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Chinese Studies in the History of Science and Technology

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As an important issue in patriotic education, the history of science and technology was highly valued by the government in the early years of the People's Republic of China. In 1957, the Chinese Academy of Sciences (CAS) founded the Research Department on the Chinese History of Natural Sciences, marking the institutionalization of the discipline of S&T history and the professionalization of S&T history studies. Scholars initiated studies on disciplinary history and thematic history on the basis of collation of historical materials. Since 1978, the discipline has been developing fast. The Chinese Society of the History of Science and Technology and research units in universities were established one after another and some academic journals came into being, accelerating academic communication and internationalization of the research. In this period, studies on S&T history were expanded from traditional Chinese to modern history, and from Chinese to world history, obtaining a great number of important achievements. In recent years, the discipline of S&T history in Chinese universities is being adjusted, which brings both opportunities and challenges as well.

Keywords: study on history of science and technology, development of the discipline, 70 years, China.

The history of science and technology became an independent branch of historical science through the world in the first half of 20th century. Studies of the history of science and technology were firstly institutionalized in Europe and the U.S.A., and then were carried out in other regions. Chinese research on the history of science and technology emerged

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in the early 20th century, and were institutionalized in the 1950s. Since the early 1950s, the discipline of scientific and technological history has traveled a unique road in China.

Institutionalization of the discipline of S&T history: 1951–1977

Establishment of institutions for the history of science and technology

Establishment of the discipline of S&T history in China was closely related to the social development in the early 1950s. On the New Year's Day of 1951, the *People's Daily* published an editorial entitled *Consolidate Our Great Motherland under the Banner of Great Patriotism*, highlighting the need to “continue to carry out the education of Movement of Resisting U.S.A. and Aiding North Korea by eradicating first and foremost the political influence of the long-standing invasion of China by American imperialism, and to channel this ideological struggle into a climax of love for the motherland”. The editorial also referred to the statement on pre-modern Chinese science and technology from the book *The Chinese Revolution and the Chinese Communist Party*, authored by Chairman Mao Zedong, using the inventions and applications of the compass, papermaking, printing and gunpowder to justify that “China is one of the earliest developed civilizations in the world” [*Editorial of People's Daily*, 1951]. After that, the *People's Daily* invited Qian Weichang, Hua Luogeng, Liang Sicheng, Zhu Kezhen (Coching Chu) and other celebrities in science and technology to write articles about scientific and technological achievements of pre-modern China. This series of articles created a social atmosphere of patriotic education at that time, making public pay attention to the pre-modern Chinese scientific and technological heritage and the history of science and technology, and reflecting the social demand for knowledge about the history of science and technology.

The Chinese Academy of Sciences (CAS), as the national institution of scientific research of the highest level, has played a crucial role in the construction of the discipline of history of science and technology. At the beginning of the academy's founding, the CAS regarded “the collection and compilation of historical materials on Chinese science” and “the translation and publication of modern scientific works” as two important tasks. The president of CAS Guo Moruo noted that in order to commemorate the past while looking to the future, we should “collate the rich heritage of our scientific activities in China over the past several thousand years”, while not neglecting “the achievements made by scientists who have studied modern science in the past thirty or forty years” [*Guo*, 1955]. According to the work division among CAS leaders, Zhu Kezhen, a vice president of the academy, was responsible for both tasks. He began to write papers on the history of science in the 1910s, and had contacts with Joseph Needham. On January 13, 1951 when he and Li Siguang were discussing the table of the contents of *Science and Civilisation in China* posted by Needham, he pointed out that we should have a committee on the history of science, so as to give Needham advisory opinions on his plan and be responsible for writing for the *People's Daily*. On February 12, 1951, they convened a symposium on the history of science in China [*Chu*, 2007]. In May 1951, they began to organize the publication of Chinese works on modern science.

On July 26, 1954, Zhu Kezhen got the first volume of Joseph Needham's *Science and Civilisation in China*. On August 1, he wrote for the *People's Daily* the article *Why We Need to Study the History of Science in Pre-modern China*, in which he mentioned the work of Needham, and emphasized the necessity of studying Chinese S & T history:

Dr. Joseph Needham of England has recently been writing a seven-volume Science and Civilisation in China (the first book was published), in which it is stated that during the 1,500 years from Han dynasty to Ming dynasty, more than 20 technological inventions in China, such as cast iron, drilling deep wells, and building seagoing vessels, were spread to Europe. The invention and spread of such technologies and their influences on the economies of Western countries should be studied and discussed [Chu, 1954].

On August 5, 1954, the CAS held its 30th executive meeting of leadership, and one of the agendas was to discuss the list of members of the Chinese Research Committee on the History of Natural Sciences. This meeting decided that Zhu Kezhen would be the chairman and Ye Qisun and Hou Wailu the vice-chairmen of the committee. At the meeting, Zhu introduced that the Peking Medical College, Nanjing Agricultural College and Tsinghua University were conducting research on the history of medicine, agriculture and engineering, respectively. Therefore, he proposed to carry out studies on the history of science and technology by different institutions: the history of science would be conducted by the CAS, and the history of engineering (technology), agriculture and medicine would be conducted by universities [Guo, J., 2007].

In fact, studies on the history of science, technology, agriculture, and medicine had had a certain foundation by the 1950s, when the history of medicine, agriculture, and technology had got some achievements, and research institutions or organizations on disciplinary history were established one after another. Historians of medicine established the Society of Medical History of the Chinese Medical Association (CMA) as early as 1935, and founded *the Journal of Medical History* in 1947. In 1950, the Central Institute of Health was established, and the Institute of Traditional Chinese Medicine, with the Department of Medical History being affiliated to it, was founded according to the decision of the First National Conference on Health Work in 1950. In December 1955, the Ministry of Health established the Academy of Chinese Medicine, and the Department of Medical History was incorporated into the academy. The main task of the Department of Medical History was to study the laws of medical development, while the Editorial and Review Office, which was established at the same time, was responsible for collating literature on Chinese medicine, writing textbooks, and editing journals of traditional Chinese medicine. In addition, scholars from Beijing College of Chinese Medicine, Shanghai College of Traditional Chinese Medicine and other Colleges were also engaged in the studies on the literature of history of Chinese medicine.

From 1924, Wan Guoding began to teach at Jinling University and serve as the director of the Research Department of Agricultural Books, getting engaged in collection of agricultural history materials and research on agricultural history. By the outbreak of Anti-Japanese War, Jinling University had collected agricultural history materials of more than 37 million Chinese characters, and over 2,000 local chronicles. In 1952, colleges and departments of higher education in China were adjusted, and Nanjing Agricultural College was established by merging the agricultural schools of the former Central University and Jinling University. In April 1955, the preparatory group of the Chinese Academy of Agricultural Sciences (CAAS) of the Ministry of Agriculture held a Symposium on Collating the Agricultural Heritage of Motherland in Beijing. The participants proposed to set up research institutes to carry out research on agricultural history. In July of the same year, with the support of the Rural Work Department of the CPC Central Committee, the Agricultural Office of the State Council, the Ministry of Agriculture, and other departments, the Chi-

nese Agricultural Heritage Research Department was established under the dual leadership of the CAAS and Nanjing Agricultural College, with Wan Guoding as the director [Wang, S., Chen, M., 2017]. In the same period, the agricultural colleges and universities, such as Northwest Agricultural College¹, South China Agricultural College², and Zhejiang Agricultural College³, also established research institutes of agricultural history to collect, collate and compile agricultural classics.

Since the 1920s, Zhang Yinlin, Zhang Zigao, Liang Sicheng and Liu Xianzhou of Tsinghua University have got engaged in the research on the history of pre-modern Chinese technology. In September 1952, Liu Xianzhou proposed to set up the Committee for Compiling History of Various Chinese Engineering Inventions. In October, the committee was approved by the Ministry of Higher Education and renamed the Editorial Committee of the History of Chinese Engineering Inventions. The office of the committee was located in the Tsinghua University Library, directly led by Liu Xianzhou. In 1956, in cooperation with the CAS, Tsinghua University set up the Research Office of History and Theory of Architecture in the Department of Architecture of Tsinghua University, with Liang Sicheng as the director. In 1958, this research office was closed due to the Anti-Rightist Movement, and the staff were incorporated into the China Academy of Building Research (CABR) of the Ministry of Construction and Engineering. At the same time, a national research institute — the CABR Architectural Theory and History Research Department—was established, consisting of the researchers from Tsinghua University, Nanjing Engineering College and the Ministry of Construction and Engineering, also with Liang Sicheng as the director. In the 1950s and 1960s, Liu Xianzhou and Liang Sicheng started to recruit graduate students in the fields of mechanical history and architectural history in the Tsinghua University, respectively [Feng, 2007].

In the mid-1950s, decisive progress was made in the establishment of the discipline of history of science and technology in China. Under the impetus of Zhu Kezhen, development of this discipline was included in *National Long-term Program for the Developing Science and Technology between 1956 and 1967* in 1956, and the CAS Research Department for Chinese History of Natural Sciences was formally established in Beijing on the New Year's Day of 1957, with Li Yan as the director. Eight scholars including Qian Baocong, Yan Dunjie and Xi Zezong were the first batch of full-time researchers. The department started to train graduate students in the history of science in 1957, and established in 1958 the first journal of history of science and technology in China, *Collected Papers on the History of Science* (with Qian Baocong as the chief editor). The establishment of the Research Department for Chinese History of Natural Sciences marked the institutionalization of the

¹ In 1952, Xin Shuzhi, Shi Shenghan and others initiated a ancient agriculture research team in the Northwest Agricultural College, and established the ancient agriculture Research Office in 1956.

² In 1955, Liang Jiamian and others set up a special collection room for ancient Chinese agricultural documents in the library of South China Agricultural College.

³ After the founding of the People's Republic of China, You Xiuling and others were engaged in agricultural history research in the Agricultural School of Zhejiang University. In the adjustment of colleges and departments of higher education in 1952, the school was independent from the university, becoming Zhejiang Agricultural College independently. In 1960, the college merged with Zhejiang Agricultural Improvement Institute, and was renamed Zhejiang Agricultural University. In 1961, the university established the Agricultural Heritage Research Office. In 1964, Zhejiang Agricultural University and Zhejiang Academy of Agricultural Sciences were established separately, and the Agricultural Heritage Research Office was placed under the Zhejiang Agricultural University.

discipline of history of science and technology in China and the professionalization of the research team [Zhang, 2017]. Historians of science and technology have since begun to conduct research activities with the support of the state.

Collation of pre-modern Chinese scientific source

Collation of pre-modern Chinese scientific source is the main task in the early-stage development of the discipline of history of science and technology. China has a long tradition of historiography, and has provided considerable precious historical materials, including very rich records on astronomy, geology, meteorology, and water conservation, which are not only important for historical research, but are also of great practical significance. Zhu Kezhen [Chu, 1954] stated in his article *Why We Need to Study the History of Science in Pre-modern China* the use of historical earthquake records for economic construction and the importance of nova records in contemporary astronomy research, noting that “scientific source in history play vital roles in both economic construction and theoretical research on basic disciplines”.

In 1953, the CAS Earthquake Working Committee was established, including a research team on history under the leadership of Fan Wenlan. According to the proposal of Li Siguang, the chairman of the committee, historical materials in pre-modern China were used to determine the seismic intensity of the proposed locations for factories and mines. Led by Fan Wenlan and Jin Yufu of the research team, the historians and experts in earthquake from the Third Institute of History, Institute of Geophysics, and other CAS institutions related completed the two-volume *Chinese Chronology of Seismic Data* in 1956 after consulting thousands of local chronicles, official history documents, and archives. Meanwhile, based on the materials collected in the chronology, researchers at the Institute of Geophysics made the “Earthquake Epicenter Distribution Map in China” and the “Earthquake Intensity Distribution Map in Chinese History”. These materials provide important references for industrial location [Chu, 2004].

In 1955 when the Yellow River Basin Comprehensive Plan was being made, Zhu Gengling from the Institute for the History of Water Conservancy of Beijing Academy of Water Resources and Hydropower proposed to collate the water conservancy archives of Qing Dynasty in the Palace Museum. In the same year, the Ministry of Water Resources issued a notification requiring immediate collation of water conservancy documents in the Forbidden City. From 1955 to 1958, more than 20 historians of water conservancy came to the Forbidden City to extract records on precipitation, floods and droughts, river evolution, hydraulic projects, water management, etc. from more than 1.1 million original documents of hundreds of millions of Chinese characters, and published these materials one after another. At the same time, the institute also collected pre-modern texts as well as water conservancy journals in the period of the Republic of China (1912–1949), water conservancy maps, local records and other related materials for years [Tan, 2006].

In the 1970s, the central authorities including the CAS, the Ministry of Education, and the State Bureau of Cultural Relics designated ten institutions⁴ to send staff to form the

⁴ The 10 institutions are Beijing Astronomical Observatory of Chinese Academy of Sciences, Yunnan Astronomical Observatory, Guiyang Institute of Geochemistry, Institute of Geology, Institute of Geophysics, Institute of Oceanography, as well as the Library of Chinese Academy of Sciences,

Research Team on Astronomical History Materials. With the Beijing Observatory being in charge, the team conducted a national survey of astronomical records in local chronicles and other books on history. In as short as two years, after consulting astronomical documents, more than 300 staff members from over 100 institutions completed *The Compilation of Chinese Astronomical History Materials* and *The Master List of Pre-modern Chinese Astronomical Records*, of more than 1.2 million Chinese characters in total. These two works are of great reference for studies on history of astronomy and modern astronomy [Chen, 1984].

In addition to large-scale projects of data compilation, historians of science and technology also made collations and studies of the historical materials in different fields. In the 1950s, Xi Zezong successively published the papers such as *Discussing the Relationship Between Supernova Outbursts and Radio Sources based on Records in Chinese Historical Literature* and *Relationship Between Nova Records in Chinese History and Radio Sources*. In 1955, after examining the records of 90 novae and supernovae in pre-modern China, he completed *A New Catalogue of Pre-modern Novae*, which was quickly translated and cited by scientists from the Soviet Union and the U.S.A.. In 1965, Xi Zezong and Bo Shuren published the paper *Pre-modern Novae and Supernovae recorded in the History of China, Korea, and Japan and their Significance in Radioastronomy*. In this study, they proposed, on the basis of *A New Catalogue of Pre-modern Novae*, the criteria for screening novae and supernovae, and finally determined the historical records of 12 supernovae. Their studies also revised the understanding of supernova explosion frequency in the field of astronomy, and was quickly widely cited by the international astronomical field [Jiang, 1994]. The discipline of agricultural history, initiated based on collation of agricultural history materials, continued to collect historical materials in the early years of the P.R. China. In the 1950s, the Chinese Agricultural Heritage Research Department, led by Wan Guoding, collected more than 4,000 pre-modern books, and compiled a set of books of 157 volumes entitled *Continuation of Chinese Agricultural History Materials*. After 1959, more than 8,000 local records were collected from all over the country, from which a total of 680 volumes of local records of agricultural history materials, such as *Local Records: Products*, *Local Records: Categorical Materials*, and *Local Records: Miscellaneous Materials* [Feng, 2007], were compiled. Scholars of agricultural history including Wan Guoding, Shi Shenghan, Xia Weiyong, and Wang Yuhu collated and annotated a great number of Chinese agricultural classics. The Editorial Committee of the History of Chinese Engineering Inventions of Tsinghua University was devoted to collecting technical history materials on mechanical engineering, water conservancy engineering, chemical engineering, and architectural engineering, which were later divided into a total of 13 classes: general machinery, machinery manufacturing, agricultural machinery, textile machinery, astronomical instruments, transportation, military engineering, chemical engineering, handicraft, river defense and water conservancy, construction, geology and minerals, and miscellaneous. By 1971, more than 21,100 types of pre-modern books were consulted [Zhang, 2017].

Studies on disciplinary and thematic histories based on collation of historical materials are the main feature of the construction and development of the discipline of S&T history in this period. Important works on disciplinary history, such as Qian Baocong's *History of Chinese Mathematics*, Chen Zungui's *Brief History of Pre-modern Chinese Astronomy*, Zhang Zigao's *A Draft History of Chemistry in China*, Hou Renzhi's *Brief History of Pre-modern*

Chinese Geography, Liu Xianzhou's *History of Inventions in Chinese Mechanical Engineering (Part I)*, the Chinese Agricultural Heritage Research Office's *History of Chinese Agriculture*, and Liang Sicheng's *History of Chinese Architecture*, are the new products based on the collation and study of *pre-modern* scientific source, which represented then S&T historians' understanding of the development of science and technology in *pre-modern* China. The main task in this period was sub-disciplinary studies of Chinese knowledge according to classification of modern scientific disciplines. Studies on Chinese S&T history, represented by the CAS Institute for the History of Natural Sciences, developed an academic tradition that focuses on disciplinary history studies, pursuing new historical materials, perspectives and methods and carefully examining historical facts and interpreting achievements [Zhang, 2007].

Further institutionalization of the discipline of science and technology history: 1978–1998

In the period of the Cultural Revolution (1966–1976), research on the history of science and technology was severely hampered. The work of the CAS Division of Philosophy and Social Sciences, the parent organization of the Research Department for Chinese History of Natural Sciences, was completely interrupted. In 1975, the division resumed its work, and the research department was renamed the Institute for the History of Natural Sciences. In January 1978, with the approval of the State Council, the institute was removed from the Chinese Academy of Social Sciences, and was put under the Chinese Academy of Sciences, affiliated to the Division of Mathematics and Physics. After the National Congress on Science, especially after the Third Plenary Session of the 11th CPC Central Committee (1978), the research and graduate-training of S&T history in the CAS and Chinese universities were restored one after another.

Degree authorization and discipline classification

Continuous talent development and a place in the national degree system are important measures to sustain the development of the discipline. After the Cultural Revolution, studies on the history of science and technology were in urgent need of young researchers. In October 1977, the State Council approved *Opinions on Enrolling Graduate Students in Colleges and Universities* issued by the Ministry of Education, and postgraduate education was restored. In 1978, the IHNS and the Inner Mongolia Normal University began to recruit graduate students majoring in the history of mathematics, and the East China Normal University, Hangzhou University, and Academy of Traditional Chinese Medicine, Beijing College of Traditional Chinese Medicine began to enroll graduates in history of physics or history of medicine. Subsequently, scholars or research institutions in the history of science and technology started to train students one after another.

Soon after, the first batch of graduate students admitted in 1978 were facing the problem of graduation and degree. In February 1980, the Standing Committee of the National People's Congress adopted *The Regulations of the People's Republic of China on Academic Degrees*, according to which the State Council set up the Academic Degrees Committee. In March 1981, the institutions began to apply for doctoral and master's degrees awarding power. In October 1981, the Academic Degrees Committee held its third meeting, approving the list of the first batch of institutions having doctoral and master's degree awarding

powers and their disciplines and specialties. The IHNS/CAS was granted the right to confer the doctoral degree in the history of sciences (history of mathematics); the University of Science and Technology of China was granted the right to confer the doctoral degree in the history of sciences (history of physics). In addition, the Beijing Astronomical Observatory of CAS, East China Normal University, Beijing Normal University, Inner Mongolia Normal College, Liaoning Normal College and Hangzhou University were also granted the power to confer the master's degree in the history of sciences. In 1984, the second batch of institutions were granted the degrees awarding power: the Institute for the History of Natural Science of the CAS was granted the power to award the doctoral degree in the history of astronomy, and the Nanjing Agricultural College, South China Agricultural College, Beijing Medical College and Harbin Medical College were granted the right to grant the master's degree in the history of science. In 1986, the third batch of units were granted the power: the Nanjing Agricultural College was authorized to confer the doctoral degree in agricultural history, and Zijinshan Astronomical Observatory of CAS, Beijing Normal University, East China Petroleum Institute, Peking University, Northwest Agricultural College, Beijing Agricultural University and Northwest University were authorized to award the master's degree in the history of sciences. In 1990, the fourth batch of units were granted the power: Northwest University was authorized to award the doctoral degree in the history of mathematics, and Beijing College of Iron and Steel was authorized to confer the master's degree in the history of technological science. In 1996, the sixth batch of institutions were granted the power. After these six batches of degree authorization in the past 20 years, the discipline of S&T history has obtained corresponding degree awarding powers in the four major disciplines of science, technology, agronomy and medicine: degrees in history of science (sub-disciplines), the first-level discipline in the category of science; degrees in history of technical science (sub-disciplines), the first-level discipline in the category of engineering; degrees in history of agriculture, the second-level discipline in agronomy in the category of agronomy; degrees in history of medicine, the second-level discipline in basic medicine in the category of medicine. There are in total 24 units authorized to award degrees in history of science and technology. In addition, in the first-level discipline of architecture are included the specialties of architectural history and theory of architecture⁵; in the first-level discipline of Chinese medicine are included the second-level disciplines of history of Chinese medicine, Chinese medical literature, doctrines of various schools, and ancient medical texts⁶; in the first-level discipline of Chinese and Western integrative medicine is included the second-level discipline of clinical discipline of Chinese and Western integrative medicine, which could award master's degree in medical records of the Qing court for a short period of time⁷ (Table 1).

Table 1. Classification of disciplines of history of science and technology before 1997

⁵ Later merged into architectural history and theory.

⁶ In the 1997 List, the specialties of history of Chinese medicine, Chinese medical literature, doctrines of various schools and ancient medical texts were cancelled, and the specialty of Chinese medicine history literature was established.

⁷ The only time was in 1981 when the Institute of Traditional Chinese Medicine was authorized to grant the master's degree in medical records of the Qing court.

Degree	First-level discipline	Second-level discipline (Specialty)
Science	History of Natural Sciences	History of mathematics, history of physics, history of chemistry, history of astronomy, history of geoscience, history of biology, etc.
	History of Technological Sciences	History of shipbuilding, history of metallurgy, history of machinery, etc. (only for master's degree)
Technology	Architecture	Architectural history and theory
	Agronomy	History of agriculture
Agriculture	Basic Medicine	History of medicine
	Traditional Chinese Medicine	History of traditional Chinese medicine, Chinese medical literature, doctrines of various schools, and pre-modern medical texts
Medicine	Chinese and Western integrative medicine	Clinical discipline of Chinese and Western integrative medicine (medical records of the Qing court)

Note: References include *The National List of Doctoral and Master's Degree Granting Institutions of Higher Education and Research Institutes* (1987), *The List of Degree Granting Institutions in China* (1994 ed.), and *The General List of Doctoral and Master's Degrees Granting Disciplines and Specialties in China* (1996) made by the Office of the State Council Academic Degrees Committee.

In the 1990s, the orientation and system structure of the discipline of history of science and technology were further clarified. In 1995, the East China Normal University was entrusted by the Office of the State Council Academic Degrees Committee to convene a research meeting of the institutions including the CAS Bureau of Basic Sciences (represented by the IHNS), the University of Science and Technology of China, Peking University, and Northwest University. In the meeting was established the National Research Group on the History of Natural Sciences to discuss categorization of the discipline. On November 23, the Group finished the graduate-training program in the history of natural sciences, and submitted *The Opinions on Standardization of the Doctoral Graduate Program in the History of Natural Science* to the Office of the State Council Academic Degrees Committee. On July 15, 1996, the office issued *The List of Doctoral and Master's Degrees Granting Disciplines and Specialties and the Comparison of the Old and New Lists (Exposure Draft)*, in which the disciplines related to the history of science and technology were adjusted: the history of agriculture was put under the category of philosophy of science and technology; the first-level disciplines of the history of natural science and the history of technical science were abolished and the second-level disciplines were merged into the corresponding disciplines. Following strong advocacy from the IHNS of the CAS and several academicians, the State Council Academic Degrees Committee finally adopted the proposal of the scientists and historians of science, and set up the history of science and technology as an independent first-level discipline under the category of science, in which graduates can be awarded degrees in science, engineering, agronomy and medicine. Some disciplines cancelled or adjusted in the Exposure Draft, including the history of natural science, the history of technological science, the history of medicine and the history of agriculture, have been categorized into the newly established first-level discipline of history of science and technology [Zhai, 2011] (Table 2). In January 1998, all the major institutions offering graduate student programs in the history of science and technology in China held a *Conference on Introduction of the First-level Discipline of the History of Science and Technology and List of the Disciplines and Specialties* in the Nanjing Agricultural University. The conference concluded that it was appropriate then to

merge the first-level or second-level disciplines of the history of natural science, the history of technological science, the history of agriculture and the history of medicine in the original list into the first-level discipline of history of science and technology in the 1997' *List of Doctoral and Master's Degree Granting Disciplines and Specialties* issued by the Office of the State Council Academic Degrees Committee and the State Education Commission; the newly established discipline was put under the category of science and could be subdivided to award degrees in science, engineering, agronomy and medicine, but the discipline did not include specialties. However, as the discipline was developing into a more comprehensive one, it was necessary to divide at an appropriate time in the future the discipline into two specialties: comprehensive and general history of science and technology. At the same time, for the history of science and technology is an independent discipline, it was also needed to establish an evaluation team for this first-level discipline [Xiaofeng, 1998].

As an interdisciplinary discipline, the history of science and technology was established as a first-level discipline in China's academic degrees system, which is the result of joint efforts of historians of science and scientists who cared and supported the studies of science and technology history at that time. This also shows that the importance and peculiarity of this discipline were recognized by the Office of the State Council Academic Degrees Committee, laying a good foundation for further institutionalization of the discipline.

Table 2. Classification of disciplines of science and technology history after 1997

Degree	First-level discipline	Second-level discipline (Specialty)
Science	History of science and technology	No division
Engineering	Architecture	Architectural history and theory
Medicine	Traditional Chinese medicine	Chinese medical history literature

Note: from *The List of Degree Granting Institutions in China* (2001 ed.) made by the Office of the State Council Academic Degrees Committee.

Academic associations, conferences and journals

As an important symbol of the construction of an academic community and the development of a discipline, the establishment of academic associations of the history of science and technology was urged by the colleagues. In October 1980, with the support of the CAS and the China Association for Science and Technology, the first national congress on the history of science and technology was held in Beijing, in which the Chinese Society for the History of Science and Technology (CSHST) was announced to be established, with Qian Linzhao as the president, Cang Xiaohu and Yan Dunjie as the vice president, and Li Peshan as the secretary-general. Yu Guangyuan (then vice director of the State Scientific and Technological Commission), Li Chang and Qian Sanqiang (then CAS vice presidents), and Mao Yisheng (then vice president of the China Association for Science and Technology) all made speeches at the conference, demonstrating the support from the Chinese scientific community for the study of the history of science and technology.

After the establishment of the CSHST, scholars successively initiated the establishment of sub-societies, promoting the academic exchange and research on the history of science and technology. By 1983 when the second congress of CSHST was held, nine sub-societies had been established for the history of mathematics, astronomy, physics, chemistry, biology, earth science, modern technology, metal history and architectural technology. Additionally, some of the sub-associations are established as academic organizations affiliated to

other societies. For example, the Chinese Society for the History of Mathematics, founded in 1981, is affiliated to both the Chinese Mathematical Society and the CSHST. The China Agricultural History Society was established in Beijing in 1987, affiliated to the China Association of Agricultural Science, and was upgraded to an independent society in 1993. In 1980, representatives of the Chinese Society of Medical History attended the national congress on the history of science and technology, and in the same year the society restored the *Chinese Journal of Medical History*. In the year of 1983 when Li Shizhen had been dead for 390 years, the Society of Pharmaceutical History was created in the first national conference on pharmaceutical history. In 1984, the Chinese Society of Naval Architects and Marine Engineers approved the establishment of academic society for the research on history of shipbuilding, and the establishment of the editorial committee for the *Journal of Marine History Studies* (yearly) as well. In 1990, the society for the history of machinery under the Chinese Mechanical Engineering Society was established, and held its first annual conference. In 1993, the society for architectural history under the Architectural Society of China was founded, and held its first annual meeting in Beijing. The predecessor of the society was the society for architectural history and theory, which ceased its activities in 1983. In addition, local societies for S&T history were established in Shaanxi, Anhui, and Shanghai. The above-mentioned societies at all levels organized considerable academic conferences, symposiums and seminars, which greatly promoted academic exchanges and discipline construction.

Research institutes, universities and societies organized scholars to attend international conferences and got in contact with the corresponding international academic organizations. As early as 1956, Zhu Kezhen, Li Yan and Liu Xianzhou were invited to attend the 8th International Congress of History of Science (ICHS) held in Italy, and China was also admitted as a member of the Division of History of Science of the International Union for the History and Philosophy of Science (IUHPS/DHS). In the period of the Cultural Revolution, however, international exchanges were grounded to a halt, and China withdrew from the IUHPS/DHS. It was not until 1980 that the first meeting of the first standing council of the CSHST began to discuss how to participate in ICHS again. In 1981, eight delegates including Xi Zezong and Hua Jieming went to Bucharest to attend the 16th ICHS. In 1985, in the 17th ICHS held in Berkeley, USA, the People's Republic of China was once again accepted as a national member of the IUHPS/DHS.

In the 1980s, studies on the history of science and technology were recovered rapidly in China, and the strong interest of Western scholars in history of Chinese science made this field one of academic hotspots. In 1982, the first International Conference on the History of Science in China was held at the University of Leuven in Belgium. In 1983, the second conference was held at the University of Hong Kong. In 1984, the CAS hosted the third conference in Beijing, which was the first time that a conference on such a theme be held in the Chinese mainland. After that, the international conference on the history of science in China was held in such cities as Sydney, Australia (1986); San Diego, USA (1988); Cambridge, UK (1990); Shenzhen, China (1996); Berlin, Germany (1998); Hong Kong, China (2002); Harbin, China (2004).

Academic journals are one of the symbols of the establishment and development of disciplines. In 1981, the *Collected Papers on the History of Science*, sponsored by the IHNS in 1958, was republished, and was renamed *Studies in the History of Natural Sciences* in the following year and published four times a year. In 1980, the IHNS created the quarterly journal, *Science History Translation Collection*, to publish Chinese translations of foreign

papers on the history of science. The magazine ceased publication in 1989 after 33 issues. In 1980, the CSHST cooperated with the China Popular Science Press to establish the journal *China Historical Materials of Science and Technology*, which is devoted to the collection, collation and publication of Chinese modern historical materials of science and technology. The journal began to be sponsored instead by the CSHST in 1985, and has been co-sponsored by the CSHST and the IHNS since 1988. In addition, the *Journal of Dialectics of Nature*, sponsored by the University of Chinese Academy of Sciences, as a comprehensive and theoretical journal of philosophy, history and sociology of science, gradually formed a “tacit division of labor” with other journals such as *Studies in the History of Natural Sciences* and *China Historical Materials of Science and Technology* in terms of publishing papers on the history of science and technology [Xu, 2008]. In 1980, the Agricultural Historical Heritage Research Department of South China Agricultural College established the *Collected Papers on Agricultural History Research*. In 1981, the Chinese Agricultural Heritage Research Department created the journal *Chinese Agricultural History*, and the Chinese Agricultural Archaeology Research Center of Jiangxi Province founded the journal *Agricultural Archaeology*. In 1987, the Chinese Agricultural Museum created the journal of *Ancient and Modern Agriculture*. These four journals became the most important academic journals in the field of agricultural history.

Research output and research field extension

On the basis of the studies before and within the period of Cultural Revolution, Chinese S&T historians began to consider writing a series of books on disciplinary history and general history of science and technology in pre-modern China, such as *History and Development of Pre-modern Chinese Architecture*, *Historical Atlas of China*, and *An Introduction to the History of Chinese Science and Technology*. In 1990, Xi Zezong [Zezong, 1994] commented on the studies of Chinese scholars on the history of pre-modern science and technology as follows: “We are likely to be far ahead of Needham in a certain discipline or aspect of research; but overall, we haven’t caught up with Needham.”

Writing book series on history of science and technology in China was important stage goals for Chinese historians. In the 1950s and 1960s, the CAS Research Department for the History of Natural Sciences came up with a project of writing a series of books, partly inspired by Needham’s works. However, due to weak research foundation and then the interference of political campaigns at that time, the work was not carried out. In 1991, the project was approved by the CAS as a key project of the Eighth Five-year Plan, with President Lu Jiayi as chief editor and director of the editorial board. Led and organized by the INSH, more than 100 scholars participated in the writing and research work. A total of 26 volumes were published, including three volumes of general works (general history, scientific thoughts, and biographies), 19 volumes of disciplinary history (mathematics, physics, chemistry, astronomy, geography, biology, agriculture, medicine, water conservancy, machinery, architecture, bridges, mining and metallurgy, textile, ceramics, papermaking and printing, transportation, military technology, and weights and measures), as well as the 4 volumes of reference books (dictionary, catalogue, chronology, and works index). This series of books reflects the research achievements of Chinese and foreign scholars, changing the situation that Chinese scholars had long relied on Needham to understand and interpret scientific and technological traditions in pre-modern China.

In addition to the 26-volume *History of Science and Technology in Pre-modern China*, scholars also wrote several series of monographs on disciplinary history in pre-modern Chi-

na, including *Book Series of History of Chinese Astronomy*, *Book Series of History of Chinese Mathematics*, *Book Series of History of Chinese Physics*, and *Book Series of History of Chinese Engineering Technology*. In addition, the Inner Mongolia Normal University also organized scholars to write a book series entitled *History of Science and Technology of Chinese Ethnic Minorities*. These works fully reflect the achievements of studies on disciplinary and thematic history in these decades.

Chinese scholars also made great efforts to open up new academic fields, extending the studies on S&T history from ancient to modern China and from China to the world. In the 1950s and 1960s, few historians studied the history of science and technology in modern China. First, some scholars believed that modern China was backward in science and technology, and it was not worth studying according to the research mode of “description of achievement in history” at that time. Second, studies on modern history involve evaluation of important figures and events, which has certain risks in some political movements at that time. After the Cultural Revolution, the IHNS set up the Research Department for the History of Modern Science to meet the needs of national modernization, and organized the compilation of *A Brief History of Science and Technology in the 20th Century*. In the 1990s, Dong Guangbi published his monograph entitled *Outline of the History of Science and Technology in Modern China*, and organized a group to write *History of Science and Technology in Modern China*. In 1990, the CAS set up the Committee for Historical Records Collection of the CAS, and set up a research office under the Institute for Science and Technology Policy and Management. In 1991, the CAS began to edit and publish the internal journal *CAS Historical Records and Research*. Such compilation of institutional history and collation of the information laid a foundation for studies on science and technology history in modern China (Wang, 2007).

Scholars in the fields of philosophy and sociology of science paid more attention to the social and ideological history of science and technology, and translated into Chinese some western works on history of science and technology. In 1982, the *Journal of Dialectics of Nature* held a seminar on the Reasons for Backwardness of Science and Technology in Pre-modern China, which was the first national conference in Chinese mainland to conduct discussion on such issue, promoting the studies on social history of science [Fan, 2017]. In 1984, the book series *Towards the Future* began to be published, including many works on the history of science and technology, philosophy of science and technology, and sociology of science, such as *Let the Light of Science Shine on Ourselves*, *The Third Mathematical Crisis*, *British Science, Technology and Society in the 17th Century*, *How God Rolls the Dice*, *Pride and Prejudice against Science*, and *The Roles of Scientists in Society*. These works introduce different research perspectives and methods, making a useful complement to traditional research on the history of Chinese science and technology.

The investigation, study and protection of traditional crafts is an important area for historians of technology. With the industrialization and economic and social transformation in China, many traditional crafts have been replaced by modern technology, and are even on the verge of extinction. In 1987, such historians as Hua Jueming proposed the *Implementation Plan for the Protection and Development of Chinese Traditional Crafts*, which is a forward-looking plan, but did not obtain enough attention from authorities. In 1995, they proposed to compile the *Complete Collection of Chinese Traditional Arts and Crafts*. In 1996, with the support of the Elephant Press, the compilation of *Lacquer Art* and *Ceramics* was started [Hua, 2018]. In 1999, the *Complete Collection of Chinese Traditional Arts and Crafts* was listed as the Major Programs of the CAS in the 9th Five-year Plan Period, and the full-

scale compilation and research work was carried out. By 2016, a total of 20 volumes of the *Complete Collection of Chinese Traditional Arts and Crafts* had been published, providing academic basis for the protection of intangible cultural heritage and promoting the integration of history of technology with other disciplines, including archaeological science, arts, folklore, and cultural anthropology.

Discipline adjustment: opportunities and challenges (1999 — present)

Since the late 1990s, the discipline of the history of science and technology in China has been adjusted according to the needs of the state and society, bringing new opportunities and challenges. The research direction and field are being extended, leading to new progresses in internationalization and important research achievements. In addition, with the improvement or adjustment of disciplines, the discipline of the history of science and technology is developing steadily in Chinese universities.

Development of new Research areas

Since the end of the 1990s, with the dual influence of the internal drive of disciplinary development and social demand, Chinese studies in the history of science and technology has been extending its research fields, experiencing a period of transformation in research directions, academic issues, methodologies, international cooperation and exchange, etc. [Zhang, 2012]. The IHNS even launched “applied research on the history of science and technology”, focusing on new academic issues. In 1999, the institute adjusted its orientation according to the requirements of the CAS, and tried to contribute to macro-strategic research on science and technology development, providing reference for the construction of Think Tanks of CAS with historical perspectives and specific cases. The institute participated in drafting the research reports such as *General Report of S&T in China: A Roadmap to 2050* and *Strategic Report of Discipline Development in China*. In building the culture of innovation in the CAS, the institute made “science and culture” as a new research direction in 2001 and established the journal *Science & Culture Review* in 2004, so as to promote the integration of science and humanities.

While maintaining its advantages in studies on the history of science and technology in pre-modern China, the IHNS keeps investing efforts in new research fields, and drives the extension of the fields of various disciplines in China via major programs. In 2000, the institute launched the project of “Comprehensive Studies in the Development of Science and Technology in Modern China”, a project of the “Knowledge Innovation Program” of the CAS, organizing more than 110 scholars from over 30 universities and institutes to conduct research. From 2004 to 2009, a total of 35-volume *Series of Studies in the History of Science and Technology in Modern China* were published. This book series opened a new chapter for the studies on history of modern science and technology in China, and many young and middle-aged participant scholars gradually grew into leading researchers in related fields. In recent years, more attention has been paid to the collection and preservation of historical materials of modern and contemporary science and technology. Fan Hongye from the CAS Institute of Science and Technology Policy and Management was a pioneer in sorting out collections of works and oral histories by scientists. He published *The Complete Works of Zhu Kezhen* and the book *Series of Oral Histories of Chinese Science in the 20th Century*. In 2009, the China Association for Science and Technology launched the Project on *Collection of Re-*

cords of Academic Development of Senior Scientists, providing important data for the research on history of modern and contemporary science and technology.

In recent 10 years, the IHNS has pioneered in trying new research perspectives, methodologies, and planned and launched the major projects including the “Production and Dissemination of Scientific and Technological Knowledge”, “Scientific Revolutions, Technological Revolutions and the Modernization of Nations”, and “Outline of the History of Science and Technology in the P.R. China”. At the same time, the institute also conducted studies on traditional crafts, collation of pre-modern science and technology books, scientific popularization, etc., aiming to break through the “achievement-interpreting” mode in the past, train a new generation of scholars, and make new explorations for the reconstruction of the history of pre-modern Chinese science and technology and the writing of a detailed history of modern science and technology.

In the past 20 years, the research on the history of science and technology in China has been more international. It has been proved that international cooperation is conducive to improving academic research level and solving complex cross-cultural or transnational problems. In 2005, the IHNS and the CSHST successfully organized the 22nd ICHS. In 2017, the IHNS and the Science Press jointly founded a new journal in English, *Chinese Annals of the History of Science and Technology*, which is co-edited by Zhang Baichun and Jürgen Renn.

The Change of degree-granting institutions

In the early years of the P.R. China, the CAS established a national institute for the history of science and technology, creating an initial environment for the development of the discipline. After more than 40 years’ development, the IHNS has collaborated with universities in setting up departments for history of science, promoting the further institutionalization of the discipline, and giving encouragement to the development of degree-granting institutions. Since the late 1990s, degree-granting institutions in the discipline have gradually upgraded their original teaching or research offices to research institutes, departments, gaining larger size and greater autonomy.

The establishment of a department of history of science and technology is a significant breakthrough in institutionalization of this discipline in universities. In 1999, in collaboration with the IHNS, China’s first department of history of science and philosophy of science was founded in Shanghai Jiao Tong University. In the same year, the Department of History of Science and Scientific Archaeology was established based on the original Research Office of History of Natural Sciences and Research Office of Scientific Archaeology by the University of Science and Technology of China, in cooperation with the IHNS of the CAS and the Institute of Archaeology of the Chinese Academy of Social Sciences.

Since the beginning of the 21st century, the number of doctoral degree-granting institutions remains a slight increase, while that of master’s degree-granting institutions keeps rising and falling. In the seventh batch of degree authorization in 1998, the institutions that had obtained the right to grant the doctoral degree in the history of science and technology were converted to the institutions having doctoral degree-granting right in the first-level discipline of the history of science and technology, including six institutions: the IHNS of CAS, University of Science and Technology of China, Peking University, Beijing University of Science and Technology, Nanjing Agricultural University, and Northwest University. Shanxi University was added in 2003, Inner Mongolia Normal University in 2006, Shanghai Jiao Tong University in 2015, Nanjing University of Information Science and Technol-

ogy and Jingdezhen Ceramic Institute in 2017, and Tsinghua University in 2018, Guangxi Minzu University in 2021. Although some universities have not yet obtained the doctoral degree-granting right in the discipline, they have recruited and trained doctoral students in the history of science and technology through other means for years. For example, Donghua University trained doctoral students in the history of textile technology, and granted the students the doctoral degree of textile science and engineering. The National University of Defense Technology trained doctoral students in the history of military technology, and conferred the students the doctoral degree in philosophy of science and technology. Adjustments to master's degree granting institutions in the history of science and technology are relatively large. In 2006, a total of 11 new master's degree granting institutions were set up, including Tianjin Normal University. In 2010, five new master's degree granting institutions were founded, including Beijing Institute of Technology. In 2016, eight master's degree granting institutions were closed. In 2017, five master's degree granting institutions were established, including Hebei University. In 2018, three master's degree granting institutions, including Liaoning Normal University, were abolished. Especially after the fourth round of discipline evaluation in 2016, a total of 11 master's degree institutions were closed, including the "new" ones established about 10 years ago, such as Beijing Institute of Technology, Northeastern University and Harbin Institute of Technology, and the "old" ones with long history, such as Wuhan University, Zhejiang University and East China Normal University. Instead of being closed, some institutions were merged into other disciplines or departments in the adjustment.

These adjustments are the natural results of discipline development, talent flow and intergenerational change, and reflect also the effect of "Double First-class" Program of the Ministry of Education on discipline construction. Although a considerable number of master's degree granting institutions in the history of science and technology have been closed or merged, some universities are growing to realize the importance of developing the discipline. Tsinghua University established the Department of the History of Science in 2017, and Peking University established the Department of History of Science, Technology and Medicine in 2019. The both departments were founded by integrating research resources in the past. Some universities have not yet obtained the right to confer degrees in the history of science and technology, but they have already had relatively big research groups, or have been in preparation for related research directions. For example, Sun Yat-sen University made history of science and technology one of the key development directions of the Department of History (Zhuhai) in 2018. Nankai University established the Research Center for the History of Science and Technology 2021, which relies on the Faculty of History at the university.

However, in general, the history of science and technology is still a minor discipline in contemporary China, and the size of its academic community is not commensurate with China's thousands of years of scientific and technological tradition and the development stage of modern science and technology, as well as the level of economic and social development and the scale of education in China. In spite of the strong support for the IHNS from the CAS, historians of science and technology in most of universities have not obtained enough attention [*Guo, S.*, 2007].

Conclusion

After about 70 years' efforts, the discipline of the history of science and technology has been institutionalized in China, and has been listed as the first-level discipline of science by the state. An academic community consisting of hundreds of professional scholars has been formed, who have supervised considerable graduate students in this field. Great research achievements have been made, contributing to the development of science and culture in China. It has also occupied an important position in the international academic community.

The IHNS gives full play to the advantages of multidisciplinary research and institutionalization, exploring new research directions, and implementing major research programs. The institute has taken the lead in research and book-writing, including *History of Science and Technology in Pre-modern China*, *Complete Collection of Traditional Chinese Arts and Crafts*, and *Series of Studies in the History of Science and Technology in Modern China*.

The departments or institutes of the history of science and technology in universities, museums and other institutions are often characterized by the studies in the history of one or more disciplines or fields, playing important roles in teaching, research, and heritage protection. These institutions give full play to their advantages of expertise and resources, achieving the complementarity of studies in the history of knowledge and related fields.

Looking into the future, the Chinese historians will keep its advantages in the studies in the history of science and technology in China, and strengthen the studies in the world history of science and technology, which has been weak hitherto. The Chinese community of history of science and technology should accelerate internationalization, so that the world can have a better understanding of China and vice versa.

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Китайские исследования в области истории науки и техники

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В первые годы существования Китайской Народной Республики история науки и техники трактовалась как важный компонент патриотического воспитания и высоко ценилась правительством. В 1957 г. Китайская академия наук основала Исследовательский отдел по истории естественных наук Китая, что ознаменовало институционализацию дисциплины истории науки и техники и профессионализацию этих исследований. Ученые начали работу по сбору исторических материалов. С 1978 г. эта дисциплина стала быстро развиваться. Один за другим были созданы Китайское общество истории науки и техники и исследовательские подразделения в университетах, появились научные журналы, что ускорило академическую коммуникацию и интернационализацию исследований. В этот период исследования по истории науки и техники были расширены от традиционной китайской до современной истории, а также от китайской до всемирной истории, что привело к большому количеству важных достижений. В последние годы дисциплина истории науки и техники в китайских университетах трансформируется, что несет в себе как возможности, так и вызовы.

Ключевые слова: изучение истории науки и техники, развитие дисциплины, семьдесят лет, Китай.