in the sciences in Britain had been instrumental in promoting such fields of learning.¹⁴

¹⁴ See John Fryer, "Chinese Prize Essays . . . for 1886 and 1887," pp. 100-101. Compare Biggerstaff, "Shanghai Polytechnic Institution," pp. 141-143. On prize essay questions in eighteenth century Europe, see Roger Hahn, "Laplace and the Mechanistic Universe," in David Lindberg and Ronald Numbers, eds., *God & Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986), p. 266. See also Keith Hoskin, "Examinations and the Schooling of Science," in Roy MacLeod, ed., *Days of Judgement: Science, Examinations, and the Organization of Knowledge in Late Victorian England* (Driffield, N. Humberside: Studies in Education, 1982).

In time this experiment became one of the most successful undertakings of the Shanghai Polytechnic to spread Western learning 西學 beyond the treaty ports. Fryer described the selection process as follows:

A high official is asked to give a subject on which prize essays are invited, and to promise not only to look over the essays himself but to bestow certain sums of money upon some of the more successful essayists in addition to the regular quarterly amount of Tls. 25 [34.75 silver dollars] voted from the funds of the Institution for this special purpose. Every quarter a fresh subject is advertised in the native newspapers, and a date is fixed after which no essay will be received. The bundle of essays is then forwarded to the co-operating official who reads them carefully over and adjudicates their order of merit, affixing a criticism of greater or less length in his own handwriting, pointing out the features of excellence or defect in each. . . . Three receive the highest awards and ten or more receive smaller sums. . . . At the end of each year the three highest names for each quarter are honoured by having their essays, with the criticisms, printed in the form of a book, complimentary copies of which are sent to co-operating high officials and successful essay writers.¹⁵

Mimicking the palace examination 殿試登科錄, three major and ten minor prizes were usually given annually for the China Prize Essay Contest, and the winners were announced in the Chinese and Western press. The best essays were released to newspapers such as the influential *Shanghai Journal* (*Shenbao* 申報). From 1886 to 1893, the three major prize winners had their essays printed together in a book that was placed on public sale for others to emulate.

¹⁵ Fryer, "Chinese Prize Essays . . . for 1886 and 1887," p. 100.

Wang Tao was also editor for the special prize science essay volumes published by the Polytechnic, which paralleled collections of 8-legged essays for the civil examinations that were widely in print in Ming and Qing China. This tactic also mimicked the official publication of the policy essays of the top three finishers on the regular palace examination. When Fryer prepared his "Second Report of the Chinese Prize Essay Scheme" in 1889, he proudly announced:

By its means the existence of the Polytechnic Institution has become known far and wide; the cooperation of some of the highest officials in the Empire secured; and an interest in western ideas has been created in some of the most influential quarters. By the annual expenditure of only a hundred Taels (139 silver dollars) or thereabouts, and by working in harmony with the Chinese methods of thought, and time-honoured systems of literary competition, a result has been obtained which the use of large sums of money in other ways would have failed to produce.¹⁶

For Fryer, one of the most encouraging features of the essay competition was the support it received from Qing officials, who quickly saw the efficacy of applying the civil examination ethos, which was so well entrenched among the literati, to Western learning. The Polytechnic's essay contest closely paralleled the civil examination process of reward and fame for prized essays. Li Hongzhang and Liu Kunyi 劉坤一 (1830-1902) as the Northern and Southern Superintendents of Trade respectively, for example, each consented to give an extra theme every year during the spring and fall, in addition to the quarterly arrangement already in place. Fryer noted that when Li Hongzhang's extra theme for the first half of 1889 was issued, thirty essays

¹⁶ John Fryer, "Second Report of the Chinese Prize Essay Scheme in connection with the Chinese Polytechnic Institution and Reading Rooms, Shanghai, From July 1887 to July 1889," *North-China Herald*, July 20, 1889, pp. 85-86. On civil examination essay collections, see Elman, *A Cultural History*, pp. 400-20.

were forwarded to him for ranking. Li's list of the names of the twenty-seven successful writers, and the extra awards of \$204 given them, together with his personal criticisms, were published in the local Chinese papers."¹⁷

Literati Participation

Literati who sent in essays for the competition between 1886 and 1893 were getting their information for the topics mainly from Jiangnan Arsenal translations, materials prepared at the Beijing School of Foreign Languages 同文館, and articles on the sciences that had appeared in *The Chinese Scientific and Industrial Magazine*, *The Peking Magazine*, as well as the *Shanghai Serial* 六合叢談. The popularity of the "Answers to readers' queries" in *The Peking Magazine* and "Letters to the editors" in *The Chinese Scientific and Industrial Magazine* also indicates the popularity these journals had elicited among literati in and outside the treaty ports, although the real boom in reprinting such publications came after the Sino-Japanese War.

Following these pioneering compilations, other compendia on the sciences were also widely available. Compiled from 1877 to 1903, they reprinted many science works from the Jiangnan Arsenal Translation Department and from Fryer's "Science Outline Series" 格致須知. Literati found out about these new compilations via book advertisements in the emerging Western and modern Chinese press and the catalogs of Western books mentioned earlier. Advertisements in the 1897 issues of the *Shanghai Journal* (*Shenbao* 申報), for instance, included mention of new works on chemistry, and public affairs that aimed at the civil examination market. Candidates were told in one advertisement that a particular book on

¹⁷ The essays were collected by Wang Tao and published in Shanghai in 1897 under the title of *Gezhi keyi huibian* 格致課藝彙編. Wang Ermin 王爾敏, *Shanghai Gezhi Shuyuan zhilue* 上海格致書院志略 (Hong Kong: Zhongwen daxue chuban she, 1980), pp. 54-55, presents a list of officials involved.

Western history was absolutely essential for success on the policy essays required in the civil examinations.¹⁸

The essay competition met with an enthusiastic response, and many of the essays were not only printed in newspapers but also included in reformist encyclopedias such as the *Collected Writings on Political Economy from the August [Qing] Dynasty* (*Huangchao jingji wenbian* 皇朝經濟文編). In a "Table Showing the Results of the Chinese Prize Essay Scheme," Fryer presented a breakdown of the competition. An average of forty-eight essays were received for each of the 15 contests with nineteen essayists (39.5 %) receiving prizes. Fryer's table presented figures through spring 1889, and I have updated these to include contests through 1893. Based on the figures for 42 contests held between 1886 and 1893, in which 2,236 candidates presented essays, an average of 46.1% were awarded prizes. Overall, about 53 candidates sent in essays for each contest.¹⁹

Seventeen Chinese officials presented a total of eighty-six questions, with several presenting questions a number of different times:

Gong Zhaoyuan 龔照瑗	4 times	4 questions	(Shanghai Circuit)
Li Hongzhang	5 times	15 questions	
Liu Kunyi	3 times	7 questions	
Sheng Xuanhuai 盛宣懷	6 times	6 questions	

¹⁸ The lead article "The Progress of Foreign Studies" in the *North-China Herald*, April 14, 1893, pp. 513-14, described some sources for answering the questions. See also Shang Zhicong 尚智叢, "1886-1894 nianjian jindai kexue zai wan Qing zhishi fenzi zhong de yingxiang – Shanghai Gezhi shuyuan Gezhi lei keyi fenxi" 1886-1894 年間近代科學在晚清知識分子中的影響 -- 上海格致書院格致類課藝分析, *Qingshi yanjiu* 清史研究 3 (August 2001): 73, 82n6, and Wright, *Translating Science*, pp. 163-173.

¹⁹ Fryer, "Second Report," p. 86. Complemented by figures from *Gezhi shuyuan keyi* 格致書院課藝 (hereafter GZSYKY) from the Fryer Private Library, University of California, Berkeley (2 vols. Shanghai: Shanghai Polytechnic, 1886-1893), Vols. 1-2, 1889-1893. See also Biggerstaff, "Shanghai Polytechnic Institution and Reading Room," p. 149.

Wu Yinsun 吳引孫	6 times	12 questions (Ningbo Circuit)
Xue Fucheng 薛福成	3 times	3 questions ²⁰

Altogether 1,878 Chinese submitted essays over the nine years of the competition. Among the ninety-two essayists who were honored (4.9 %), several produced five or more essays that were awarded prizes:

Yang Minhui 楊毓輝	Licentiate	14 essays
Li Dingyi 李鼎頤	2 nd class provincial	7 essays
Xu Keqin ³ 克勤	Supplementary student	7 essays
Wang Zuocai 王佐才	Senior tribute student	6 essays
Yin Zhilu 殷之輅	Polytechnic graduate	6 essays
Li Jingbang 李經邦	2 nd class provincial	6 essays
Zhong Tianwei 鍾天緯	Expectant official	5 essays
Ye Han 葉瀚	County purchase	5 essays ²¹

Despite such success and patronage, Fryer was still troubled by the small number of essays Chinese sent in for the extra spring 1889 competition: "The fact that only thirty essayists dared to tackle all three subjects is an evidence of the general ignorance of the literati on everything outside the ordinary curriculum of Chinese study; while at the same time it shows how effectively this prize essay scheme is doing its work." Fryer also saw some limits in the sorts of questions that other officials such as the Shanghai circuit intendent or governor-general

²⁰ Xiong Yuezhi 熊月之, *Xixue dongjian yu wan Qing shehui* 西學 東漸與晚清 社會 (Shanghai: Renmin chubanshe, 1994), pp. 385-86.

²¹ Xiong Yuezhi, *Xixue dongjian*, pp. 387-91. Compare Shang Zhicong, "1886-1894 nianjian jindai kexue zai wan Qing zhishi fenzi zhong de yingxiang," p. 81, and Wang Ermin, *Shanghai Gezhi Shuyuan zhilue*, pp. 69-72.

in Nanjing prepared: "[A]lthough their questions relate, perhaps, more to political economy and commerce than to the severer branches of science, it is still gratifying to see how patriotic they are, and how they regard knowledge from the practical, utilitarian point of view, rather than from the theoretical alone."²²

In time, the Shanghai Polytechnic prize essays themselves, discussed below, became sources of information, as indicated by the publication of the *Compendium of Prize Essays on Science* (*Gezhi keyi huibian* 格致課藝彙編) in 1897 and the *Shanghai Polytechnic Prize Essay Competition* (*Gezhi shuyuan keyi* 格致書院課藝) again in 1898. Key bibliographies of Western Learning were also compiled in the 1890s such as *Books on Eastern and Western Learning* (*Dong Xixue shulu* 東西學書錄), when published in 1899 praised *The Chinese Scientific and Industrial Magazine* published by the Polytechnic's for introducing the sciences to a generation of literati since the 1870s.

These essay competitions had a great deal of impact as model essays on the reformed 1901-1904 civil examinations, which were promulgated after the Boxer Rebellion 頤和園 and required all candidates to be knowledgeable of the new fields in the sciences and world affairs. Often, candidates who had prepared essays for the Polytechnic Prize Essay Competition, such as Zhong Tianwei 鍾天緯 (1840-1900), went on to take the reformed civil examinations. In addition, many of the policy questions used in the reformed civil examinations were derived from the topics chosen by officials such as Li Hongzhang for the essay competition. Although the civil examinations were abrogated in 1904, these scientific texts and science topics remained important educationally in the new schools (*xuetang*) formed after 1905.²³

²² Fryer, "Second Report of the Chinese Prize Essay Scheme," p. 85.

²³ Xiong Yuezhi, "Gezhi huibian yu Xixue chuanbo," pp. 65-66, and Wang Ermin, *Shanghai Gezhi Shuyuan zhilue*, pp. 69-72.

Hence, from the 1880s to the end of the Qing dynasty, we can document a significant increase in numbers of literati, such as Du Yaquan 杜亞泉 (1873-1933), who were educated in the modern sciences in this period. In 1911, Du became the editor of *Eastern Miscellany* (*Dongfang zazhi* 東方雜誌), a scholarly journal published by Commercial Press 商務印書館 in Shanghai, but he had gained his knowledge of science at the end of the nineteenth century and first served as a science educator in Zhejiang province before taking charge of the science publications section of the Press in 1904. The growth of a significant community of scholar-officials conversant with science, which accompanied the growth of thousands of technicians, engineers, and artisans in the empire-wide arsenals, began in the 1880s and 1890s--before the Sino-Japanese War.²⁴

Prize Essay Topics and Their Scientific Content

Between 1886 and 1894, 46 prize essay contests were held on Western learning. A total of 92 essay topics were selected by the Polytechnic and Qing officials. Of these, 33 (36%) dealt with political economy and industry (*fuqiang* 富強). The sciences (*gezhi* 格致學) were next with 24 topics (26%). Fryer noted the importance of the latter in his first report for 1886 and 1887. The questions that Li Hongzhang and his Qing colleagues prepared also influenced the reformed civil examinations initiated after 1900 as part of the "New Governance" (*Xinzheng* 新政) policies initiated in the last decade of the Qing dynasty.²⁵

²⁴ *Zhongwai shiwu cewen leibian dacheng* 中外時務策問類編 (1903 edition), 16.1a-b (essay prepared by Zhong Tianwei), 18.2b-3a (civil examination question taken from Xu Xingtai's 星台 spring 1887 Polytechnic essay competition topic). See also Elman, "Naval Warfare and the Refraction of Qing Nineteenth Century Industrial Reforms into Failure," *Modern Asian Studies* (Fall 2003), forthcoming.

²⁵ See GZSYKY, Vol. 1, 1887-90, Vol. 2, 1891-93. Compare Xiong Yuezhi, *Xixue dongjian*, p. 374n3 and Shang Zhicong, "1886-1894 nianjian jindai kexue," pp. 79-80, with Wang Ermin, *Shanghai Gezhi Shuyuan*, pp. 56-68. Shang presents all 24 essay topics on science from 1886

The revamping of the civil examinations held empire-wide for some 150 thousand provincial candidates meant that science questions were now regularly introduced under the category of science (*gezhexue* 格致學). For example, five of the eight post-1900 essay topics on the natural sciences were phrased as follows:

1. Much of European science originates from China; we need to stress what became a lost learning as the basis for wealth and power.
2. In the sciences, China and the West are different; use Chinese learning to critique Western learning.
3. Substantiate in detail the theory that Western methods all originate from China.
4. Prove in detail that Western science studies mainly were based on the theories of China's pre-Han masters.
5. Explain why Western science studies are progressively refined and precise.
6. Itemize and demonstrate using scholia that theories from the Mohist Canon preceded Western theories of calendrical studies, optics, and mechanics.²⁶

Such questions and their answers revealed that in official terms, the wedding between the traditional Chinese sciences and Western science was still in effect among imperial examiners.

Beginning with the first civil examinations since the enactment of the post-Boxer reforms in 1902, many of the essays in the Shanghai Polytechnic Prize Essay Contest became model essays for the required science policy questions. Xu Xingtai's 徐星台 spring, 1887, theme comparing the sciences of China and the West, and Nie Jigui's 聶緝槃 spring, 1894, question

through 1894. Fryer's collection at the University of California, Berkeley, library end with the 1893 essays.

²⁶ See *Zhongwai shiwu cewen leibian dacheng*, "Mulu," pp. 13a-b.

on locating the Western principles of calendrical studies, optics, and mechanics in the ancient text of *Master Mo's Teachings* (*Mozi* 墨子) became a model policy question that Qing examiners might use for civil examination policy questions between 1902 and 1903.

The Polytechnic's prize essays thus give us a unique vantage point from which to evaluate the more common understanding of modern science among Qing literati. Normally we focus on the perspectives of a few leading classical scholars such as Kang Youwei, Liang Qichao, or Tan Sitong when we present the impact of science in the late Qing, which is overdetermined in favor of a few prominent reformers who were more interested in the political importance of science rather than the study of science itself. The 92 questions prepared by eighteen Qing officials for the Polytechnic's forty-six regular and special essay competitions from 1886 to 1894 provide a better overall frame of reference.²⁷

For example, Zhong Tianwei, an expectant appointee to be a magistrate's aide in Guangdong province from Huating, Jiangsu, prepared an essay for Li Hongzhang's spring 1889 "Extra Theme" on native and Western science. Parts of his answer, presented below, were written following the exact parallelism of an 8-legged civil examination essay:

With regard to the sciences, China and the West are different.

Speaking of it from the angle of what is above form,

then earlier literati scholars clarified everything leaving nothing out.

Speaking of it from the angle of what is below form,

then the new principles of the West daily emerge without end.

It is likely that,

²⁷ See *Zhongwai shiwu cewen leibien dacheng, mulu* 目錄, pp. 13a-b. For discussion of the civil examination reforms of 1901-02, see Elman, *A Cultural History of Civil Examinations*, pp. 594-602. See also Xiong, *Xixue dongjian*, pp. 362-63.

China has emphasized the Way while undervaluing the arts.

Therefore, Chinese science solely prioritized meaning and principles as important.

The West has emphasized the arts and undervalued the Way.

Therefore, Western science has focused more on the principles of things

This is why China and the West have diverged.²⁸

In another spring 1889 essay prepared for Li Hongzhang's "Extra Theme" on the development of Western science since Aristotle, Wang Zuocai, a student at Shanghai Polytechnic, argued:

Therefore, Master Zhu [Xi] 朱熹 appended a chapter to the [Great Learning 大學] commentary . . . , but what was elucidated was a form of science [*gezhi* 格致] that stressed meanings and principles and not the *gezhi* that emphasized the principles of things. China has stressed the Way and undervalued the arts. Anything to do with statutes and institutions, or rituals and music for moral edification and civilizing, were always stressed without leaving anything undone. If a sage were to reappear, he would have nothing to add. Only the makeup of the principles of things, which have examinable forms, have been discarded.²⁹

²⁸ See GZSYKY, Vol. 1, 1889, p. 20b. The essay is cited from another edition in Xiong Yuezhi, *Xixue dongjian*, pp. 371-72, and Li Shuangbi 李雙璧, "Cong 'gexhi' dao 'kexue': Zhongguo jindai keji guan de yanbian guiji" 從格致到科學：中國近代科技觀的演變軌跡, *Guizhou shehui kexue* 貴州社會科學 137 (1995.5): 105. See also Elman, *A Cultural History*, pp. 389-99, for stylistic examples of the 8-legged essay.

²⁹ See GZSYKY, Vol. 1, 1889, p. 6b, which is also cited from another version in Xiong Yuezhi, *Xixue dongjian*, p. 371.

This perspective stressed that since the Greeks the West had focused on things themselves as objects of analysis in contrast to the political, moral, and institutional focus of classical scholars in imperial China.

Medical Questions as Prize Essay Topics

Since Dr. Benjamin Hobson's (1816-1873) pioneering translations of nineteenth century Western medicine in the 1850s, the anatomical and surgical strengths of Western medicine, when compared to the therapeutic efficacy of traditional Chinese medicine, were increasingly noted. The missionary vocation that informed Hobson's work and that of his successors had focused on medical education and missionary hospitals. For example, the English missionary and physician John Dudgeon (1837-1901) introduced courses in anatomy and physiology at the School of Foreign Languages in Beijing in 1872. Dudgeon also published a six volume work in Chinese on anatomy, which the Qing government subsidized in 1887. A companion volume on physiology also came out.³⁰

Between 1874 and 1905, the number of professional medical missionaries had risen from 10 to some 300. In 1876, there were 40 missionary hospitals and dispensaries treating 41,281 patients. Three decades later, there were approximately two million treated annually in 250 mission hospitals and dispensaries. Dr. John G. Kerr (1824-1890), who was associated with the American Presbyterian Mission, took over Peter Parker's (1804-1888) Guangzhou hospital, and

³⁰ See Su Jing 蘇精, *Qingji Tongwen guan ji qi shisheng* 清季同文館及其師生 (Qing foreign language schools and their teachers and students) (Taipei: Shanghai yinshua chang, 1985), pp. 252-255. See also Ting-yee Kuo and Kwang-Ching Liu, "Self-Strengthening: the pursuit of Western technology," pp. 531-532, and Bridie Andrews, "Tailoring Tradition: The Impact of Modern Medicine on Traditional Chinese Medicine," in Viviane Alleton and Alexei Volkov, eds., *Notions et Perceptions du Changement en Chine* (Paris: Collège de France, Institut des Hautes Études Chinoises, 1994), p. 152.

supervised the treatment of over a million patients during his half century of service to his Cantonese patients.

Other large missionary hospitals were established in Hangzhou and Tianjin. The latter was endowed by Li Hongzhang's wife to repay Dr. John K. Mackenzie for saving her life. In addition, a generation of Chinese trained as modern physicians also emerged after 1870. Many, such as Sun Yat-sen 孫中山(1866-1925), were trained in missionary hospitals in China or Hong Kong. By 1897, there were about 300 Chinese doctors who had graduated from missionary medical schools, with another 250-300 then in training. Many more, fully trained native assistants made up the staffs of most such hospitals and dispensaries.³¹

Bridie Andrews has noted that several Chinese revolutionaries studied Western medicine early in their careers. Sun Yat-sen, for example, was a member of the first graduating class of the Hong Kong College of Medicine in 1892. Both Guo Moruo 郭沫若 (1892-1978) and Lu Xun 魯迅 had traveled to Japan to study modern medicine, and Guo completed his premedical and medical courses there. Lu Xun turned to literature after viewing depressing news reels of the Russo-Japanese War fought on Chinese soil, but he described his youthful zeal for Western medicine as a reaction against the "unwitting or deliberate charlatans" who posed as traditional Chinese physicians. Lu also gleaned from existing translations that the Japanese revival had been based in part on the "introduction of Western medical science to Japan."³²

³¹ See Paul Cohen, "Christian Missions and Their Impact to 1900," in Denis Twitchett and John Fairbank, eds., *Cambridge History of China*, Volume 10, *Late Ch'ing, 1800-1911*, Part 1 (Cambridge: Cambridge University Press, 1978), pp. 574-575.

³² Bridie Andrews, "Medical Lives and the Odyssey of Western Medicine in Early Twentieth-Century China," paper presented at the History of Science Society Annual Meeting, San Diego, CA, November 8, 1997. See also Lu Xun, *Selected Works of Lu Hsun*, translated by Yang Hsien-yi and Gladys Yang (Beijing: Foreign Languages Press, 1956), p. 2, and Howard Boorman and Richard Howard, eds., *Biographical Dictionary of Republican China* (New York: Columbia University Press, 1967), pp. 170-189. Compare Elman, "Wang Kuo-wei and Lu Hsun: The Early

Not yet triumphant until the twentieth century, Western medicine still faced a sizeable opposition among traditional Chinese physicians in the late Qing, although many Chinese had joined Xu Shou in his critique of the conceptual weaknesses in the etiology provided by Chinese medical theories. Moreover, the Western anatomy of blood vessels and the nervous system were gradually more integrated by traditional Chinese physicians. Accordingly, when the Polytechnic included medical topics for the Prize Essay Contest, the rout of traditional medicine was not yet on .³³

In spring 1891, for instance, the topic chosen dealt with the medieval traditions of *materia medica* that had linked particular foods to human health. This query was directed at "students who researched the principles of things" (*wuli* 物理). Moreover, it was framed in light of Ji Kang's 稽康 (233-262) medieval advocacy of medical and spiritual techniques for "nourishing life" 養生, which informed many late Ming encyclopedias 類書 .

The prize essays appealed to the methods for investigating things that had informed medieval lexicographies 訓詁 such as the Jin 晉 (265-419) scholar Yang Quan's 楊泉 *On the Principles of Things* (*Wuli lun* 物力論) and Zhang Hua's 張華 (232-300) *Treatise on Broad Learning of Things* (*Bowu zhi* 博物志). In addition, the essays engaged in a comparative pharmacopoeia that related Chinese and Western foods. Most importantly, however, the essays pointed to the strength of modern chemistry to elucidate the alchemical findings of medieval masters of *esoterica* 方士學 . Citing Martin's *Elements of Natural Philosophy and Chemistry* (*Gewu rumen* 格物入門), one essay noted that native traditions for "nourishing life" could be complemented by Western chemistry to get a better sense of the efficacy of *materia medica* 本

Years," *Monumenta Serica*, 34 (1979-80): 389-401.

³³ Bridie Andrews, "Tailoring Tradition," pp. 152-153.

草 in China. When Wang Tao added his comments for the published version, he agreed that medieval *esoterica* had paralleled Western chemistry in important ways.³⁴

Similarly, when Liu Kunyi prepared an essay topic on medicine for the special fall 1892 Prize Essay Contest, he asked authors to address which medical tradition, Chinese or Western, was superior theoretically. The Zhejiang literatus Xu Keqin, who submitted seven prize essays, stressed the achievements of ancient Chinese physicians, especially Zhang Ji 張機 (150-219), whose *Treatise on Cold Damage Disorders* 傷寒雜病論 had by early Ming times reached canonical status. Xu added that Western physicians emphasized the nervous system but they were unaware of the meridian system of twelve circulation tracts (*jingluo* 經絡) needed to understand the human body and its susceptibility to illness. In particular, Xu and the other essays focused on the strength of "heat factor" 熱病 and "cold factor" 傷寒 therapies in Chinese medicine, while pointing to the dangers in the surgical techniques employed by Western physicians.³⁵

In his prize essay for the summer 1893 contest, Xu Keqin again addressed a query by the Ningbo circuit intendent Wu Yinsun on the comparative strengths and weaknesses in Chinese and Western medicine. This time, however, the essayists were asked to demonstrate their knowledge of the history of Western medicine and its most famous physicians. Xu provided such a summary, but he still concluded that Chinese therapies were superior to the more invasive, i.e., surgical techniques, used in Western countries and now in China. He admitted, however, that each tradition had certain strengths that should be selected out and combined.

³⁴ GZSHKY, Vol. 2, 1891, p. 1b (topic), pp. 1a-17a (prize essays).

³⁵ GZSHKY, Vol. 2, 1892, pp. 3a-b (topic), pp. 4b-6b, 33b-34b (prize essays). See also Shang Zhicong, "1886-1894 nianjian jindai kexue zai wan Qing zhishi fenzi zhong de yingxiang," p. 81.

The 1893 prize essay on medicine by the Anhui literatus Li Jingbang 李經邦 pointed to the stress on the brain 腦 in Western medicine, but Li also noted the institutional importance of the Western hospital for the success of Western medicine. Li claimed that traditional medicine had also stressed the brain, but his apologetics were a transparent effort to apply the still prominent claim of the "Chinese origins of Western learning" (*Xixue Zhongyuan* 西學 中源) to medical studies.

Li claimed, for example, that during the Roman empire Westerners had come to China and that they had taken back copies of the *Basic Questions* (*Suwen* 素問) part of the *Inner Canon of the Yellow Emperor* (*Huangdi neijing* 黃帝內經), among other canonical medical texts. Over time, Western medicine had built on these Chinese texts to produce new findings drawn from chemistry. Such traditionalistic claims were increasingly suspect by 1900 as more Chinese were trained as modern physicians. Moreover, Li placed the blame for the decline of Chinese medicine on its recent practitioners, who had failed to live up to the comprehensive understanding that the ancient physicians had achieved.

Yang Minhui's prize essay for the summer 1893 medicine theme betrayed the fact that Western medicine was increasingly respected in official and popular circles and feared by native physicians. Yang tackled this change by appealing to the theoretical superiority of traditional medical principles while at the same time admitting the advantages of Western medical practices. Western knowledge of electricity and chemistry, according to Yang, were two areas that when applied therapeutically superseded native medicine. Altogether Yang presented ten areas in which Western medicine was superior but only four for native medicine. To salvage the strengths

in Chinese medical principles, Yang proposed that a "great medium" (*dazhong* 大中) could be achieved if ancient principles were informed by the new medical procedures from the West.³⁶

The Polytechnic's Prize Essay topics on medicine also influenced the science questions that official examiners used in the reformed civil examinations after 1901. Essays from both the 1891 Polytechnic query on the medieval *materia medica* 本草 and the 1892 theme of "which medical tradition was superior theoretically" 中西醫理孰長 were presented as model policy essays for the civil examinations. Moreover both the Shandong licentiate Sun Weixin's 孫維新 1891 prize essay on the *materia medica* and Li Jingbang's 1893 essay on the history of Western medicine were included verbatim as model essays in a 1903 collection of "New Governance" 新政 era policy questions and answers. More significantly, medicine was now regarded officially as one of the modern natural sciences, whereas it had only been considered an unofficial part of the investigation of things and extension of knowledge (*gezhi* 格致) before the nineteenth century.³⁷

Natural Theology, Darwin, and Evolution

Li Hongzhang's spring, 1889, "Extra Theme" had included a straightforward request for clarification of Darwin's and Spencer's writings:

"With respect to the 'Science' referred to in the 'Great Learning,' from Ching-kang-ching downwards, there have been several tens of scholars who have written on the subject. Do any of them happen to agree with Western scientists? Western science began with Aristotle in Greece; then came Bacon in England who changed the previous system and

³⁶ GZSHKY, Vol. 2, 1893, p. 2a (topic), pp. 4a-9b (prize essays).

³⁷ *Zhongwai shiwu cewen leibien dacheng, mulu*, pp. 14a-b, 19.15a-22b, especially 18b-20b.

made it more complete. In later years, Darwin's and Spencer's writings have made it still more comprehensible. Give a full sketch of the history and bearings of this whole subject." (問：大學格致之說自鄭康成以下，無盧數十家，於近今西學有偶合否？西學格致始于希臘之阿盧力士托德爾，至英人貝根出，盡變前說，其學始精，逮達文，施本思而家之書行，其學益備。能詳溯其源流歟？),³⁸

The essays sent in for this topic, however, reveal a remarkable range of ignorance and knowledge concerning Darwin's then increasingly famous claims about the biological evolution of all life forms.

For example, Jiang Tongyin's 蔣同寅 prize essay betrayed how some Han Chinese essayists simply bluffed their way through the complexity of Western learning. The essay judges, including Li Hongzhang, apparently did not know the difference. Jiang received the first prize for his essay on the development of science in the West, but when it came to identifying Darwin, he simply noted that Darwin was a famous geographer who also wrote on chemistry. Jiang described Spencer as an expert in mathematics. These were an odd portrayals for someone who was a supplementary student 附生 in Baoshan county, just outside of Shanghai. The reason becomes clearer when we note that Jiang added: "Today the works by both gentlemen are widely prevalent abroad, . . . but unfortunately I regret not yet seeing translations anywhere."³⁹

³⁸ The translation for this question is taken from Fryer, "Chinese Prize Essays: Report of the Chinese Prize Essay Scheme in connection with the Chinese Polytechnic Institution and Reading Rooms, Shanghai, for 1886 and 1887," p. 100. Fryer's "Ching-kang-ching" is the Later Han classicist, Zheng Kangcheng, i.e., Zheng Xuan 鄭玄 (127-200), whose classical importance Fryer did not seem to recognize.

³⁹ GZSHKY, Vol. 1, 1889, p. 1a.

Wang Zuocai, because he studied at Shanghai Polytechnic, presented Darwin and Spencer in his second-place essay in somewhat more discerning terms. Wang noted that Darwin had argued that all organisms changed from the course to the spiritually elevated in the process of adapting to the world. Without such adaptation they could never survive eternally. Although Wang recognized that Darwin had discovered a principle that no one had ever understood before, his account missed the key role of the survival of the fittest. Moreover, when he came to Spencer, Wang bluffed his way through by linking Spencer to Darwin and simply stressed the popularity of the latter's writings.⁴⁰

As the third place finisher on the spring, 1889, "Extra Theme," Zhu Dengxu 朱澄敘, like the first-place essayist, revealed total ignorance of Darwin's and Spencer's views. A supplementary student 附生 in Shanghai county, Zhu described Darwin as a geographer who had become famous because of his travels. Darwin's research, Zhu added, was based on the study of science and chemistry, but most of his work had not yet been translated into Chinese. According to Zhu, Spencer was skilled in practical applications of mathematics for the study of science. Such myopic characterizations of Darwin and Spencer in 1889 by Chinese literati in the Shanghai area are surprising, perhaps, given John Fryer's ties to British science since his early 1870s home visit. After returning to Shanghai in 1873, it is interesting that Fryer failed to deal with the Darwinian controversy. No works of Darwin or Spencer were ever translated at the Arsenal.⁴¹

This lack of attention to Darwin by Fryer and other missionary translators from England and the United States becomes a bit more worrying, however, when we examine more carefully the essay on the spring, 1889, "Extra Theme," prepared by the fourth-place finisher, Zhong

⁴⁰ GZSHKY, Vol. 1, 1889, p. 8b.

⁴¹ GZSHKY, Vol. 1, 1889, p. 12b.

Tianwei, which we have briefly looked at. Zhong had received a local degree in the civil examinations at the age of twenty-six *sui* 歲. Failing to advance through the more competitive provincial examinations in Nanjing, Zhong at age thirty-three circa 1873 entered the Foreign Language School 廣方言館 located in the Jiangnan Arsenal, where he studied Western Learning for three years.

Subsequently, Zhong traveled abroad in Europe for two years, and then he worked with Fryer and others in the Jiangnan Arsenal's Translation Department. Because of his ties to the Arsenal, both as a student and translator, and his travels abroad, he likely had access to accounts of Darwin and Spencer unavailable to others in Shanghai. Later, after 1901, Zhong's answer to a question on "comparing the vicissitudes in Chinese and Western mathematical astronomy" (問中西曆算源流) was chosen by examiners as a model essay in the reformed civil examinations. The question, and Zhong's reply, were drawn on information that Wylie and Li Shanlan had included in their article "Progress of Astronomical Discovery in the West" (西國天學源流) that had appeared in the *Shanghai Serial* 六合叢談 in 1857.⁴²

Among the works Fryer had brought back with him in 1873 after his leave in England had been Henry Roscoe's (1833-1915) series of *Science Primers* published in 1872, which had included the participation of Thomas Huxley (1825-1895), a champion of Darwin since 1860 when Huxley had debated the bishop of Oxford at the British Association for the Advancement of Science. Fryer must have heard of Darwin's *Origin of the Species* while on home-leave in England to find appropriate science textbooks to translate in the Jiangnan Arsenal and later for the missionaries' School and Text-Book Series Committee. Moreover, he chose to have the Arsenal's Translation Department translate Roscoe's series of *Science Primers* 格致啟蒙,

⁴² *Zhongwai shiwu cewen leibien dacheng, mulu*, p. 12a.

despite the participation of Thomas Huxley. Hence, we find in Zhong's prize essay, a remarkably accurate account of Darwin's theory of evolution. Why was it ranked fourth, then?⁴³

David Wright has explained that the essays submitted for the Chinese Prize Essay Contest contain some of the earliest references in Qing China to Charles Darwin and his theory of evolution. The first, brief documented reference to Darwin came in the 1873 Jiangnan Arsenal translation of Lyell's *Elements of Geology* (6th edition; *Dixue qianshi* 地學 淺釋) by Hua Hengfang and Dr. Daniel Jerome Macgowan (1814-1893), and again that year in an article in the *Shanghai Journal* (*Shenbao* 申報).

A vague mention of human evolution also appeared in an anonymous September 1877 article in *The Chinese Scientific and Industrial Magazine* entitled "The Theory of Chaos" (*Hundun shuo* 混蛋說), in which humans evolution from apes was discussed in an account of theories for how the world might end. This article, which argued that it was more important to consider the end of life forms rather than their origins, may have been written by Fryer and Luan Xueqian 樂學 謙 , suggesting perhaps that it was best for an unnamed Christian to present and critique Darwin anonymously to the Chinese. Jesuits had introduced Copernicus in a similar, misleading manner and later were chided by eighteenth century literati for the contradictions in their presentation of the Copernican system.⁴⁴

⁴³ Li Changli 李長莉, "Wan Qing dui Xixue de liangzhong wudu – lun Zhong Tianwei de Xixue guan" 晚清對西學的兩種誤讀--論鍾天緯的西學觀, *Jiangsu shehui kexue* 江蘇社會科學 (Nanjing) 6 (1999): 110-14.

⁴⁴ For the essay on the "The Theory of Chaos," see *Gezhi huibian* 格致彙編 (Reprint in 6 vols. Nanjing: Guji shudian, 1992), Vol. 2, pp. 13-15 (September 1877). The dating of articles in this reprint are defective, and some sections are disordered. Reference to the original editions, though limited in number, is recommended. See also *Gezhi keyi huibian* 格致課藝匯編 (Shanghai: Polytechnic, 1897), collected by Wang Tao 王韜 as editor, pp. 4.1a, 4.6a, 4.9b, 4.16a, 5.42b, *Dixue qianshi* 地學 淺釋 (Shanghai: Jiangnan Arsenal, 1873), 13.16a, and *Shenbao* 申報 2 (Tongzhi 12th year, intercalary 6th month, 29th day; August 21, 1873), p. 2. Pusey, *China and Charles Darwin*, pp. 4-5, has stressed 1895 for when Darwin's views were first

Zhong Tianwei 1889 spring essay, cited above, had opened with a well-prepared and well-informed account of Greek science. Then it described the evolution of science from Aristotle to Bacon, Darwin, and Spencer. Zhong, however, went well beyond the natural theology that the missionary essays on science in the *Shanghai Serial* and the *Scientific and Industrial Magazine* had encoded in their translations of botany and biology. After surveying the three-stage development of Greek science from natural philosophy (*gezhi lixue* 格致理學) to metaphysics (*xingli xue* 性理學) and dialectics (*bianli xue* 辯理學), Zhong summarized the modern contributions of Francis Bacon, Charles Darwin, and Herbert Spencer:

Two thousand and three years later, the Englishman Bacon first appeared and transformed Aristotle's theories. . . . At the age of thirteen he entered the state school to study, but he dismissed old learning, which demonstrated his independent stance. . . . Then he focused on the study of science. . . . The main point of his study was that in all scientific matters it was necessary to provide substantiation through demonstrable proof. On this basis each principle can be exhaustively grasped without first enunciating a principle as is. In this manner, through an evidential analysis of the nature of things, its principle will become manifest [考證物性以實之]. . . .

Darwin was born in 1809 the grandson of a physician and the son of a scientist. . . . Growing up he was selected to attend Edinburgh University in Scotland. Later he traveled around the globe accompanying an English naval vessel carrying out surveys and preparing drawings while investigating each plant and animal in its ecological setting. . . . In 1859 he prepared his magnum opus "on the origins of the species of all things" [論萬

物分種類之根源]. He also declared the "principle of the survival of the fittest" [[萬物強存弱滅之理, lit., "the principle that the strong survive and the weak perish"].

All species of plants and animals undergo changes over time and never remain unchanged from time immemorial to the present. Those plants and animals that are not successful in adapting slowly perish. Those that successfully adapt survive for the long term. This is the natural principle of the heavenly way [天道自然之理, i.e., natural selection]. His theory, however, contradicted the teachings of Jesus, and thus scholars from each country together did not follow his words. At first he was greatly attacked, but today those who honor him have gradually increased. Hence, science underwent a great change, and Darwin can be called a superior man who arises once in a thousand autumns.

As for Herbert Spencer, . . . he was with Darwin for eleven years in his youth. His life works mainly expanded on Darwin's theories, enabling people to grasp the principles of psychology [靈魂之理] . . . What he claimed was knowable was only the external appearance of all things. The inner subtleties of all things were in fact unknowable . . . Comparing it to what Christianity has called God [*shangdi* 上帝], what science calls a fundamental element [*yuanzhi* 原質], although it cannot be known or measured through the power of human intellect, yet the point is that without any doubt such elements actually exist. Moreover the changes that all things go through go back to an origin in one thing. This one thing is the root, and all other things are its branches.⁴⁵

Although couched in the rhetoric of evidential studies 考證學 and the investigation of things 格物, Zhong Tianwei's remarkable essay for the Polytechnic's essay contest represented

⁴⁵ See GZSYKY, Vol. 1, 1889, pp. 21a-b. The essay is also cited from another version in Xiong Yuezhi, *Xixue dongjian yu wan Qing shehui*, pp. 365-66.

a succinct summary of Darwin's theories and introduced Spencer's methodology almost a decade before Yan Fu's 嚴復(1853-1921) Chinese translation of Huxley's 1893 Romanes Lectures on "Evolution and Ethics" appeared in 1898 under the title of *On evolution (Tianyan lun 天演論)*. Yan, for example, translated "natural selection" as "heavenly selection" (*tianze 天擇*), which like the missionary introduction of evolution in botany avoided direct mention of the Darwinian struggle of the fittest to survive.

By contrast, Zhong avoided the natural theology that had informed Protestant accounts of evolution. Zhong noted in his essay that he had seen a recent translation of Spencer's first work, which was called *Essential Guides for Study (Siye yaolan 肄業要覽)*. Zhong's student account of the survival of the fittest through natural selection in 1889, presented above, contrasted with the more classically domesticated notion of "heavenly selection" that Yan Fu later presented a decade later as a translation for natural selection.⁴⁶

The lower rank that Zhong's essay received, despite its more expert account of Darwin and Spencer, becomes understandable, however, when we review the comments by Wang Tao, who was the overall supervisor of the essay contests. In the edition of the 1886-1893 essays that were published together as an annual group of essays, Wang Tao's comments were often included in the top margins of the page, as had been the comments of Ming and Qing examiners and outside teachers in the collections of model literary and policy essays for the civil examinations. In his comments on Zhong's explication of the "principle of the survival of the fittest," Wang wrote of Darwinism:

⁴⁶ Yan Fu's translation of Spencer's *Study of Sociology* 群學論 appeared after 1898. Pusey, *China and Charles Darwin*, p. 59, traces the first introduction of Darwin to Yan Fu's 1895 essay "On the Origins of Strength" (*Yuan qiang 原強*). See also David Wright, "Yan Fu and the Tasks of the Translator," in Michael Lackner, Iwo Amelung, and Joachim Kurtz, eds., *New Terms for New Ideas: Western Knowledge & Lexical Change in Late Imperial China* (Leiden: E. J. Brill, 2001), pp. 235-255, especially p. 253.

This essay describes the flourishing of all living things whereby those most suitable survive the longest. What is referred to as "those most suitable" [*yizhe* 義者] means "those most benefited" [*yi ye* 宜也]. The theory that "under heaven the strong survive and the weak perish" [*tian qiangcun ruomie zhi shuo* 天強存弱滅之說] has no basis in fact [*yi qian kaoju* 以欠考據].⁴⁷

Wang's comments indicate that the Darwinian view of evolution was unacceptable in the 1880s and 1890s for the Protestant missionaries in Qing China. Such opposition carried over to their longtime collaborators such as Wang Tao, who earlier had worked with the Scottish missionary James Legge (1815-1897) to translate the Chinese Classics into English. Hence, the lower ranking of Zhong's 1889 essay was an indication of the antagonism Darwin's views provoked among the contest judges, even though Zhong's essay was the only one to describe clearly the controversy of how Darwin's views "contradicted the teachings of Jesus."

Nevertheless, Zhong's essay was awarded fourth place and published in 1889 and reprinted in later collections. As a low-level translator and educator, Zhong supported educational reform in China within the balanced framework of adapting Western science and technology to Chinese learning, thus unifying the practical "arts" (*yi* 藝) and the unifying Way. His precocious analysis of Darwin, however, revealed the potential for Chinese literati to supersede the Christian packaging of the modern sciences, a process that began among Chinese literati in earnest after the Sino-Japanese War, at the same time that Zhong continued earlier efforts to award Chinese learning eminence of place in theoretical matters.⁴⁸

⁴⁷ GZSYKY, Vol. 1, 1889, p. 21a. See also Elman, *A Cultural History of Civil Examinations*, pp. 407-20, on official collections of civil examination essays.

⁴⁸ Shang Zhicong, "1886-1894 nianjian jindai kexue," p. 81, and Li Changli, "Wan Qing dui Xixue de liangzhong wudu," pp. 112-13.

Just as the Chinese eventually learned about Copernicus despite the Jesuits' efforts to conceal his theory of a heliocentric cosmos, so too they learned about Darwin in spite of the Protestants' attempts to replace the theory of natural selection with a natural theology of "Christian Darwinism." The Chinese Prize Essay Contest reveals that the Protestant enterprise, once its religious agenda was exposed, was no more convincing to many Chinese in the late nineteenth century than the Jesuit translation agenda had been in the seventeenth and eighteenth. Hence, after the Sino-Japanese War, Chinese literati quickly turned to Meiji Japan as the source for the latest currents in modern science.

In the late 1880s, most Chinese scholar-officials such as Li Hongzhang, who posed the spring 1889 question, were still ignorant of Darwin's theory of evolution based on the survival of the fittest and followed instead the revised natural theology of Protestants, which informed the 1879-80 and 1886 versions of the *Primers for Science Studies* 格致啓蒙 and most of the articles on science in *The Chinese Scientific and Industrial Magazine*. Ironically, the essay contest exposed that some Chinese such as Zhong Tianwei were more in tune with the Darwinian turn in biology, zoology, and botany than their missionary teachers or their older Chinese predecessors in science studies such as Wang Tao.

After Wang Tao's death and Fryer's departure for Berkeley University, the essay contests were not as enthusiastically promoted, although they were still held regularly, sometimes monthly, sometimes quarterly in 1901, 1904, 1906, and 1907. The Sino-Japanese War heightened the disjunction between events before the war and those after. In particular, many of the events from 1865 to 1894 leading up to the establishment of modern science in late imperial China were replaced by the public attention that reformers, iconoclasts, and revolutionaries received after 1895. Their generation was designated as the decisive one, and not those who had

been part of the Protestant era or the arsenals and schools associated with the dispersed foreign affairs movement.

One example of this displacement of pre-1894 literati efforts to master Western learning and modern science was the meteoric rise of Yan Fu as a public figure. His reputation vis-à-vis his predecessors as an iconoclast and the pioneer translator of Spencer and introducer of Darwin's theories replaced his earlier career as a graduate of the Fuzhou Navy Yard and naval school teacher and administrator. This spotlight on Yan Fu after 1895 has overlooked the historical events in the rise of modern science and Western learning in China before the Sino-Japanese War.

Similarly, Liang Qichao overlooked "the explosion of the newspaper market" after 1850 in his own self-serving accounts of the heroic emergence of a new and critical journalism in late nineteenth century China. In the process, Yan and others such as Tan Sitong, Liang Qichao, and Kang Youwei who rose to prominence after the war have received the credit for many of the contributions that Li Shanlan, Hua Hengfang, Wang Tao, and others such as Zhong Tianwei had already made in breaking new intellectual ground in the 1870s and 1880s. Both Tan Sitong and Kang Youwei as publicists appropriated science to legitimate their millennial visions but understood very little of science on its own terms.⁴⁹

⁴⁹ See *North-China Herald*, January 29, 1902, p. 180, September 22, 1905, pp. 697-98, January 25, 1907, p. 202, February 21, 1908, pp. 418-19. See also Xiong Yuezhi, *Xixue dongjian*, p. 373, and Chen Liwei 陳力衛, "Meiji shoki ni okeru Kan yakusho no shûyô" 明治初期における漢譯書の受容, *Tôhōgaku* 東方學 99 (2000): 54-57. Compare Natascha Vittinghoff, "Unity Vs. Uniformity: Liang Qichao and the Invention of a 'New Journalism' for China," *Late Imperial China* 23, 1 (June 2002): 91-143.

What is interesting about the China Prize Essay Contest is that it used the prestige of the imperial civil service examinations to aid missionary efforts to promote modern science during the late Qing, which created a working partnership between Western translators and Qing high officials, particularly those in provinces with treaty ports. At the same time, those who were drawn to scholarly and technical work in the new industrial arsenals after the Taiping Rebellion in Fuzhou, Shanghai, and elsewhere, or to translation positions in the official Foreign Language Schools in Beijing, Shanghai, and Guangdong, tended to be relatively marginal literati. They often had failed the more prestigious civil examinations several times and saw Western learning and the sciences as an alternative route to fame and fortune.⁵⁰

The missionaries generally remained sanguine about the civil examinations until the 1894-95 Sino-Japanese War. Thereafter, Chinese naval defeats contributed to the transformation of official, elite, and popular perceptions of the Self-Strengthening 自強 era. New public opinions appeared in the Chinese and missionary press that shaped the emerging national identity and sense of crisis among Han Chinese, who increasingly opposed the Manchu regime in power. Disappointment with the military losses convinced many Chinese that the Foreign Affairs Movement 洋務運動 had failed and that more radical political, educational, and cultural changes were required to follow Japan's lead in modernizing and coping with foreign imperialism.

The Sino-Japanese War provoked a striking switch in Protestant confidence about the future of Qing China. An account of the Chinese defeat prepared by one of the leading Protestant missionaries and translators in Beijing, Young J. Allen (1836-1907), when translated into

⁵⁰ Wright, "The Great Desideratum," pp. 35-70.

Chinese, was frequently pirated, for example, and became required reading for the 1896 Hunan provincial examination in Changsha. Allen's account of the defeat outlined his views of needed reforms in China. In the essay, Allen traced China's backwardness to three root causes: 1) superstition (*mixin* 密信); 2) opium 鴉片; and 3) civil examinations 科舉. In this series, he also stressed the importance of science (*gezhi* 格致) as a corrective for the causes of China's backwardness.

Native studies, according to Allen, had failed to grasp the universal lessons of modern science. In particular, China's assimilation of Western science was missing the importance of the "study of the principles of things" (*wuli zhi xue* 物理之學), or what in the late 1890s would increasingly be called "physics" based on Japanese translations of Western scientific texts. Moreover, Allen used "superstition" as a modern cultural category to pigeon hole the entire Chinese classical tradition, a reduction that would become de rigueur among many Chinese radicals in the twentieth century.⁵¹

Similarly, before his departure for California to take up the chair of Oriental Languages at Berkeley University, which he had been offered in 1895, John Fryer publicly announced a competition for "new age novels" (*xin xiaoshuo* 新小說) in Chinese that would enhance the morals of China and eviscerate the triple evils of opium, stereotypical examination essays, and footbinding. This appeal for a new literature written in "easy and clear language with meaningful implications and graceful style" attracted the interest of Liang Qichao and other reformers who would provide the foundations for the call for a new culture in China, which was premised on the failure of traditional Chinese civilization symbolized by the bound feet of Chinese women.⁵²

⁵¹ The essay is abridged in *Wan'guo gongbao wenxuan* 萬國公報文選, edited by Qian Zhongshu 錢鍾書 and Zhu Weizheng 朱維錚 (Beijing: Sanlian shudian, 1998), pp. 179-201.

⁵² Patrick Hanan, "The Missionary Novels of Nineteenth-Century China," *Harvard Journal of*

Like the Protestant missionaries, Chinese literati also attacked the civil examinations and footbinding after 1895. The race to establish Chinese institutions of higher learning that would stress modern science accelerated after the occupation of the capital by Western and Japanese troops in 1900. The Boxer popular rebellion in north China and the response of the Western powers and Japan to it unbalanced the power structure in the capital so much that foreigners were able to put considerable pressure on provincial and metropolitan leaders such as Li Hongzhang. Foreign support of reform and Western education thus strengthened the political fortunes of provincial reformers such as Yuan Shikai 袁世凱 (1859-1916) and Zhang Zhidong 張之洞, who had opposed the Boxers.⁵³

After the civil examinations were abrogated in 1904, the Qing dynasty quickly lost control of its science policies, which increasingly fell under the control of local Chinese intelligentsia and overseas students. The political consequences of this loss of control were to be expected when the Qing bureaucracy meekly gave up one of its major institutions that had for centuries successfully induced literati acceptance of the imperial system. Some noted that the post-Boxer reforms were so radical that they helped precipitate the downfall of the dynasty. By spring 1906, for instance, Yen Fu in an article "On the Relation between Schools and the Nation" 論教育與國家之關係 admitted that many, including himself, were now having second thoughts about getting rid of the civil examinations so precipitously.⁵⁴

What should be added, however, is that the radical reforms in favor of new schools allowed the sciences to develop independently of the political system for the first time. Via new

Asiatic Studies 60, 2 (December 2000): 440-441, and Anonymous, "The New Novel Before the New Novel," in Zeitlin and Liu, eds., *Writing and Materiality in China*, pp. 317-340.

⁵³ Elman, *A Cultural History*, pp. 608-618.

⁵⁴ Yan Fu 嚴復, "Jiuwang jue lun" 救亡決論 (On what determines rescue or perishing), in *Wuxu bianfa ziliao* 戊戌變法資料 (Beijing: Shenzhou guoguang she, 1953), 3/60-71.

school-based national examinations, the Manchu court tried in vain to maintain control over the delegitimated remnants of the older examination constituencies while at the same time gain control over education in the new schools. The Qing dynasty never reestablished its control of the provincial and local educational systems, which it had irrevocably lost in 1905. Power had shifted to the new schools and more importantly to the Han Chinese gentry constituencies they served.

In this rapid parade of events, the 1886-1893 Chinese Prize Essay Contest was quickly discarded as a failed experiment and ultimately forgotten. I would suggest, however, that the second half of the nineteenth century was the "seeding time" for the modernization of China. During the period from 1850 to 1895, many works on astronomy, mathematics, medicine and related fields of botany, geography, geology, mechanics, and navigation were translated by a core group of Protestant missionaries and Chinese co-workers in Guangzhou, Beijing and Shanghai. The essay contest helped to popularize the new knowledge contained in those translations by employing a traditional vehicle to valorize that knowledge. The Sino-Japanese War made such efforts appear still-born, but had the Chinese won that war, which was not impossible, such efforts to spread the new sciences through traditional institutional forms might have been legitimated and expanded.⁵⁵

⁵⁵ Biggerstaff, "Shanghai Polytechnic Institution and Reading Room," p. 127. See also Elman, "Naval Warfare and the Refraction of Qing Nineteenth Century Industrial Reforms into Failure," forthcoming.