第九屆科學史研討會

The 9th Conference on the History of Science

會議日程及論文摘要

Program & Book of Abstract

會議時間：中華民國一〇〇年四月九、十日

會議地點：中央研究院人文社會科學館第一會議室

主辦單位：國際科學史與科學哲學聯合會科學史組中華民國委員會

協辦單位：中央研究院、張昭鼎紀念基金會、義守大學通識教育中心

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學術構想與宗旨

科學革命，16、17 世紀時，由哥白尼、伽利略、克卜勒與牛頓等人先後在天文與物理上的突破與成就，在 1759 年被法國數學家達朗伯特 (Jean-Baptiste le Rond d'Alembert, 1717-1783)，也是《百科全書》(Encyclopédie) 的編輯之一，描述成一種波濤洶湧而無法抵抗的河水，衝破了由亞理斯多德千餘年來所建築的堤壩，從各個方向蔓延穿透了歐洲大地，改變了歐洲人的視野、心智與靈魂，進而讓歐洲的十九世紀蛻變為科學的世紀。同樣的，這股浪潮在十九世紀中葉時也開始席捲了中國。

清末戰爭的連續失利，使清廷瞭解到學習西方科學與技術的必要性。然而中國該如何開始進行？在傳統的政治社會制度束縛中，西方科學應由誰來引介？儒家文化扮演何種角色？這一連串的問題都有待中國知識份子的覺醒和主動解決。然而，在中國知識份子還來不及自我轉型前，西方科學與技術已開始敦促中國改變，並進一步引起中華文化與社會結構的連環改變。值得注意的是，在中國全面引進西方科學的同時，卻也促進了我們對於自身文明中科技歷史價值的探索，進而重新回顧與檢視中國傳統的科技與社會、宗教、經濟與教育等相關發展歷史。

民國 43 年，李約瑟團隊出版第一冊《中國之科學與文明》，此書開啟了研究中國科學史之先河，其以西方科學史研究來檢視中國科學發展成就的「大滴定」理論也開始蔚為風潮，喚起了國人對於科學史研究的重視。在臺灣最值得重視的發展，是關注科學史研究的學者專家們，於民國 71 年成立了中央研究院科學史委員會（下稱科學史委員會）。不久之後，更申請加入國際科學史與科學哲學聯合會，組織臺灣科學史學者與專家們參與國際科學史的交流。在積極發展與國際接軌的同時，新竹清華大學歷史研究所也在各界期盼當中，成立以科學史為導向研究的科技組，成為臺灣推動科學史教學與研究最重要的學術單位之一。

科學史委員會於民國 75 年 12 月 19、20 日，在臺北舉行第一屆科學史研討會，並在會後出版論文集，其後賡續不輟，至今已舉辦八屆研討會，並印行論文集。三十年來，臺灣的科學史專家與學者已在醫學史、數學史、科技與社會、生物學史、機械學史、軍事技術史等領域形成研究群體，並已有卓越的學術成就。今年所舉辦的第九屆科學史研討會欣逢本會成立三十週年，回顧前輩學者的無私奉獻與傑出成就，在緬懷之際，我們願以推動與提昇科學史之研究自勉，期能繼續促進國內科學史與相關領域之交流活動，並加強國際交流與擴大國際視野，締造科學史研究的下一個高峰。

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相關資訊

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聯絡人：義守大學通識教育中心　劉惠青小姐

電　話：(07) 657-7711 轉 5204

傳　真：(07) 657-7056

E-mail: hcliou@isu.edu.tw

議事規則

1. 每篇論文發表時間15分鐘，討論為5分鐘，單場論文全部發表結束後，進行綜合討論。
2. 論文發表時間到達第12分鐘時，將以一短鈴提示，第15分鐘按一長鈴表示時間結束。
3. 單場全部論文發表完畢後，每位與會者請於1分鐘內提問完畢，時間到即按一長鈴表示提問時間結束，俟發表人回應後再進行下一道問題。
4. 主持人於開放討論中，如遇必要，請協助釐清問題及協調提問次序。

議程

中央研究院人文社會科學館　四月九日（星期六）	
08:20-09:00	報到
09:00-09:10	開幕
專題演講	
09:10-10:10	劉廣定（國立臺灣大學化學系名譽教授）：百年來的中華民國化學研究
10:10-10:30	茶敘
【1-1 場】主題：數學史　　主持人：洪萬生	
10:30-11:30	城地茂／劉伯雯　西漢以前算書群與《周髀算經》的直角三角形： 《周髀算經》的夏至之日晷與《數》第 0304，0457 簡 英家銘　從《算學正義》與《九章數解》看韓國史上的數學正典 張耀祖　秦九韶大衍求一術的近代應用
11:30-13:30	午餐（召開委員會 12:00-13:00） 影片欣賞：鄭和下西洋
【1-2 場】主題：醫療專業化及醫技發展　　主持人：劉士永	
13:30-14:30	朱瑪瓏　同行相嫉：梅威令醫生與其他洋醫關於中國人西醫教育的爭議 巫潔濡　公醫制度：日治臺灣醫學教育的濫觴 吳燕秋　戰後臺灣墮胎技術發展史(1945-1984)
14:30-14:50	茶敘
【1-3 場】主題：生物學史　　主持人：傅大為	
14:50-15:50	李學勇　七十年(1940-2010)學習接受達爾文學說的回憶： 物不競人競，天不擇人擇 劉昭民　臺灣日據時代(1895-1945)植物學之研究 賴伯琦　後達爾文時期物種概念發展史
15:50-16:10	休息
【1-4 場】主題：古機械的研究與教學　　主持人：徐光台	
16:10-17:10	林聰益／楊政峰／李宜倫　龍骨水車的分類與其構造 林聰益／呂金塗／林育昇　臥軸式風力翻車的構造分析 林聰益／曾聖超　水運儀象臺之水運儀的復原製造
17:30-19:30	晚宴

中央研究院人文社會科學館　四月十日（星期日）	
【2-1 場】主題：醫藥及其應用　　主持人：陳恒安	
09:10-10:10	陳韻如　常山、青蒿與砒霜：從藥方比較觀察瘧對宋代醫學的影響 魏嘉弘　帕西尼與霍亂弧菌 林政佑　殖民地的指紋：日治時期指紋技術的形成與應用
10:10-10:30	茶敘
【2-2 場】主題：科學哲學與科學教育　　主持人：陳德勤	
10:30-11:50	陳正凡　由臺灣科學教育史的角度來認識趙金祁哲學的意義與影響 林明聖　臺灣詩中的明清小冰期(1624-1895) 陳怡靜／吳明德　空氣動力車史 吳明德／陳怡靜　記錄資訊的輪子
11:50-13:30	午餐 影片欣賞：鄭和下西洋
【2-3 場】主題：水利史與博物館學　　主持人：張澔	
13:30-14:50	鄭永昌　談木龍：清代乾隆年間治理江南水利的一種河工器具 陳東和　從技術與審美趣味看論南宋官窯演進的內外因素 沈建東　長江中下游新石器時代晚期玉器工藝製作前的構圖及其意義 林加豐　都江堰水利工程再探
14:50-16:10	茶敘
【2-4 場】主題：軍事史和其他　　主持人：吳嘉麗	
16:10-17:10	李其霖　略論清代戰船之頭巾及插花 周維強　師夷長技：清代子母砲之制度及其應用 張澔　江南製造局訂購之化學書籍(1868-1870)：清末引進西方化學之探討
17:10-17:30	閉幕
17:30-19:30	晚宴
賦歸	

中英文論文摘要

（依發表序排列）

西漢以前算書群與《周髀算經》的直角三角形：《周髀算經》的夏至之日晷與《數》第 0304，0457 簡

城地茂[*]　劉伯雯[**]

摘要

於 1983 年在湖南省荊州市發現《算數書》(BCE186 年頃)，才開始知道《九章算術》(CE1c?)、《周髀算經》(BCE50 年頃?) 以前的實物史料。之後進入 21 世紀，陸續發現了《數》(秦簡？)(湖南大學岳麓書院藏)、《算術》(BCE157 年頃)(湖北省孝感市雲夢縣・睡虎地 M77 墓出土)、《算表》(西漢？)(北京・清華大學藏) 等算書。《數》的第 0304，0457 簡與《九章算術》第 9 章第 6 題幾乎是相同的問題，都是 5:12:13 的直角三角形（句股形）問題。從這件事來看，在《周髀算經》成立以前，中國數學學者，天文學家就不只有 3:4:5 的研究，於 5:12:13 的直角三角形上也曾考察其性質的。

在《周髀算經》內記載夏至時以 8 尺的表(gnomon)出現了 1 尺 6 寸影子的地方（緯度）則稱為「地中」。此時得知表與影子形成 5:1 的直角三角形，而相反方向則形成 5:12:13 的直角三角形。

像這樣，《九章算術》以前的數學者不光只是思考使用像「相補定理」的面積算法也可能有使用到比例計算。

關鍵詞：《數》、《周髀算經》、句股、5:12:13

[*] 日本國立大阪教育大學。E-mail: jochi@cc.osaka-kyoiku.ac.jp

[**] 國立高雄第一科技大學。E-mail: lbw@ccms.nkfust.edu.tw

Chinese Mathematical Arts before the Western Han Dynasty and the Right Triangles at the *Zhoubi Suanjing*: The Sun Shadow of *Zhoubi Suanjing* at the Summer Solstice and Slip no. 0304 and 0457 of *Shu*

JOCHI Shigeru*, LIU Bowen**

Abstract

In 1983, the *Suanshushu*(about B.C.E.186) was discovered at Jizhou, Hubei, China, we know Chinese mathematical arts before the *Zhoubi Suanjing* (about B.C.E.50?) and *Jiuzhang Suansh*u (B.C.1 c). Then, in 21st century, *Shu* (the Qing dynasty?, Yuelu School, Hunan University), *Suanshu* (about B.C.E.157, M77 Tomb, Shuihudi, Yunmeng, Hubei), *Suanbiao* (the western Han dynasty?, Qinhua University) and so on were discovered in China. The question at slip no. 0304 and 0457 of *Shu* is quite similar with the question 6, chapter 9 of *Jiuzhang Suanshu*, that is to say, these are the questions of right triangles of 5:12:13. Therefore Chinese mathematicians and astronomers did not already study only triangles of 3:4:5, but they also studied triangles of 5:12:13 before the *Zhoubi Suanjing*.

The *Zhoubi Suanjing* said that the "center of China" was the point (latitude) of the sun shadow was 1.6 Chi length at the summer solstice by the 8 Chi height gnomon of "Guibiao". In this time, the gnomon and sun shadow made the right triangle of 5:1, and at the opposite side, they made the right triangle of 5:12:13.

Therefore the authors think that Chinese mathematicians did not study only the area of right triangles, but they also studied the ratio of triangles.

Keywords: *Shu*, *Zhoubi Suanjing*,"Gougu"(right triangles), the ratio of 5:12:13

* Osaka Kyoiku University, Japan.

** National Kaohsiung First University of Science and Technology.

從《算學正義》與《九章術解》看韓國史上的數學正典

英家銘*

摘要

南秉吉 (Nam Pyŏng-Gil, 1820-1869) 是韓國朝鮮王朝（公元 1392 年至 1910 年）末期代表性的算學家，著有至少七部算學專著，包含對中國古典算學的重新注解 –《九章術解》– 與包含朝鮮當代大多數重要數學主題的「教科書」–《算學正義》。本篇論文將從這兩部著作的序文與數學內容為主，輔以其他數學著作，來討論韓國史上與南秉吉心目中的數學正典。

韓半島在統一新羅時期（公元 668 年至 935 年），仿唐制，立「國學」。其中算學教育的官方教材包含《九章》與《綴術》，而這兩部來自中國的算學經典也可被視為韓半島上最早的數學正典，亦即包含官方認可數學知識的書籍。朝鮮王朝初期，《九章算術》可能已佚失，而雜科中的算學取材科目轉變為來自中國宋元時期的算書。至十八世紀初，康熙御製之《數理精蘊》成為清帝國與朝鮮共同認定的數學正典。

南秉吉在生涯前期與中期，同樣認定《數理精蘊》為標準算學知識的來源，並藉以注解重新傳入韓半島的《九章算術》。然而，在生涯後期，南秉吉認為《精蘊》中的代數方法「借根方」，其適用範圍不如宋元算書中的「天元術」來得大，所以他在自己所寫下的《算學正義》中，以天元術取代借根方，成為主要的代數解題方法，並希望以《正義》一書做為可能的朝鮮算學正典。

* 中原大學應用數學系。E-mail: commandershran@gmail.com

Mathematical Canons in Korean History: Judging from the Contents of the *Sanhak chŏngŭi* 算學正義 and the the *Kujang sulhae* 九章術解

YING Jiaming*

Abstract

Nam Pyŏng-Gil (1820-1869) was an important mathematician near the end of the Chosŏn Dynasty (1392-1910). He wrote at least seven mathematical texts, including a reinterpretation of some classical Chinese mathematics – the *Kujang sulhae* – and a "textbook" covering most of the important mathematical topics in contemporary Korea – the *Sanhak Chŏngŭi*. This paper will discuss mathematical canons in Korean history as well as in Nam's mind by investigating the prefaces, postfaces and mathematical contents in these two and some other mathematical works in his time.

During the Unified Silla period(668-935), the mathematical education system in the National Academy in Korea used *The Nine Chapter*s and the *Zhui Shu* 綴術 as their textbooks, which made these two Chinese texts the earliest mathematical canon in the peninsula. In the early times of the Chosŏn Dynasty, *The Nine Chapter*s was lost, and the official mathematical textbooks were replaced by the texts from China's Song-Yuan period. And then, at the beginning of the 18th century, the *Shuli jungyun* 數理精蘊, which was imperially composed, was recognized as the mathematical canon by both Qing China and Chosŏn Korea.

In the earlier periods of Nam's career, he also treated the *Shuli jungyun* as his mathematical canon, and commentated on the reintroduced *The Nine Chapter*s with the knowledge in it. However, in the later years of Nam's, he realized that the algebraic method in the *Shuli jingyun* – "Jiegenfang" – can solve less problems then the algebraic method from the Song-Yuan texts – " Tianyuan Method". Thus in his *Sanhak Chŏngŭi*, he replaced Jiegengfan with Tianyuan Method, and hope this text would become a mathematical canon in Korea.

* Department of Applied Mathematics, CYCU.

秦九韶大衍求一術的近代應用

張耀祖*

摘要

由於中文方塊字一字一音的特性，極利於數字運算，加上使用先進的十進位值制，發展出以算籌為工具、演算法為特色的中國數學，與發展出演繹為特色的希臘數學中西呼應，為人類數學發展的兩大主流。

優異的數字計算能力，讓中國人在解方程問題方面優於西方，因此比西方更早發展出解線性聯立方程以及同餘方程的系統解法。

南宋數學家秦九韶提出大衍求一術，是同餘方程系統解法的關鍵步驟。他的傑出成就，博得科學史之父－薩頓(G. Sarton, 1884-1956)極高的評價，稱讚他“是他那個民族、他那個時代、並且確實也是所有時代最偉大的數學家之一。”

在這個報告中，我們將介紹大衍求一術的近代應用：目前數位影音、通訊應用中一個極為關鍵的技術－糾錯編碼理論，其中的解碼過程所用的技巧，可以說是大衍求一術的現代版；此外，許多近代工程技術也用到了該方法，是一個相當重要的工具。

* 義守大學應用數學系。E-mail: ytchang@isu.edu.tw

同行相嫉：梅威令醫生與其他洋醫關於中國人西醫教育的爭議

朱瑪瓏*

摘要

1880 年代，中國海關醫師梅威令(Dr. W. W. Myers)於打狗（今高雄）開始了一個教導中國人西方醫學並賦予證照的計畫。四個梅醫師的中國學生於 1886 到 1888 年間，在香港及上海進行了證照考試。兩個主要港口城市的報紙對此的高度關注，包含了針對梅威令的相關批評。本文嘗試論證這些洋醫同行對梅威令的批評，(主要來自醫療傳道士)，以及梅威令的反擊，透露出當時在中國的洋醫之間彼此的矛盾。這個矛盾進一步顯示了西醫專業的世俗化過程。這些在本土受教的華人西醫的加入，儘管一開始人單勢薄，卻成為西醫專業科層裡，在殖民史的脈絡中，被認可的底層生力軍。

關鍵詞：梅威令、西方醫學、醫學教育、專業

* 美國紐約州立大學賓漢頓校區歷史系。E-mail: marlon@ntu.edu.tw

"Professional Jealousy": Controversy between Dr. W. W. Myers and his medical colleague in Medical Education for Chinese

ZHU Marlon*

Abstract

In the 1880's, Dr. William Wykeham Myers, a medical officer of the Chinese Maritime Customs in Takow (Kaohsiung) had made a scheme of both educating and certificating Chinese in western medicine. Four of Myers' students had been educated in Takow and taken exams in Hong Kong and Shanghai from 1886 to 1888. The high publicity of these exams on newspapers in both principal port-cities in China arose several critics on Myers' enterprise. Major criticism came from medical missionaries who had also trained their Chinese assistants. Focusing on these criticisms, this article argues that this controversy had pinpointed the tension among western medical practitioners in late nineteenth-century China. This tension had demonstrated a process of "secularization" of Western medical profession, which further secured medicine as a profession in the intricate colonial context. The recruiting of Chinese had supplemented the hierarchy of the profession with a vulnerable base in various western settlements in China and Southeast Asia.

Keywords: W. W. Myers, Western medicine, Medical education for Chinese, Profession

* Ph. D candidate, Department of History, State University of New York at Binghamton.

公醫制度：日治臺灣醫學教育的濫觴

巫潔濡*

摘要

後藤新平在臺提出公醫制度的用意，除了配合推行鴉片漸禁政策、改善殖民地環境衛生以吸引更多日人來臺，更期望這些受過西方醫學教育的日籍公醫能成為傳遞文明知識與殖民理念的先鋒。然而，欲以日籍醫師與公醫制度作為唯一基層醫療人員與體制的想法，很快地由於財政短缺、志願任職公醫者「質」的參差與「量」的不足，不得不以培養及任用臺灣醫師，且逐步開放公醫人選的限制，來解決執行該制度時所面臨的困境。出乎意料的是，大多數的臺籍醫學校畢業生並未如殖民政府預想般成為公醫，而是選擇回到故鄉在自己的私人診療所執業。這個情況，一直要等到大正九年（1920），臺灣的政權制度由中央集權改為地方分權，州廳政府獲得任用公醫的權力與義務，地方上的臺灣醫師以「囑託公醫」的身分回到該制度內，才改善公醫人數長久以來不足的問題，只是這般操作上的轉變，卻也將公醫制度的意義帶離了後藤新平最初的構想。

本文以「公醫制度實行上的困境成就了日治臺灣醫學教育」為假設，在論述的主軸上則試圖以公醫制度與醫學教育的互相影響，來呈現公醫制度從構想、實施到轉變背後的意義。「濫觴」不僅指醫學教育的出現，且代表公醫制度與醫學教育互為因果的開端，更預告著爾後公醫制度的演變。

關鍵詞：公醫制度、醫學教育、囑託公醫

* 法國高等社會科學院健康、人口、社會政策碩士。

The Public Dispensary System: The Seed of Medical Education in Colonial Taiwan (1895-1945)

WU Chiehju*

Abstract

The public dispensary system was designed by Gōtō Shinpei in order to promote the policy of progressively inhibiting opium in Taiwan and to improve the colony's environment sanitation. Public dispensary doctors were also expected to offer primary medical care and to act as the communicator of civilization and the pioneer of colonialism. However, because of the financial problems, insufficient and unqualified Japanese medical personnel, the system could not have been operated thoroughly. The colonial government thus launched medical education to train Taiwanese doctors. Persons selected restriction for public dispensary doctors also had been relaxed. Unexpectedly, most graduates of official medical school practiced medicine in their own private dispensaries rather than public dispensaries. The problem of insufficient public dispensary doctors had not yet been solved. Until 1920, the organization of the colony was changed from centralism to regionalism. The local governments had obtained the authority to appoint public dispensary doctors. Many Taiwanese private dispensary doctors therefore were employed as "entrusted public dispensary doctors". The insufficiency situation had finally been improved. Nevertheless, the public dispensary system had also been far away from Gōtō Shinpei's design.

Keywords: Public Dispensary System, Medical Education, Entrusted Public Dispensary Doctors

* Master, Santé, Populations, Politiques Sociales(SPPS), École des Hautes Études en Sciences Sociales （EHESS）, Paris, France.

戰後臺灣墮胎技術發展史(1945-1984)

吳燕秋*

摘要

臺灣自日治時期禁止墮胎，墮胎卻未因此絕跡。依據人口統計資料及醫師推估顯示，戰後墮胎有逐漸增長之勢。問題在於這些不斷增加的墮胎數，是用何種方法進行的，技藝的傳播過程為何？又遭遇什麼樣的技術競爭？技術發展上又歷經什麼樣的變遷？則須進一步探討。因此，本文擬從墮胎技術與社會、經濟、文化互動的脈絡切入，釐清戰後臺灣墮胎技術的發展軌跡，時間斷限上起 1945 年，終於墮胎合法的 1984 年。戰後墮胎技術可粗分為傳統藥物及西醫手術二類，約在 1960 年代，傳統用藥墮胎知識逐漸消失。此時引進的真空吸引術，與過去講究技藝訓練的子宮擴刮術（Dilation and Curettage，簡稱 D&C），發展出既競爭或合作的關係。不過真空吸引術的早期應用，曾在其他國家引起爭議，如操作技巧、電壓調整等問題，但在臺灣，卻少見醫師討論這類操作問題。亦曾有本土醫師企圖以腳踏式的真空吸引器與進口的真空吸引機競爭，但未獲得太大的迴響。然而，同樣利用真空原理的月經規則術（Menstrual Regulation, 簡稱 MR），卻得以 1970 年代因國際人口組織的倡導下，風光傳入臺灣，甚至成為墮胎的代名詞。出人意料之外的是，在優生保健法通過後，月經規則術並未延續其盛況，反逐漸式微。

* 中央研究院人文社會科學研究中心衛生史計劃博士後研究員。E-mail: mandy@mail.emandy.idv.tw

A History of Abortion Techniques in Taiwan from 1945 to 1984

WU Yanchiou

Abstract

Abortion was prohibited in Taiwan starting from the colonial period under Japan. However, the law did not stop people from having abortions completely. According to the population statistics and the estimates of doctors, the number of abortions kept increasing after World War II. There are some questions to investigate further. How did people induce abortion? How were the abortion techniques communicated? What kind of competition was there between abortion techniques? What changes took place in the development of abortion techniques? This paper, covering the period of 1945 to 1984, will clarify the development of abortion techniques after World War II, including the the influence on abortion techniques from society, economy and culture. The abortion techniques can be categorized as medical abortion and surgical abortion. Medical abortion disseminated by laypersons declined gradually during the 1960s. The development of surgical abortion was more complicated than the former. The electrical suction evacuation technique, introduced in the 1960s, competed and coexisted with Dilation and Curettage(abbr. D&C), the most common abortive surgery before the 1960s. There was some controversy about electrical suction evacuation, but this was rarely discussed by gynecologists in public. One gynecologist invented new equipment for vacuum aspiration with a foot pedal to replace the electrical suction evacuation equipment, but it was not a success. Menstrual Regulation (abbr. MR), which was based on the same principle as electrical suction evacuation, was introduced with the help of international population organizations in the early 1970s, and popularized by many gynecologists. Unexpectedly, Genetic Health Law, passed in 1984 to legalize abortion, didn't make MR more popular. On the contrary, MR was on the decline due to its deficiencies.

七十年(1940~2010)學習接受達爾文學說的回憶：物不競人競，天不擇人擇

李學勇*

摘要

一、余生已晚，十七歲讀到高中，才由陳楨教授所編的《生物學》，讀到達爾文的演化論及長頸鹿的演化過程，對演化學是毫無感覺。（舉例）

二、進入大學(1942)，更逢抗戰正酣，深深感到「生存競爭，優勝劣敗」的真義，對達爾文學說非常信服（列舉弱肉強食的案例）。

三、選讀生物演化分類及課程，直接閱讀嚴復翻譯的「天演論」，深以「物競天擇」為生命原則。

四、購讀馬君武中譯《達爾文物種原始》。因文字艱深，長篇累牘，略知大意。

五、選讀周建人、葉篤庄及方宗熙等合譯的《物種起源》。對於達爾文學說有了深切的瞭解。但也產生諸多懷疑。

六、讀 Ruse, M.《達爾文的再革命》，發現達爾文學說之所以受人信服的「類比」哲學。

七、讀 Denmet, D. C. (1995) *Dangenous.Darwinism*，方知物不競人競，天不擇人擇。（討論大會時提交）

* 國立臺灣大學植物學系退休。

Darwinism of 20th Century in Taiwan: Struggle for Survival and Natural Selection

LI Siaojong*

Abstract

I. The basic items for discussion:

1. "On the Origin of Species by Means of Natural Selection; or The Preservation of Favoured Races in the Struggle for life". 1859.
2. "Descent of Man, and Selection in Relation to Sex." 1871.

II. Some Refresentative Literatures.

1. 1895. Huxley, T.: "Evolution and Ethics."
2. 1898. Yen Fu: Chinese translation of "Evolution of Ethics."
3. 1933. Newman, H. H.: "Advanced Biology".
4. 1942. Huxley, Julian: "Evolution: The Modern Synthesis."
5. 1964. Schwartz, B.: "In Search of Wealth and Power."
6. 1971. Provine, W. B.: "The Origin of Theoretical Population Genetics."
7. 1979. Ruse, Michael: "The Darwinian Revolution."
8. 1995. Cziko, Gary: "Without Miracles." (Second Darwinian Revolution)
9. 1995. Dennett, D. C.: "Darwin's Dangerous Idea."

III. Some Examples of Experiments for Confirmation of Darwinism. (Natural Selection and Struggle for existence).

1. Fertilization of Human Sperms.
2. Struggle of micro-organisms.
3. Sexual Selection in Insects.
4. Sexual Selection in Frogs.
5. Sexual Selection in Birds.
6. Sexual Selection in Seals.

* National Taiwan University, Retired.

7. Sexual Selection in Monkey.

8. Sexual Selection in Human kind.

IV. Revolutionary Changes in Human Society.

1. Changes in Religin.

2. World War I.

3. World World II.

4. Revolutionary Changes in Education.

V. Conclusion:

1. Organisms don't Compet, but Humankind do.

2. Nature don't Select, but Human Society do.

臺灣日據時代(1895-1945)植物學之研究

劉昭民*

摘要

日人據臺 50 年(1895-1945)，曾經派遣一些植物學家來台進行植物學調查和研究，後來又有一些在台執教的教員和教授研究植物學。由於他們都使用現代自然科學的方法進行研究，所以曾經獲得不少之成就。

本文主要是敘述日本植物學家在臺 50 年所得到的主要成就，包括植物分類學、植物生態學、植物生理學、熱帶植物、高山植物、森林植物、植物地理學等，並約略介紹這些植物學家的生平和主要貢獻，俾提供研究科學使者參考。

關鍵詞：植物學、植物學家、現代自然科學研究方法

* 中央研究院科學史委員會委員。

The Researches of Botany in Taiwan during 1895-1945

LIU Zhaoming

Abstract

The Japanese botanists have paid much attention to research the botany by means of methods of modern natural science in Taiwan during 1895-1945, including botanical classification, botanical ecology, botanical physiology, tropical botany, alpine plant, forestry growth, botanical geography etc.

The purpose of this paper is to make a brief introduction of their botanical researches and their biographies.

Keywords: botany, botanist, the methods of modern natural science

後達爾文時期物種概念發展史

賴伯琦*

摘要

自達爾文的鉅著「物種起源」(*The Origin of Species, by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life*)於 1859 年出版後，生物科學中「物種」的概念產生重大的影響。亞里斯多德對於動物的區分進行說明時，認為所有的生物都有其內在目的與重現自身的特質，據以分類，而這樣的物種概念建立於物種的本質性與不變性。然而，達爾文卻從自然生物的演變過程中，提出物種之特質並非不變的，而是經由「發生變異」、「子嗣遺傳」與「自然選汰」等過程，在生物發展過程中產生「演化」現象—新的物種。達爾文的物種演變觀點，使得「物種」這個原本只是生物分類重要單元的概念，延伸為生物演化的基礎單位，「物種概念」也因為生物科學內涵的開拓、遺傳學的發展、考古生物學研究方法的進步、分子生物學的興起與分子生物技術、資訊工程技術的改良，而使得其概念內容日益複雜與分歧，致使許多不同的「物種概念」被提出，其中，Ernst Mayr 所提出的「生物物種概念」更是歷久彌新。

本文試圖整理達爾文之後，「物種概念」因為生物科學學門研究多樣化的歷史進程，進而探討「物種概念」在生物科學史中演進與發展的軌跡，以及 Ernst Mayr 在物種概念形塑過程中所扮演的角色與重要性。

關鍵詞：物種概念、生物科學史、Ernst Mayr、演化論

* 大葉大學生物資源學系。E-mail: biophilia.lai@gmail.com

The History of Species Concept Development in Post-Darwinian Period

LAI Bochi G.*

Abstract

Since Darwin's monumental work, "The Origin of Species, by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life", published in 1859, the species concept in biology have been transformed. Far from Aristotle illustrating the characterization of animals, all the organisms are with inner destinations and to reproduce themselves. The organisms can be categorized by such the principle, based on the species concept which is formed by the essentiality and invariance of species. However, from the evolutionary process of natural organisms, Darwin proposed that the characters of species is not invariable, but originates by the process of variation, heredity and natural selection instead. It means that the new species comes from the evolutionary process of organisms' development. The evolutionary view of species by Darwin make the implication of species changed, from the fundamental unit of taxonomy to evolutionary biology. Furthermore, accompanied by the extension of biological science, such as the development of genetics, the progress of paleobiological research methods, the rise of molecular biology and biotechnology, and the improvement of bioinformatics algorithm, the species concepts those were proposed by the studies of evolutionary biology and speciation have become more and more complicated and divergent. Among them, the "biological species concept" proposed by Ernst Mayr is enduring important.

The aim of this article is to try systemizing the historical process of species concept transformed under the diversified researches of biological disciplines. Nevertheless, exploring the developmental trace of species concepts in biological history is to understand the importance and status of Ernst Mayrs in the evolutionary process of species concept formation.

Keywords: Species concept, Biological history, Ernst Mayr, Evolutionary theory

* Department of Bioresources, Dayeh University.

龍骨水車的分類與其構造

林聰益* 楊政峰 李宜倫

摘要

龍骨水車又稱翻車、龍骨車、槽筒或水車，為早期中國及其周邊地區重要的提水裝置，主要是運用於農業灌溉、鹽田提水、積水排澇、以及河道水利等用途。目前發現最早的文獻是記載於《後漢書》，其形制和構造的發展到唐代已經成熟並定型，它具有一種刮板式鏈條傳動裝置，主要是由上下兩個鏈輪和傳動鏈條所組成，是世界上獨特的鏈式水泵。其車之制：「車身用板作槽，長可二丈，闊則不等，或四寸至七寸，高約一尺。槽中架行道板一條，隨槽闊狹，比槽板兩頭俱短一尺，用置大小輪軸，同行道板上下通，以龍骨板繫在其上」。

龍骨水車與其它如轆轤、筒車之提水機械相比，不但可連續提水，而且效率高，是古中國應用最廣泛、影響最大的灌溉機械，因此，有各種不同的形式，可依不同動力源來進行分類，有人力、畜力、水力、風力等類型。在唐文宗大和三年（829 年）前，已有手轉（拔車）、足踏（踏車）、服牛（牛車）等類型，風力龍骨水車依據其風帆的運作方式又可分為立軸式以及臥軸式。立軸式風力龍骨水車最早文獻記載是在南宋（12 世紀），而臥軸式風力龍骨水車則約在明末清初（17 世紀）出現，本文是以動力、傳動、工作等三大系統進行各種龍骨水車之構造與工作原理的分析。

關鍵詞：龍骨水車、翻車、龍骨車、灌溉用具

* 南台科技大學機械工程系。E-mail: tylin@mail.stut.edu.tw; E-mail: m9810201@stut.edu.tw

Classification of Chinese Square-pallet Chain Pumps and their Structure

LIN Tsungyi*, YANG Chengfeng, LEE Yilun

Abstract

Chinese square-pallet chain pumps were important water-lifting devices in China and its neighbors, mainly used for raising water in agricultural fields and salt fields. It can also drain water away from rivers and floods. The earliest record of Chinese square-pallet chain pumps appears in the Book of the Later Han（《後漢書》）, and pump's shape and structure were standardized in the Tang Dynasty(618-907). There was a unique scraper chain transmission composed of two sprockets and a drive chain in a Chinese square-pallet chain pump.

Compared with other water-lifting devices as lu lu（轆轤, windlass）, Chinese noria（筒車）, scoop waterwheel), Chinese square-pallet chain pumps can raise water continuously and efficiently. It was not only widely used in ancient China but also strongly affects Irrigation Machinery. Because it was popular in China, people developed many different types. It can be classified by power sources as manpowered, animal powered, water powered, and wind powered. The square-pallet chain pump which was powered by human's hand and foot or powered by animals has been appeared in AD 829(in the Tang Dynasty). In the Song Dynasty (12th century), ancient Chinese also made a kind of pump powered by wind as a vertical shaft wind-powered chain pump. And the horizontal shaft wind-powered chain pump was developed since 17th century. According to historical records, there were many different Chinese square-pallet chain pumps. And we will analyze the mechanisms by dividing their structure into three components: a propulsion system, a transmission system, and a pumping system.

Keywords: Chinese square-pallet chain pump, water-lifting device

* Department of Mechanical Engineering, Southern Taiwan University.

臥軸式風力翻車的構造分析

林聰益* 呂金塗 林育昇

摘要

中國在二十世紀前對風力的利用除了帆船外，在陸上主要是用於帶動翻車（即龍骨水車），以提水灌溉或汲水曬鹽。風力翻車依據其風帆的運作方式又可分為立軸式與臥軸式。立軸式風力翻車最早文獻記載是在南宋（12 世紀），而臥軸式風力翻車則約在明末清初（17 世紀）出現，李約瑟認為其受到耶穌會傳教士的影響，但其技術和傳動原理應是來自立軸式風力翻車。其構造在文獻的記載極為簡略，只記述其「用風帆六幅」，直到 1993 年張柏春與馮立升對江蘇連雲港市贛榆鹽場的臥軸式風力翻車進行考察與測繪，才有詳細的記載。然此型與近現代文獻的圖示或照片仍有些差異，經本研究可知，這種臥軸式風力翻車是具有六篷式風車，其臥軸是由一固定的四方錐形立架和一可移動人字支架所支撐，臥軸中點有六眼缽，插入 6 根桅桿，桅桿相鄰間在外端用鐵絲連結成正六邊形，其每個角再用鐵絲前後分別連結臥軸的兩頭，桅桿上用定滑輪升掛約 1.3 米寬、2 米長的布篷。在四方錐形立架中心豎一立軸，其上端的齒輪機構可傳遞風車的轉動與扭力，經立軸下端的齒輪機構帶動車軸上的旱撥，使翻車能連續提水上岸。根據風向調整人字支架，視風力大小決定布篷張開帆數，約 3 級風即可運作，超過 6 級風則有翻覆的危險，故一般都有專人管理，此一架風車可灌溉農田約 30 畝。

關鍵詞：風力翻車、龍骨水車、風車

* 南台科技大學機械工程系。E-mail: tylin@mail.stut.edu.tw

Structure Analysis of the Horizontal Shaft Wind-powered Chain Pump

LIN Tsungyi*, LU Chintu, LIN Yusheng

Abstract

The use of wind power in China before the twentieth century, in addition to sailing, is mainly to drive the Chinese chain pump（翻車）on land, used to raise water for irrigation or basking salt. According to its operation, wind-powered chain pumps can be divided into vertical and horizontal shaft types. The earliest record of vertical shaft wind-powered chain pump was in the South Song Dynasty (12th century), while the horizontal shaft wind-powered chain pump appeared in 17th century. Joseph Needham believed that the horizontal shaft wind-powered chain pump was affected by Christ missionaries, but its technology and transmission methods should be inherited from the vertical shaft type.

The statement of wind-powered chain pump in literature was very simple; it only noted that wind-powered chain pump had six sails（用風帆六幅）. Records were not detailed until Baichun Zhang and Lisheng Feng explored and sketched the horizontal shaft wind-powered chain pump in Ganyu Saltwork(贛榆鹽場), Lianyungang Jiangs. Even though Zhang and Feng described what the wind-powered chain pump was, it still differed from the original one.

This study shows that a horizontal shaft wind-powered chain pump possessed a six-sail style windmills, and its horizontal shaft was hold by a fixed pyramidal tower and a moveable herringbone stand. There was also a six-hole joint in the middle of horizontal shaft which could insert six masts. Chinese people used steel wires to coil the six apexes of masts so that the shape of joint was just like a hexagon. They also fixed the six apexes to the top and bottom of horizontal shaft, and then installed fixed pulleys on the mast to raise sails about 1.3 meters wide and 2 meters long. By standing a vertical shaft in the middle of pyramidal tower, the gear mechanism in the top of vertical shaft can transform torque, and the gear mechanism in the bottom of vertical shaft can drive the land gear on the transmission shaft to raise water from the river continuously.

* Department of Mechanical Engineering, Southern Taiwan University.

This kind of windmill only needs third-grade wind to work. If the wind velocity is higher than that of sixth-grade, it might be overturning dangerously. So, the wind-powered chain pump is always managed by a specialist. The herringbone stand must be adjusted according to the wind direction; the number of spread sails should be decided according to the wind strength. The horizontal shaft wind-powered chain pump can irrigate a farmland about 30 mu（畝）(0.494 acres).

Keywords: Chinese chain pump, windmill

水運儀象臺之水運儀的復原製造

林聰益* 曾聖超

摘要

本文是記述座落於臺南縣樹谷生活科學館前之「水運儀象臺的水運儀」的復原製造過程。水運儀象臺是在 11 世紀北宋時期，由蘇頌領導韓公廉等太史局技術官員於元祐年間(1086-1092）所建造的一座將渾儀（天文觀測儀器）、渾象（天球儀）、以及報時裝置等三個工作系統整合在一起之水力運轉的天文鐘塔。水運儀是由水運儀象臺的水運系統和水輪秤漏裝置所組成的，是整座天文鐘塔的步進動力水輪。其中，水輪秤漏裝置與現代機械鐘之擒縱調速器的功能相同，是用來產生等時性間歇運動的機構，它是世界最早的機械鐘擒縱調速器，也是古中國擒縱調速器的基本型式。水運儀可以讓水運儀象臺上的渾儀、渾象一步一步地追天運行，使其五層木閣能準確報時。

本次水運儀的製造是根據北宋蘇頌所撰的《新儀象法要》上記載之水運儀象臺的水運系統和水輪秤漏裝置所復原的，包含其構造、尺寸、及形制皆符合《新儀象法要》的記載。整座水運儀是以青銅為主要材料，用傳統工藝製造出與原物大小相同尺寸（約長 4.7 公尺、寬 2.3 公尺、高 4.2 公尺）之實物，不但能重現水運儀象臺的步進運動，並可融入生活科學館的建築與展示意境。

關鍵詞：水運儀象臺、水運儀、復原製造

* 南台科技大學機械工程系。E-mail: tylin@mail.stut.edu.tw

A Reconstruction Fabrication of the Water Power Device of Su Song's Clock Tower

LIN Tsungyi, TSENG Shengchao*

Abstract

This is the record of reconstruction fabrication process of the water power device of the Su Song's clock tower in the Tree Valley Park, Tainan City. Su Song's clock tower (Water-Powered Armillary Sphere and Celestial Globe, an astronomical clock tower) reflected the achievements of ancient China in both astronomy and mechanics during the 11th century. It was built by Su Song and Han Gong-Lian during 1086 ~ 1092 of the Northern Song Dynasty. It integrated three working systems including the armillary sphere, the celestial globe, and the time-telling system. The water power device which is the step water-powered wheel of the astronomical clock consists in the water-transport system and the waterwheel steelyard-clepsydra of the Su Song's clock tower. Moreover, the waterwheel steelyard-clepsydra device used to generate intermittent movement had the same function with the escapement regulators of modern mechanical clock. It is not only the earliest mechanical clock escapement regulators in the world, but also the basic escapement regulators type of ancient Chinese. The water power device drove the armillary sphere and the celestial globe of Su Song's clock tower running and made the five-storey wooded pagoda tell time accurately.

The fabrication of the water power device was based on the Su Song's clock tower's water-transport power device and the waterwheel steelyard-clepsydra device in *Xin Yi Xiang Fa Yao* written by Su Song, including its structure, size, and shape. The whole water power device was made by bronze as the main material and utilized traditional techniques to present the its original size(Length 4.7 m, Width 2.3 m, Height 4.2 m). It not only reproduced the step motion of Su Song's clock tower, but also blended with the building, Tree Valley Science Museum, and the artistic conception.

Keywords: Su Song's clock tower, water power device, reconstruction fabrication

* Department of Mechanical Engineering, Southern Taiwan University.

常山、青蒿與砒霜：從藥方比較觀察瘧對宋代醫學的影響

陳韻如*

摘要

透過比較宋代(960-1279)以常山、青蒿或砒霜等物抗瘧的藥方，本文試圖探究：相較於前代，此時期的醫者如何提出更多治瘧的嘗試與討論，進而呈現瘧至宋代已成為醫者關注的疾病。

本文的研究目的為討論一項醫療史的假說：隨著全國水稻栽種面積的增加，宋代瘧的流行率也相應上升。由於現存的史料多未記載爆發的疾疫是否為瘧，我們無法統計瘧的流行數目。既然數目檢證不可行，本文將由比較抗瘧藥方探討此假說。學界已指出常山自漢代以來便是常用的治瘧藥物，而青蒿與砒霜則至宋時才普遍應用於抗瘧。延續此觀察，本文將比較這三類藥物的藥方組成、製方過程、施用時機、與使用規範，勾勒宋代醫者如何摸索更有效的治瘧方法。本文希望藉此論證：縱然不清楚瘧的流行數增長，但從醫者對治瘧的關注，可知宋時瘧成為了更受醫學重視的疾病。

* 牛津大學東方研究所。E-mail: mirranda0223@gmail.com

Changshang, Qinghao, and Pishuang: Observing the Influence of Intermittent Fever on the Song Medicine by Comparing Relevant Prescriptions

CHEN Yunru

Abstract

By comparing how physicians and authors of medical texts in the Song (960-1279) applied *Changshang*,*Qinghao*, and *Pishuang* to medical practice against intermittent fever, this essay argues that the physicians and authors engaged themselves in proposing treatments for such fever much more than those in previous periods did. This argument tends to demonstrate intermittent fever became an important issue in the Song medicine because of its prevalence.

This essay aims to discuss a hypothesis in the medical history: areas of wet-rice cultivation increased during the Song and correspondingly the prevalence of intermittent fever increased. It is difficult to calculate the number of intermittent fever in the Song because extant sources rarely recorded explicit sorts of occurring epidemics. Since the calculation is difficult, this essay discusses this hypothesis through a comparison between prescriptions composed by*Changshang*,*Qinghao*, or *Pishuang*. Regarding these prescriptions, historians have observed a trend that while *Changshang* had served to treat intermittent fever since the Han period,*Qinghao* and *Pishuang*began to be applied to cure the fever during the Song. On the basis of this observation, this essay compares composite of and preparation for these prescriptions, as well as conditions and regulations of applications. This essay then tends to propose that although the specific number of intermittent fever remains uncertain, increasing attention of treating intermittent fever demonstrates the fever became a much-discussed subject of the Song medicine.

帕西尼與霍亂弧菌

魏嘉弘*

摘要

霍亂是一種急性的腸胃道傳染病，曾經在十九與二十世紀造成多次世界性大流行，以及駭人聽聞的死亡率；二十世紀中葉以後，該傳染病主要存在於第三世界地區，惟死亡率已明顯下降。2010 年，非洲中部、巴基斯坦、海地、多明尼加、美國等地均曾爆發不同規模的流行，藉助於現代進步的科學醫療與衛生措施，已經能夠有效降低該傳染病的感染率與死亡率。

關於致病原因，十九世紀時，帕西尼(Filippo Pacini)與柯霍(Robert Koch)兩人先後證實霍亂弧菌能夠導致發病；一八五四年，帕西尼率先成功的分離出霍亂弧菌並且提出這種細菌與霍亂的直接相關性，但是，並沒有被當時的「國際衛生會議」(International Sanitary Conferences)所重視。因此，本文首先將究明在十九世紀的醫學背景之下，帕西尼的新發現被忽視之因；其次，比較柯霍與帕西尼所發現的霍亂弧菌是否相同？世界衛生組織是否重新審視並且肯定帕西尼的成就以及其影響，均值得吾人加以探討。

關鍵詞：霍亂弧菌、帕西尼、柯霍、世界衛生組織

* 國立臺灣師範大學歷史學系。E-mail: smlai639@yahoo.com.tw

Filippo Pacini and Vibrio Cholerae

WEI Jiahung*

Abstract

Cholera is an acute gastro-intestinal infectious disease. It had caused several worldwide overwhelming epidemic of Cholera between 19th and 20th centuries with high mortality. After the second half of 20th century, this disease primarily exists in the third world, but the mortality is much decreasing. In 2010, the cholera broke out to different extent in the central area of Africa, Pakistan, Haiti, Dominican and the United States. By the advanced scientific-based medicine and the hygiene treatments, the infectious rate and mortality have been controlled in effective and reduced much more.

In order to realize how to get sick, in the 19th century, Filippo Pacini and Robert Koch had verified the *Vibrio Cholerae* was the reason to get sick. Filippo Pacini, the first one in 1854, separated successively the bacteria and verified the immediate connection between the cholera and this kind of bacteria. But the brand-new discovering had not been accepted by the International Sanitary Conferences at that time. In this condition, this article aims to survey the medical and historical environment in 19th century, why Pacini's landmark discovering was ignored? And then, it tries to compare *Vibrio Cholerae* which had been discovered by Koch and Pacinni, if they are both the same or not. It is a good question to study that if the WHO reviews Pacini's discovering, and confirms his achievement and his influence.

Keywords: *Vibrio Cholerae,* Filippo Pacini, Robert Koch, WHO

* Department of History, National Taiwan Normal University.

殖民地的指紋：日治時期指紋技術的形成與應用

林政佑*

摘要

因為技術的存在，法律的治理才更加有可能。本文對日治時期指紋技術的形成與變遷進行歷史的考察，日本帝國如何引進和再詮釋指紋技術，進而建立指紋制度，又人種學、犯罪學等知識如何與指紋技術產生結合，並試圖藉此觀察殖民地時期法律、技術與社會的關係。

本文採取法律史研究的途徑，觀察的對象不僅是法律條文的演變，亦結合技術與知識的相關論述作為討論對象，提供法律與技術之間相互構造的輪廓。採用的資料與檔案，除了官方檔案外，亦包括報紙、相關期刊文章以及相關學者對於指紋技術的著作，另外也結合私人的日記和傳記，藉此看到社會與技術彼此之間的相互關係。

初步發現：首先，指紋作為可以記錄和辨識犯罪人的重要技術，這一項技術先在殖民地臺灣與日本內地的監獄，被當成實驗室所逐漸發展出來，與行刑體系有密切的關係。進而逐漸擴散到一般的社會，甚至在日韓併合以後，指紋技術亦適用之，透過 1918 年共通法的實施，指紋技術確保了整個帝國的犯罪緝捕網絡有所可能。其次，透過指紋技術在殖民地與殖民母國的擴散和影響關係，除了思考殖民地技術的意義之外，亦提出對於現代型法律的反思和批判。

關鍵詞：技術、指紋、殖民治理、辨識、犯罪學

* 國立臺灣大學法律學研究所。r96a21002@ntu.edu.tw

The Empire's Touch:
Fingerprinting Technology in Taiwan under the Japanese

LIN Chengyu*

Abstract

In the colonial context it is often the advent of modern technologies which makes legal governance possible. This paper investigates the historical formation and development of fingerprinting in colonial Taiwan. How did the Japanese empire transplant and re-interpret this technology, and establish fingerprinting as an institution? Moreover, how and why are realms of knowledge such as ethnology and criminology, connected to the fingerprinting? I hope to observe the complex relationship between law, technology and society during the colonial period.

This paper adopts legal history as its research approach. What I want to observe is not only statutory law, but also discourses of technology and knowledge in order to reveal the profile of interaction of law and technology. I therefore draw upon not only official documents, but also print media, relevant researches from colonial Taiwan and private diaries.

My preliminary findings are as follows: first, fingerprinting became a key technique to the recording and identification of criminals. The technology had initially and gradually developed using prisons in Taiwan and the Japanese mainland as laboratories. Thus, the technique of fingerprinting was intimately connected to the penal system. Secondly, the scope of fingerprinting gradually expanded to govern the rest of society. Furthermore, after the annex of Korea the Japanese empire also applied the technique of fingerprinting there. With the establishment of a common law across the empire in 1918, the technique of fingerprint supported the formation of a network of social control within colonies and the Japan mainland. Finally, through an examination of the spread and influence of fingerprinting between colony and mother country, we can not only consider the significance of technology in colonies, but reflect upon law and modernity as well.

Keywords: technology, fingerprint, colonial government, identification, criminology

* Graduate Institute of Interdisciplinary Legal Studies, College of Law, National Taiwan University.

由臺灣科學教育史的角度來認識趙金祁哲學的意義與影響

陳正凡*

摘要

趙金祁先生是中華民國第一位科學教育博士(1974)，更是開拓中華民國（臺灣）科學教育領域的啟蒙者與先行者。在大科學主義浪潮正席捲科學領域的環境裡，他主張科學與人文的平衡，並提出「三維人文科技通識架構」(three-dimension framework for the interdisciplinary education of humanities and sciences)的主張；面對著科學教育只重視「臨時真理」(tentative truth)的現象，他晚年通過金岳霖哲學的啟發，更提出「求如」(authenticity or unperturbedness)的新科教哲學。他曾經擔任中華民國的教育部政務次長(1987-1992)，實質負責推動教育政策大計的規劃與落實，加上他培育大批的科學教育研究工作者，因此他的哲學對臺灣科學教育的發展，有著如何的意義與影響，這是本文想要釐清的主軸。本文作者曾經對趙金祁先生做過為期一年餘的口述歷史，協同對話與整理《趙金祁回憶錄》，並負責編纂《趙金祁科教文集》(全二冊)，因此本文主要採取這兩本書的文本研究，並參照同時期臺灣科學教育史的相關研究，來共同架構出趙金祁哲學對臺灣科學教育史的意義與影響。

關鍵詞：趙金祁哲學、三維人文科技通識架構、求如、科學教育、臺灣科學教育史

* 國立臺灣師範大學科學教育中心。E-mail: pankutze@gmail.com

Recognizing the Meaning and Impact of the Philosophy of CHAO Chinchi from the Perspective of the History of Taiwanese Science Education

CHEN Chengfan(Chen Fu)*

Abstract

Mr. CHAO Chinchi is the first person to obtain the doctoral degree in science education in the Republic of China (1974). He is also the forerunner of the science education development in the Republic of China (Taiwan). In the environment where the scientism is taking a part in the field of science, Mr. CHAO Chinchi highly supported the viewpoint of a balance between science and humanity as well as proposed the three-dimension framework for the interdisciplinary education of humanities and sciences. In his old age, he even brought up a new science education philosophy "authenticity or unperturbedness" through the inspiration of CHIN Yue lin's philosophy when noticing that the science education only places emphasis on the tentative truth. In addition, he has assumed the role of the Administrative Vice Minister of Education between 1987 and 1992 to actually carry out the planning and implementation of major educational strategies. Since he has cultivated many science education researchers, how does his philosophy influence the science education development in Taiwan is the theme that this study aims to clarify. The author of this paper has taken an oral report of CHAO Chinchi's history for more than one year, written the "Memoirs of CHAO Chinchi" and compiled the "CHAO Chinchi Science Education Collections" (Two Volumes). As a result, this paper is mainly based on the study of these two books and took the related contemporary Taiwanese science education studies as references to structure the meaning and impact of CHAO Chinchi's philosophy on the history of Taiwanese science education.

Keywords: The philosophy of CHAO Chinchi; three-dimension framework for the interdisciplinary education of humanities and sciences; authenticity or unperturbedness; science education; the history of Taiwanese science education .

* Center for Science Education, National Taiwan Normal University

臺灣詩中的明清小冰期(1624-1895)

林明聖*

摘要

由王善宗、齊體物、林慶旺、王璋、高拱乾、婁廣、莊年、褚祿、覺羅四明、余文儀、余延良、金文焯、朱仕玠……等人的「雞籠積雪」，盧觀源的「臺陽山川風物迥異中土因就遊覽所及誌之以詩」，劉明燈的「金字碑」，林豪的「客自雞籠還，言形勢甚悉」，楊浚的「雞嶼晴雪」詩中，明確的得知當代基隆積雪的事實。由上述的詩作的寫作時間可以整理出來有五個時期，分別為I期（1690-1705年）、II期（1743-1747年）、III期（1759-1768年）、IV期（1812-1814年）、V期（1867-1871年）。

基於詩文寫作必定晚於降雪，重新檢視臺灣降雪紀錄，最接近I 期（1690-1705年）者為周鍾瑄、陳文達、王必昌、唐贊袞、朱仕玠分別編撰的地方志中紀錄的1683 年「雨雪」、「冰堅厚寸餘」、「雨雪冰」、「北路降大雪，寒甚」的記載，當年不僅臺灣下雪，1654、1683、1684年，廣東的南海、番禺、廣州也有「冬大雪霜」，海南島的文昌也有「冬大寒雨雪，海魚凍死，檳榔盡枯」的報導。此時期屬於中國第五冰期（1644-1720），其成因可能與蒙德爾太陽活動極小期（Maundar Minimum, 1645-1715）有關。

II期（1743-1747年）、III期（1759-1768年）臺灣地方志雖無降雪記載，而且也非中國冰期，但廣州在1735年「正月十三、十四等日，省會一方，微降雪珠」。1758年時廣東的南海、番禺、順德、廣州皆記載「正月有雪」，而粵東的豐順縣志甚至用「嚴寒無異於北京」來形容。此時期究竟真實性、成因為何？有待探討。

IV期（1812-1814年）早於1815、1817、1824 年有「台中及苗栗雨雪、奇寒、結冰寸餘」的報導，特別是1815-1816年，全中國各地幾乎都有降雪的報導，雖說目前已知與1815 年印尼坦博拉（Tambora）火山爆發有關，然而火山噴發時期恰巧與道爾頓太陽活動極小期（Dalton Minimum 1795-1825）也應該扮演著推波助瀾的角色。

臺灣最接近V期（1867-1871年）者為陳培桂、沈茂蔭分別編撰的地方志中紀錄的1857年「大雪」、「屯山積幾尺」等記載；而廣東雖無志書記載，卻在番禺的詩人潘恕在「雙桐圃集」中的「九曜橋賞雪歌」寫道「今年（1861年）辛酉臘月初，上天雨雪如珍珠。瑩瑩魚目光閃爍，皎皎晶鹽堆密疏」的詩句，證明確有

* 臺北市立教育大學自然科學系。E-mail: linms@tmue.edu.tw

其事。此時期屬於中國第六冰期（1840-1880年），也剛好位在未命名的太陽活動極小期範圍。

以上由詩中找到的明清小冰期記錄證實了當年氣候變化確實影響了臺灣，至於其驅動機制主要與太陽黑子活動的平靜期有一定的相關性。

關鍵詞：小冰期、臺灣、詩、太陽黑子

Summary of the Little Ice Age (LIA) in Taiwan Poems, 1624-1895

LIN Mingsheng*

Abstract

According to the historical poem records which show 38 years with cold winter when snow fall occurred in Taiwan, it is found that the Little Ice Age began in 1690 and ended in 1871. During this period there were five cold stages, i. e. 1690 to 1705, 1743 to 1747, 1759 to 1768, 1812 to 1814 and 1867 to 1871, while four relatively warm stages were intercalated between two cold ones. The cold stages of Little Ice Age are essentially consistent with the tranquil periods of sunspot activity.

Keywords: Little Ice Age, Taiwan; Poem, Sunspot Activity

* Department of Natural Science, Taipei Municipal University of Education.

空氣動力車史

陳怡靜* 吳明德**

摘要

在 19 世紀時，法國的科幻小說家曾撰文描繪出未來世界的情景，街道上奔馳的汽車都是以空氣作動力用壓縮空氣做為交通工具的動力來源。最早能夠實際成功運用的，應該是作為水中武器的魚雷；而以壓縮空氣作為動力驅動的軌道車與空氣車，在一百五十年以前就陸續在歷史中出現過，可惜當時缺乏安全耐壓的複合材料氣瓶，因此曇花一現。空氣引擎目前發展出壓縮式與迴轉式兩種主要形式。其中最有名的壓縮式空氣引擎，是總部設在法國的 MDI 公司所開發的，其創辦人 Guy Negre 曾經設計方程式賽車引擎。

相較於壓縮式空氣引擎，迴轉式空氣引擎體積小，而且效率更高，其中一款迴旋運轉空氣引擎(Rotary Air Engine)是由義大利裔的澳洲人 Angelo di Pietro 所發明，壓縮空氣動力將可有效取代高污染的石化燃料，甚至比電池科技來的成熟，未來壓縮空氣加氣站普遍設立後，將可見到空氣車奔馳在街道上。

* 國立臺灣師範大學科技應用與人力資源發展研究所。E-mail: smartsofia@gmail.com

** 國立臺灣大學工程科學與海洋工程研究所。

The History of Air Car

CHEN Yiching* WU Mingte**

Abstract

In 19th century, the French sci-fi writer ever described the scene in the future world, where the vehicles were powered by compressed air. The torpedo used as the weapon under water should be the earliest successful application of air engine. The motor-trolley and air car empowered by the compressed air had already appeared in history 150 years ago, but they couldn't have last long because of the lack of the safe gas cylinder made of compound materials. The most famous compressed air engine was designed by the MDI in France, whose inventor, Guy Negre, used to design the engine for Formula automobile race.

The rotary air engine is smaller than the compressed air engine in size, and works with higher efficiency. One model of the rotary engine was invented by Angelo di Pietro, who is Italian lineage Australian. The rotary air would replace the petrochemical fuel with highly contamination, which is even more mature than the battery technology. We will see the air cars everywhere on streets after the compressed air station are set well in the future.

* Department of Technology Application and Human Resource Development, National Taiwan Normal University.

** Department of Engineering Science & Ocean Engineering, National Taiwan University.

記錄資訊的輪子

吳明德* 陳怡靜**

摘要

曾有人說人類最偉大的發明，除了用火之外就是發明輪子。換個方向將輪軸直立，放上黏土就變成製作陶器的轆轤，轉動轆轤就可以在陶土上刻畫圖案。在崎嶇不平的西藏高原，輪子不是用來帶動車輛，而是記錄經文的法輪。將輪子裝上發條動力並依照樂譜刻上凸點，敲擊長短不一的的金屬簧片，就化身為音樂盒，發出奇妙的旋律。將輪面上擺著刻有凹痕的黑色膠盤，與連接動線圈的金屬針，就轉變成為唱機；再換成塗上磁粉的圓盤與磁頭，就變成磁碟機。塗上具有反光特性的鍍膜與雷射讀寫頭，就變成光碟機。最新的奈米科技—「原子力顯微鏡」的動作原理，與唱機裡的唱針拾取訊號概念是十分相似的。只不過是改用極微小的探針相距觀察的物件僅數十奈米，透過凡得瓦力作用來感測物體的表面起伏變化，未來將可利用這個原理來記錄大量的資訊。可見科技的創新不是一蹴可幾的，需建立在過去的創新與發明之上。

* 國立臺灣大學工程科學與海洋工程研究所。E-mail: smartsofia@gmail.com

** 國立臺灣師範大學科技應用與人力資源發展研究所。

The Wheel Records Information

WU Mingte* CHEN Yiching**

Abstract

Someone ever said that the greatest invention is wheel despite of the usage of fire. When we put the axle erect and smear it with clay, it would become a hoisting tackle. And we can curve on the clay when the hoisting tackle is rotated.

When the wheel was wound with a spring, and curved with salient points according to the notation, it would become a music box going off music if we knock the reeds in different length. When we put the black plate curved with indents on the wheel and connect the wheel with moving coil, it would become a record player. If we replace it with the plate and point treated with magnetic powder, and it will become a disk driver. When it is treated with coating that can reflect lights and with laser read-write head, it will become a CD-Rome drive. The theory of the latest nanotechnology, “atomic force microscope” is very similar with the concept of the gramophone needle in the record player when it pick up the signals. The only difference is that the needle was replaced by a tiny probe that the distance between the observed objects is only a few nanometers, which can record the change on the surface of the object through the Van der Waals Force, and we can use the theory to record a great amount of information. From this we can know the innovation of technology is not achieved in no time, but built in the innovation and creation in the past.

* Department of Engineering Science & Ocean Engineering, National Taiwan University.

** Department of Technology Application and Human Resource Development, National Taiwan Normal University.

談木龍：清代乾隆年間治理江南水利的一種河工器具

鄭永昌*

摘要

位於江蘇省洪澤湖流域的清口地方，緊繫著黃河、淮河與運河的咽喉，三河匯聚，水量宣洩疏暢與否，攸關著當地民生經濟、農業發展與國家漕糧運輸的命脈。清代政府重視河道的整治管理，而清口地區黃、淮、運交匯之處，更是歷朝政府整頓河工的焦點。

木龍，作為一種河工水利的護堤器具，首見於十一世紀北宋真宗天禧五年(1021)河南滑州知州陳堯佐採用。惟此法後世湮滅多年，直到十八世紀乾隆年間，河道總督高斌為整治南河（江南段河道）工程而再次復用。

國立故宮博物院現藏清代奏摺檔案、官書文集以及河工圖冊等資料，留下有關當時使用木龍的零星記載，從中提供我們了解當時治河工具的構造、治河技術的水平；更重要是木龍使用之後，改變了河道周邊的地貌環境，成為今人研究十八世紀中國河工史與環境生態史最好的線索。本主題即利用院藏相關檔案文獻與輿圖資料，深入分析清代乾隆年間治河技術與河道環境變遷的一段歷程。

* 國立故宮博物院圖書文獻處副研究員。E-mail: cwcheong@npm.gov.tw

從技術與審美趣味看論南宋官窯演進的內外因素

陳東和*

摘要

官窯為南宋物質文化的重要代表，而支配其發展的因素很多。自中興渡江後，襲故京遺制，在脩內司置窯燒造精緻、油色瑩澈的青器，到郊壇下別立新窯，南宋官窯的發展有其演變的政治、社會經濟及文化脈絡。過去關於南宋官窯的研究，由於缺乏考古出土材料佐證、比對，一直存在許多難題，例如年代、來源、文獻記載的可靠性及對其有不同的解讀等問題。而隨著杭州鳳凰山老虎洞及烏龜山郊壇下官窯遺址的發掘及許多學者投入相關研究，不少問題逐漸明朗化。

從出土的瓷片標本來看，南宋官窯乃從厚胎薄釉向薄胎厚釉發展，而此演進的現象之外，有其或隱或顯的技術與審美趣味的影響因素。釉的開片是官窯的重要表徵，也是審美趣味的核心之一。從無意、簡單的開片線條，到經營層次堆疊的冰裂紋，南宋官窯的發展乃從一種二度空間的審美趣味跨入到三度空間的意象欣賞裡，這無疑是一種創新與突破。而這種三度空間意象的營造，若沒有多重掛釉技術的發展，便無從發生。然而，究竟是技術的內在發展導致審美趣味的轉向，抑或是對一種新奇的追求，驅策技術的發展?在本文中，我們將從檢視傳世與出土官窯出發，探討南宋官窯演進過程中，技術發展及審美趣味演變的內與外的驅動因子以及交織的相互影響。

* 國立故宮博物院登錄保存處助理研究員。E-mail: thchen@npm.gov.tw

Evolution of the Southern Song Guan wares: Influence from the Entanglement of Technology and Taste

CHEN Tungho*

Abstract

The Guan ware is one of the most important representatives of the material culture of the Southern Song dynasty (AD 1127-1279). The excavated shards from Laohudong Kiln and Jiaotanxia Kiln in Hangzhon demonstrated that one of the principal evolutional characters of the Southern Song Guan ware is from “thick body with thin glaze” to “thin body with thick glaze”. Technology and taste are, behind the appearance of glaze, dominantly or recessively, two main driving forces responsible for the evolution. As an aesthetic index, the crackle of glaze was developed from unintentional simple lines to intentional stacked cracked ice pattern. The turning from two-dimensional appearance to three-dimensional image is certainly an innovation. However, without the multi-layer firing technology, the three-dimensional image can’t be produced. One may pose questions: does the inner development of technology lead to the change in taste, or dose the quest for aesthetic variation conduct the improvement in technology? In this work, the influence of the entanglement of technology and taste to the evolution of the Southern Song ware is explored.

* National Palace Museum.

長江中下游新石器時代晚期玉器工藝製作前的構圖及其意義

沈建東*

摘要

玉器工藝製作之前的打樣設計是研究玉工藝史方面較被忽略的部份，製作玉器的過程中，不可能邊做邊構思的，因而在工序上無妨包括選料前後的構思部份，即筆者所謂的構圖過程。藉由幾年來的資料收集及部分實際觀察與測量，並運用計算精度較高的軟體進行重建構圖的原貌，對長江中下游新石器時代晚期幾個類型的玉器工藝製作，從器形與工藝痕，及未完成物件上的刻畫痕的測量，發現可能存在著有規律的構圖法，而這類構圖法即可能已運用了圓與圓、圖型之間的關連與變化之運用，也可能是早期幾何概念的濫觴。

本文就以長江中下游玉璜、玉鳥及琮的射口等案例闡述早期構圖法的可能方式，其目的在於說明以下幾個關注的問題：（一）由構圖法發現如玉璜長度的測量較不具意義，而由構圖法呈現的圓的半徑才是有重要的測量意義，大小圓存在著單位倍數的關係。（二）由此可進而推測古代測量長度的基本單位關係，但非最小度量單位。（三）大溪、馬家濱、崧澤文化有相似的構圖及半徑倍數值，良渚時期則有所不同與變化。（四）構圖法呈現了古人對接圓、同心圓、轉換圓心定點及不同圓徑所組成曲度的利用上，可能已有技術層面的了解與掌握。（五）構圖法暗示了相關可能製作工具的存在，筆者亦由此進行了不同圓徑曲度的來回旋截製作方法。

* 國立故宮博物院登錄保存處助理研究員。E-mail: shenct@npm.gov.tw

都江堰水利工程再探

林加豐*

摘要

西元 1974 年於都江堰入水口處發掘東漢李冰石像，證明《史記》、《水經注》等論著的記載是有依據的，然考古發掘的石像位置與今日都江堰堰體入水處存在著不一致的問題。又，試析後魏酈道元(？-527)對岷江主支流的論述，也會發現與今日的河道水勢明顯不同。

在清人楊守敬(1839-1915)所編繪的輿圖中，確實也發現古今岷江於都江堰處已出現改道的狀況，並將其時間斷於五代，但其繪依據目前已無法確知，故在近人研究論著中，此圖文資料較少被利用。回顧五代前蜀時期，杜光庭(850-933)所呈賀牋，是否就是楊氏所言堰體位移的關鍵時刻？而該堰體真能對抗兩千多年來的江水及洪災的沖刷而無損毀？

以上諸多疑惑，均成為今日爭辯李冰所修都江堰堰體是否必然包括魚嘴、飛沙堰、寶瓶口三項工程？

是故，本文試圖重新查找正史地理志、唐宋方志、文集、輿圖等文獻，並配合地下考古文物，及自然地理學科（地形學）的輔助下，再次論述五代時期岷江與都江堰兩者的變動關係。

* 國立中正大學歷史研究所博士生。abel_gf@yahoo.com.tw

A New Investigation on the Formation of Dujiang Weir: Based on a Letter Presented to Emperor by Du Guangding

LIN Jiafeng*

Abstract

The stone statue of Li Bing, sculpted in the Eastern Han Dynasty and excavated from water inlet of Dujiangyan in 1974, authenticates the descriptions in *Records of the Grand Historian*, *Shui Jing Zhu*(*Commentary on the Waterways Classic*), etc. Nevertheless, on one hand, the excavation site of the statue is inconsistent with present-day water inlet of Dujiangyan. On the other, the description concerning the main tributary of Min River in the work of Li Daoyuan(?-527) obviously conflicts with the trend of waterway today.

In the chorographic maps by Yang Shoujing(1839-1925) of Qing Dynasty, there were clear findings for the redirection at Dujiangyan of Min River, which by Yang's estimation could be traced back to Five Dynasties. Unfortunately, the evidences upon which those maps were based can no longer be confirmed. His maps are therefore less referenced by modern writings. As revealed in the congratulatory notes by Du Guangding(850-933) and claims in Yang's work, it is doubtful that Former Shu of Five Dynasties was the critical period when the weir started to change arrangement. It is also questionable that the weir can stay undamaged against the flushing of river and flooding for two thousand years.

The above-mentioned questions lead to the debate whether the weir of Dujiangyan constructed by Li Bing really consisted of these three constructions: Yuzui(Fish Mouth Levee), Feishayan(Flying Sand Weir) and Baopingkou (Bottle-Neck Channel).

As a result, this paper attempts to rediscover the movement connection between Min River and Dujiangyan during Five Dynasties period by means of reviewing the documents, such as official geographical annals, local gazetteers of Tang and Song Dynasties, anthologies, chorographic maps, in combination with archaeological findings and with the help of physical geography(geomorphology).

Keywords: Dujiangyan, LI Bing, DU Guangding, YANG Shoujing, *Shui Jing Zhu*

* Department & Institute of History, National Chung Cheng University.

略論清代戰船之頭巾與插花

李其霖*

摘要

頭巾與插花為明、清時期商、漁船所使用的一種航海技術。頭巾的使用可增加船舶速度，插花的使用則提高船舶的穩定度，讓船隻在行駛及轉向時較為平穩。這種航海技術的使用，至清代成為戰船之配備。

因為頭巾及插花可提升船舶速度，卻間接造成清政府反對民間使用之主要原因，如果不遏止民間船舶使用，一旦民船為海盜所用，那水師戰船將難以追擊海盜，亦將影響海疆之安全。

本文擬探討頭巾、插花的發展脈絡，並針對此種船舶技術運用在航海的使用情況，進而了解此技術與清代水師政策之關聯性。

關鍵詞：插花、頭巾、水師、戰船、清代

* 中央研究院歷史語言研究所博士後研究。Email: lee6627@hotmail.com

Brief Exploration of Topgallant Sails and Topsails for Warships in Qing Dynasty

LEE Chilin*

Abstract

Both of topgallant sail and topsail were a sailing technique for merchantmen and fishing boats in Ming and Qing Dynasty. Topgallant sail could speed up ships; while topsail could increase the stabilization for ships, so that ships would stay smooth and steady during the navigation and making turns. And it became the necessary equipment for warships in Qing Dynasty.

Though the technique of topgallant sails and topsails helped accelerating the ships, it was also the major reason for the Qing government prohibiting people from using the technique. It was for fear of the pirates taking the civil ships with such equipment, the navy warships might not catch up with the pirates easily. And it would definitely influence the safety along the seashore.

This article would discuss the history for topgallant sails and topsails development, and focused on the technique applications on navigation so as to understand the relationship between it and the navy policy in Qing Dynasty.

Keywords: Topsail, Topgallant sail, Navy, Warships, Qing Dynasty

* Postdoctoral Fellow, Institute of History and Philology, Academia Sinica.

師夷長技：清代子母砲之制度及其應用

周維強*

摘要

清代的子母砲是沿襲自前明的佛郎機銃。佛郎機銃自明正德年間輸入中國後，被明人大量的仿製，並配屬於軍隊之中，成為明軍的主力火器。明末清初，佛郎機銃在西洋傳教士的砲學知識協助之下，逐漸成為性能穩定的輕型高倍徑後膛火砲，因此也受到清軍的重視，大量配屬在八旗和綠營之中。

本文著眼於科學史和軍事史脈絡下的子母砲研究。首先，本文擬查考耶穌會士對於此砲的改良情況。其次，試探清軍水陸兩軍中布署及修造制度加以考察。第三，清代將領頗好捐造此砲，但在康熙末年至雍正年間曾有限造之舉，本文將探析此一史實及其影響。第四，清廷對於火器甚為崇拜，每年均於蘆溝橋舉行祭祀和演放火砲，本文將探究此一禮儀之形成過程及其內容。最後，將評析子母砲在戰爭中之表現。

關鍵詞：子母砲、佛郎機銃、耶穌會士、火砲史

* 國立故宮博物院圖書文獻處助理研究員。fence.chou@msa.hinet.net

The Zimupao and Qing Empire: it's models, deployment, maintenance and effectiveness

ZHOU Weiqiang*

Abstract

The Zimupao of Qing Dynasty is the major derived version of Frankish breechloader in Ming Dynasty. Since the second decade of 16th Century, Portuguese imported Frankish breechloader to China, then Chinese mass-produced and well-deployed these guns for defend their Empire. In late Ming and early Qing dynasties, due to Jesuits' introduced the European knowledge and technology of artillery, Frankish breechloaders has been modified as a more sophisticated and highly-caliber cannon. Although Ming Empire was conquered by Manchu eventually, Frankish breechloaders' descendant Zimupao become a standard weapon and equipped in the Eight Flags Army and Green Banner Army.

This article concludes both the view of technology history and military history on Zimupao. Firstly, we demonstrate how the Jesuits improved the gun and anatomize the basic models of it. And to understand the relations between Zimupao and Qing Empire, we analysis and discuss the deployment and logistics in Qing Army and costal defenses. Furthermore, for pledging loyalty, generals of Qing delight to donate Zimupao for their military region, but in the late Kangxi to Yongzheng period, the emperors made a limited to it. This great change shows the emperor's eager attitude to gun control. In Addition, the Qing court also very respect Zimupao, therefore they offer sacrifices and exercise as a ritual in Lugou Bridge. Finally, we try to examine the effectiveness and performance in campaign of Zimupao by historical archives.

Keywords: Zi-mu-pao, Frankish breechloader, Jesuits, History of Artillery

* Assistant Curator, Department of Rare Books and Documents, National Palace Museum.

江南製造局訂購之化學書籍(1868-1870)：清末引進西方化學之探討

張澔*

摘要

十九世紀中葉的時候，西方現代化學才開始逐漸由西方傳教士引進中國，而在 1868 年之前也只有一些零星的化學知識被傳入。在甲午戰爭之前，江南製造局是引進西方化學知識最重要的機構，因為江南製造局翻譯局所出版的化學書籍數量與質量遠遠超過同文館及西方教會等機構，因此探討江南製造局所翻譯的化學書籍無非是最能掌握清末中國引進西方化學的歷史原貌的方法之一。從 1868 年 3 月至 1870 年 12 月期間江南製造局所訂購一批化學書籍，無非是研究滿清政府引進西方化學的構想最好的材料之一。本論文研究之目的，除詳細列出江南製造局所翻譯的西文化學書籍的作者、出版地、出版公司及年份等資料外，我們也將它們與同時期的西方化學書籍比較，以便確認它們的化學知識之深淺與範圍，及在西方化學書籍的所佔的質量及數量。為了瞭解江南製造局在中國人幾乎概念的狀況下，如何挑選翻譯一些適合中國人學習的化學書籍，在這個同時，它又必須兼顧軍事化學工業的重責大任，因此我們將基礎化學及軍事化學書籍進行比較，及已翻譯及未翻譯之書籍進行比較。

* 義守大學通識教育中心。E-mail: ch3hao@gmail.com

Jiangnan Arsenal's Order for Chemical Books (1868-1870): The Study of Introduction of Western Chemistry in Late Qing Dynasty

CHANG Hao*

Abstract

Modern Western chemistry began to be gradually introduced into China by missionaries arriving in the middle of the nineteenth century. With the establishment of Tongwen College in 1868, the first modern government school in China, scraps of information regarding Western chemistry began to be mentioned in some of their missionary publications. Moreover, during the period March 1868 to December 1870, Jiangnan Arsenal, the most significant organization for introducing Western science and technology in the Self-Strengthening Movement (c.1861-1895), ordered many Western chemistry and applied chemistry books. Although many of these chemistry books were not translated, and some of them were not even on the order list, Jiangnan Arsenal translated many more chemical books, both in quantity and quality, than any other similar organization of its time. Hence, a study into the chemical translations of the Jiangnan Arsenal is definitely one of the best ways for understanding the tactics of the Qing government in introducing Western chemistry into China in the latter half of the nineteenth century.

After a brief introduction, therefore, the first part of this paper, seeks to give a complete list and detailed information of these ordered books - including author, publisher, and date of publication. The second part of the paper seeks to compare these books with other Western chemistry books in order to confirm their scope and level of chemical knowledge. While in the third part, we seek to classify the chemistry books into 'basic' and 'applied'; and then to analyze why many of the ordered books were not translated. The aim here is to gain some insight into Jiangnan Arsenal's rationale and method for introducing Western chemistry into late Qing China.

* Center for General Education, I-Shou Univeristry.

地圖

中央研究院地址：臺北市南港區研究院路二段 128 號