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THE CHINESE ASTRONOMICAL BUREAU, 1620–1850

LINEAGES, BUREAUCRACY AND
TECHNICAL EXPERTISE

Ping-Ying Chang



The Chinese Astronomical Bureau, 1620–1850

This book offers a new insight into one of the most interesting and long-lived institutions known to historians of science, the Chinese imperial Astronomical Bureau, which for two millennia observed, recorded, interpreted, and predicted the movements of the celestial bodies.

Utilizing archival material, such as the résumés written for imperial audiences and personnel administration records, the book traces the rise and fall of more than 30 hereditary families serving at the Astronomical Bureau from the late Ming period to the end of the Qing dynasty. The book also presents an in-depth view into the organization and function of the Bureau and succinctly charts the impacts of historical developments during the Ming and Qing periods, including the Regency of Prince Dorgon, the influence of the Jesuits, the relationship between the Kangxi and Yongzheng emperors and the He family and the failure of the bureau to predict correctly the solar eclipse of 1730.

Presenting a social history of the Qing Astronomical Bureau from the perspective of hereditary astronomer families, this book will be of interest to scholars and students of Chinese Imperial history, the history of science and Asian history.

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First published 2023
by Routledge
4 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge
605 Third Avenue, New York, NY 10158

Routledge is an imprint of the Taylor & Francis Group, an informa business

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British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

Names: Chang, Ping-Ying, author.

Title: The Chinese Astronomical Bureau, 1620–1850 : lineages, bureaucracy and technical expertise / Ping-Ying Chang.

Description: Abingdon, Oxon ; New York : Routledge, 2023. |

Series: Needham research institute series | Includes bibliographical references and index.

Identifiers: LCCN 2022017187 (print) | LCCN 2022017188 (ebook) | ISBN 9780367439675 (hardback) | ISBN 9781032354903 (paperback) | ISBN 9781003008255 (ebook)

Subjects: LCSH: Qin tian jian (China)—History. | Astronomy, Chinese—History.

Classification: LCC QB33.C5 C43 2026 (print) | LCC QB33.C5 (ebook) | DDC 520.951—dc23/eng/20220711

LC record available at <https://lcn.loc.gov/2022017187>

LC ebook record available at <https://lcn.loc.gov/2022017188>

ISBN: 978-0-367-43967-5 (hbk)

ISBN: 978-1-032-35490-3 (pbk)

ISBN: 978-1-003-00825-5 (ebk)

DOI: 10.4324/9781003008255

Typeset in Times New Roman
by Apex CoVantage, LLC

**To the Memory of My Parents,
Tsang-Lang Chang and Emmy Chou Chang**



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Acknowledgments

I am most grateful to Professor Joseph W. Dauben for teaching me the joy of historical research. Without his patience, my journey to earning a PhD would not come to a happy conclusion; without his encouragement, I would not have started the new journey to turning my doctorate dissertation into this book. I also wish to express my sincerest appreciation to Professor Christopher Cullen and Professor Catherine Jami for having kindly read the manuscript of this book and made many insightful suggestions. Particular thanks are due to Professor Wang-Sheng Horng for his timely and humorous advice that has rescued me from excessive anxiety during the long process of revising the book.

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Taipei, Taiwan

Reign Titles of the Qing Emperors (1644–1911)

Shunzhi	順治	1644–1661
Kangxi	康熙	1662–1722
Yongzheng	雍正	1723–1735
Qianlong	乾隆	1736–1795
Jiaqing	嘉慶	1796–1820
Daoguang	道光	1821–1850
Xianfeng	咸豐	1851–1861
Tongzhi	同治	1862–1874
Guangxu	光緒	1875–1908
Xuantong	宣統	1909–1911

1 Introduction

1.1 The Research Question

In the ninth month of the twelfth year of the Qing Yongzheng 雍正 reign (September 1734), Bao Qinhui 鮑欽輝, the Supervisor of the Winter Office (*Dongguan Zheng* 冬官正) of the Astronomical Bureau (*Qintianjian* 欽天監), attended an imperial audience along with a group of officials from other institutions who were seeking to finalize their recent job promotions. An audience such as this represented the only occasion for lower-ranking civil servants like Bao to communicate directly with the emperor.¹ At the time, Bao was about 45 years old and had worked at the Astronomical Bureau all of his adult life.² Three years earlier he had been promoted to one of the highest positions in the Calendar Section (*Li ke* 曆科) and had been in charge of calculating the official calendar for the dynasty.³ As a result of his long and excellent service record, Bao was granted a new position as Department Secretary at the Ministry of Works (*Gongbu zhushi* 工部主事)⁴. However, while the other officials at this imperial audience hoped to be approved for new jobs, Bao's object was to convince the emperor to let him remain in his old post. Uncertain about how much time he would be allowed to talk to the emperor, Bao Qinhui elaborated his concerns in the résumé that the emperor would be browsing through during the audience. Bao began by recounting his lineage:

Although my intrinsic quality is mediocre and foolish, I have had the fortune to meet such a prosperous era that the profession of computation and observation has been showered with favor and grace. My grandfather, Bao Yinghua, 鮑英華, was an Erudite (*Boshi* 博士) of the Astronomical Bureau. My grandfather's elder brother, Yingqi 英齊, was a Senior Vice-Director (*Zuo jianfu* 左監副). My father, Kewei 可畏, was a Student Astronomer (*Tianwensheng* 天文生), and his younger brother, Kecheng 可成, was the Supervisor of the Spring Office (*Chunguan Zheng* 春官正). From grandfather to grandson, every generation [of my family] has learned the method of calendar making (*li fa* 曆法) and received grace from the imperial state.⁵

2 Introduction

After reminding the emperor that his family members had proudly served the dynasty for generations with their specialty in mathematical astronomy, Bao Qinhui recounted his own contributions. He listed three mathematical projects in which he had participated: the Office of Compiling Mathematical Treatises (*Xiu suanshu chu* 修算書處) in the previous reign, the modification of the calendar-making system in the 1730s, and the new mathematics education program in the Eight Banners Official Schools (*Baqi guanxue* 八旗官學) that had commenced earlier in the current year. Bao concluded his résumé by informing the emperor, “I worry about my stupidity. Except for the knowledge of calendar making, there really is not anything that I can contribute.”⁶ Bao’s petition successfully convinced the Yongzheng emperor, and he remained in his position as the Supervisor of the Winter Office of the Astronomical Bureau until he died two decades later.⁷

The stories of Bao Qinhui, his family, and many other astronomer families, together with Bao’s résumé and tens of thousands of Qing state documents that lie silently in archives, have attracted little attention from historians. Indeed, at first glance, Bao Qinhui’s résumé is hardly exciting or inspiring. Mathematical astronomy as a hereditary profession has long been a historical phenomenon in China, but the Bao family was almost unheard of. Unlike other Qing astronomers, such as He Guozong 何國宗 (1687–1766), Mei Juecheng 梅穀成 (1681–1764), and Minggantu 明安圖 (c. 1692–c. 1763), neither Bao Qinhui nor any of his family members had previously been considered distinguished enough to be included in the series of *Biographies of Mathematicians and Astronomers* (*Chouren zhuan* 疇人傳) that Ruan Yuan 阮元 (1764–1849) and other late-Qing mathematicians and historians compiled.⁸ The Qing official history includes very few descriptions of the two Yongzheng-period mathematical activities in which Bao Qinhui was involved—the modification of the calendar-making system and the new mathematics education program. Similarly, historians are typically more interested in an earlier and larger-scale project, namely, the compilation of the *Origins of Mathematical Harmonics and Astronomy* (*Lüli yuanyuan* 律曆淵源), which Bao Qinhui also participated in but was not included in the state-approved list of major contributors.⁹ Few historians perceive the Yongzheng period mathematical activities to be relevant or important in the development of Chinese mathematics.¹⁰

Nonetheless, historical research is about revisiting the stories that have been told and investigating the parts of the stories that have not been told. In particular, the purposes of research are to find out what storytellers have purposely hidden from the readers, reassess the significance of the stories, and reconstruct the stories if necessary. For instance, Bao Qinhui was indeed from one of the oldest hereditary astronomer families that had served the Qing court since its establishment in Beijing, and he appeared thankful for the rewards that Yongzheng and preceding emperors had bestowed on his family.¹¹ However, knowing that the formidable Yongzheng emperor had banned the dissemination of Christian teachings, Bao Qinhui did not mention in his résumé that he was from a Christian family. Bao Qinhui’s granduncle, Bao Yingqi, had once been banished to the northeast borderland in the early Kangxi 康熙 reign (1662–1722) for being a member of the Jesuit faction.¹² In August 1702, Bao Yingqi and Bao Kecheng led their family

and more than 40 Chinese Christians to send a collective testimony to the Pope regarding the Rites Controversy (*Liyi zhi zheng* 禮儀之爭), and they all signed the testimony with their official titles at the Astronomical Bureau.¹³ The Bao family's career development in fact relied more on the Jesuits than on the Qing rulers' imperial grace. It is not a coincidence that the number of archival records related to the Bao family decreases as the Jesuits' status in the Qing court declined, and no record bearing the surname Bao dated after the end of the Jiaqing 嘉慶 reign (1796–1820) has been found (see Appendix A for a reconstructed family tree of the Baos).¹⁴

According to mid-Qing scholar and mathematician Tan Tai 談泰 (a. 1786), the character “*chou*” 疇, could best be interpreted as passing on a familial profession generation after generation (*Jiaye shishi xiangchuan zhiwei chou* 家業世世相傳之為疇).¹⁵ While this interpretation would not limit the meaning of “*chou ren*” 疇人到 astronomers or the career of calendar-making, Tan points out that astronomical officials' learning particularly esteemed generational inheritance and that the tasks of predicting celestial phenomena were often given to hereditary officials.¹⁶ Zu Chongzhi 祖沖之 (429–500) and Zu Gengzhi 祖暅之, for example, were a famous father–son pair of Chinese mathematicians and astronomers.¹⁷ Zu Chongzhi's calculation found that π must lie between 3.1415926 and 3.1415927. This approximation not only was the best of his time but also would not be surpassed until the end of the sixteenth century by François Viète (1540–1603).¹⁸ Zu's treatise *The Method of Threading Together* (*Zhui Shu* 綴術), now lost, was listed in the curriculum of the College of Mathematics (*Suanxue* 算學) in the Tang dynasty (618–907) as the most advanced textbook; studying it would take four years.¹⁹ Zu Gengzhi was also an accomplished mathematician. Although we do not know exactly how much Gengzhi contributed to his father's achievements mentioned earlier, it is through Gengzhi's continuous efforts that Zu Chongzhi's Daming calendrical system (*Daming li* 大明曆) was finally adopted by the Southern Liang (Nan Liang 南梁) dynasty (502–557) as the official method of calendar making in 510.²⁰ In the Qing period, Minggantu 明安圖, who is known to historians of Chinese mathematics for his calculations of infinite series, and his son Mingxin 明新 were a father–son pair of Mongolian imperial astronomers.²¹ Minggantu's most important contribution was working on the theory of the power series expansions of sine and versed sine. Minggantu's work was completed and published posthumously in the *Quick Methods for the Circle's Division and Precise Ratio* (*Geyuan milü jiefa* 割圓密率捷法), by Mingxin with assistance from his disciples Chen Jixin 陳際新 and Zhang Gong 張肱.²²

It is noteworthy that although both Bao Qinhui and Minggantu worked at the Astronomical Bureau until their deaths, there are more differences than similarities in their career experiences. The Bao family learned the method of calendar making from Jesuit missionaries, but Minggantu claimed his mathematical lineage from the Kangxi emperor and became a major compiler of the *Origins of Mathematical Harmonics and Astronomy*.²³ When the treatise was completed, he was rewarded with the position of Supervisor of the Five Offices (*Wuguanzheng* 五官正). Minggantu devoted his later years to researching the analytic formulas

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that his Jesuit colleague Pierre Jartoux (1669–1720) had refused to explain.²⁴ Although Mingxin inherited the profession of astronomer, Minggantu's intellectual achievements seemed to be built on more by his disciples than by his own descendants.

The comparison between Bao Qinhui and Minggantu suggests that famous pairs of father-son mathematicians, such as Minggantu and Mingxin, are not necessarily the most representative cases of the hereditary astronomer families. It calls for more complete and in-depth research into the astronomer families that had worked for the Astronomical Bureau generation after generation. Only after such research is completed can we understand the systematic design that discouraged Minggantu and other non-Han imperial astronomers from passing knowledge and skills to their descendants and the family interests that Bao Qinhui had in mind when he considered whether or not he should accept the new position offered to him.

This book aims to construct a social history of the Qing Astronomical Bureau from the perspective of hereditary astronomer families. When the research for this book began, the initial goal was to understand the life and career of an imperial astronomer in the Qing period. It soon found that these astronomers should not be considered merely as individual officials at the Astronomical Bureau because familial relation was a crucial factor to their career. Most astronomers learned the mathematical knowledge and skills needed for a career at the Bureau as part of their early family education. In the workplace, their colleagues were often relatives from their extended families. It was not unusual for them to attend periodical examinations administered by their own senior relatives. As such, the research gradually turned its attention to the relationship between an individual official's career progression and an astronomer family's collective interests. Re-examining historical incidents has deepened the understanding of how astronomer families dealt with external challenges and navigated through political crises. In particular, it becomes clear that the historical significances of the two Yongzheng-reign mathematical activities that Bao Qinhui was involved in need to be reassessed. Although later Qing official documents downplayed the importance of these activities, this book hopes to demonstrate that such vagueness, in fact, is a by-product of the continually changing and never-ending power struggle between the Qing monarch, European missionaries, and different hereditary astronomer families.

1.2 **The Sources**

Because of the nature of the research question, many archival materials that are already familiar to researchers of Qing history are less helpful to this study than one might expect. The focus of this study, the astronomer families associated with the Qing Astronomical Bureau, has two distinct characteristics: their members were low-ranking officials of the central government and their profession depended on mathematical knowledge. Because their ranking in the civil service hierarchy was low, the Astronomical Bureau officials did not have the right to

communicate with the supreme ruler directly.²⁵ Therefore, popular archival materials such as the vermilion rescripted palace memorials (*zhupi zouzhe* 硃批奏摺)—the secret written communications between the emperor and a small group of trusted officials—contain very few records related to the astronomer families. Although some superintendents and Directors of the Astronomical Bureau were granted the privilege of submitting palace memorials, they mostly memorialized the monarch for affairs related to the jobs they held concurrently in other institutions that had nothing to do with the Astronomical Bureau. Similarly, the *Veritable Records* (*Shilu* 實錄) and the *Imperial Diary* (*Qiju zhu* 起居注) focused on the emperors, who—with the exception of the Yongzheng emperor—seldom paid attention to the routine operations and personnel administration of the Astronomical Bureau. These sets of archival sources are useful for gaining access to information on the monarch and his high ministers, whose policy decisions affected the Astronomical Bureau, but rarely do they provide insight into the lives of the astronomer families. The biographies contained in the *Draft History of the Qing* (*Qingshi gao* 清史稿), *History of the Qing Empire* (*Qing guoshi* 清國史), and the *Biographies of Mathematicians and Astronomers* have not fared much better.²⁶ They include about 20 persons who were associated with the College of Mathematics or the Astronomical Bureau. However, how these individuals studied and worked at the two institutions is rarely mentioned.

Traces of the astronomer families have to be found in other types of sources. The *Collected Statutes of the Great Qing* (*Da Qing huidian* 大清會典), which was updated and amended several times throughout the lifespan of the dynasty, contains laws that governed the organization and administration of every government institution of the Qing dynasty. These laws proved essential for understanding how the Astronomical Bureau operated and what the career path of an astronomer at the Astronomical Bureau typically looked like. However, as a set of laws, the *Collected Statutes* include almost no record of individual officials; only in the precedents that were added to the later versions of the *Collected Statutes* can some descriptions be found to include personal information about the officials involved.²⁷ Indeed, even locating the names of those who served at the Astronomical Bureau is not always easy.

Fortunately, previous researchers, such as Qu Chunhai 屈春海 and Shi Yumin 史玉民, have laid inspiring groundwork for this study. Qu's "A Chronological Table of Officials Serving in the Qing Dynasty's Imperial Board of Astronomy and Section of the Almanac" (*Qingdai Qintianjian ji Shixianke zhiguan nianbiao* 清代欽天監暨時憲科職官年表) collected the rosters attached to the Qing official calendars.²⁸ A typical roster on the calendar consists of the titles and names of the Astronomical Bureau directorate and the higher-level Calendar Section officials. Qu's table suggests that the published calendars could be used to trace the personnel change among the higher-level Calendar Section officials, although the names of lower-level officials and trainees—Erudites and Student Astronomers—must be found elsewhere. Shi's "A Chronological Table for Officials Serving in the Division of Astronomy of the Qing Dynasty Qintianjian" (*Qing Qintianjian Tianwenke zhiguan nianbiao* 清欽天監天文科職官年表) provides similar

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information for the officials of the Section of Heavenly Signs (*Tianwen ke* 天文科).²⁹ Compared to Qu, who conventionally compiled his table from a single type of source, namely, the official calendars, Shi had to search the routine memorials (*ti ben* 題本) preserved in the First Historical Archive in Beijing to abstract the names of the Astronomical Bureau officials.³⁰ Shi's table has the advantage that it sometimes includes officials of the Erudite level. However, the number of officials that Shi located fluctuated during different periods, and he did not explicitly explain which types of routine memorials he used.³¹ Nonetheless, Qu Chunhai's and Shi Yumin's tables have been handy references for this research, and their works suggest that routine memorials and regular state documents could contain records related to the lower-level staff members of the Astronomical Bureau.

Among the 300,000 Qing state documents housed in the Archive of the Grand Secretariat at the Institute of History and Philology (IHP) of the Academia Sinica in Taiwan, approximately 1,400 are related to the Astronomical Bureau and the College of Mathematics.³² The majority of these documents are reports on routine duties and personnel affairs administered according to the regulations prescribed by the *Collected Statutes*. Their contents include the nominations of officials when vacancies arose, requests for imperial approvals to hold periodical and entrance examinations for the Astronomical Bureau and the College of Mathematics, reports on examination outcomes, the submission of sample calendars and predictions of solar and lunar eclipses to the emperor, and so on. When the Bureau submitted a progress or final report on the assigned task, it often attached the rosters of the officials responsible for that activity. If the report was related to personnel administration, then brief information about the officials in question—such as their ages, hometowns, academic degrees, and job performance reviews—often had to be included. Such reports provide personal information about Astronomical Bureau staff, from the highest-level Directors down to the lowest-level trainees. Moreover, information found in the process can be used to correct some of the errors in Qu's table that resulted from incorrect typesetting, and it can also help to clarify some administrative regulations that the *Collected Statutes* did not explain.

The *Complete Collection of the Qing Officials' Résumés* (*Qingdai guanyuan lili dang'an quanbian* 清代官員履歷檔案全編) is another set of documents that have been indispensable to this research.³³ This published archive consists of records related to the imperial audiences, including lists of the officials who attended the imperial audiences, individual officials' service records kept by the government, and the résumés prepared by individual officials. Among these records, the résumés were the most useful to this research. Before the Qianlong 乾隆 reign (1736–1795) commenced, the format of the résumés was less restricted, and officials were permitted to introduce themselves more freely or to make suggestions related to their jobs. That is why some Astronomical Bureau officials like Bao Qinhuai could describe their families' connection with the Bureau and state their preferences pertaining to their career transitions on their résumés. However, by the mid-Qianlong reign, lengthy résumés were no longer permitted, and the contents of these résumés became much less informative. Nevertheless, audience

résumés are one of the rare types of documents to include records about the ages, places of origin, and degrees of lower-ranking officials.

Other sets of archives are useful for some special topics in this research. The IHP, together with the Qing Dynasty Palace Memorials and Grand Council Archived Memorials, housed in the National Palace Museum (NPM) in Taipei, contains relatively few records related to the Astronomical Bureau in the Yongzheng period. As such, the *Sources Related to the Personnel Administration in the Qing Dynasty* (*Qingdai lizhi shiliao* 清代吏治史料) becomes a great complement to them.³⁴ Note that the title of the latter set of archives is misleading, for it includes only records from the Yongzheng reign, not from the entire dynasty. The *Sources Related to China in the Veritable Records of the Chosŏn Dynasty* (*Chaoxian Lichao shilu zhong de Zhongguo shiliao* 朝鮮李朝實錄中的中國史料) complements Qing official records in a different way.³⁵ The *Veritable Records* of the Korean Chosŏn Kingdom included numerous descriptions related to the Qing court that Qing state historians would rather omit or alter than allow to embarrass their dynasty. This research makes use of evidence in the Chosŏn *Veritable Records* that exposes the deterioration of the Qing official calendar in the Yongzheng period.

Finally, it is noteworthy that the digitization of archival records played a critical role in this research. Due to the astronomers' low status within the giant bureaucratic system, finding records related to them was sometimes like searching for a needle in a haystack. Even when armed with the knowledge of which types of sources were more likely to contain useful material, locating useful details, which were often buried in tens or even hundreds of thousands of records, was challenging. To build a pool of members of the Qing Astronomical Bureau that was large enough to show the familial relations between them, a working environment that the researcher could effectively examine, abstract, and process the contents of archival records was important. The IHP and NPM archives can be accessed online, and the majority of the other sources used are published photocopies of archives. The author scanned or photographed all potentially useful records found in these archives to turn them into digitalized image files. After this extra step of digitization, collected records could be reviewed on computer screens as often as necessary. The rest of the process of data abstraction, filing, and analysis could also be accomplished much faster with computers than with traditional pen-and-paper methods. The time and effort spent on digitization undoubtedly repay itself for research involving large amounts of archival records.

1.3 The Plan of This Book

The process of scrutinizing the archival papers related to the Astronomical Bureau from the late Ming 明 dynasty (1368–1644) to the end of the Qing dynasty has found over five hundred Bureau members who were from about 30 astronomer families. To convey the stories of the astronomer families that served the Qing Astronomical Bureau effectively, the He 何 family was used as a representative case. The He family began serving the Astronomical Bureau in Ming times.

Before the last He departed the Bureau in the Daoguang 道光 reign (1821–1850), the family had worked at the Astronomical Bureau for two hundred years, and more than 50 members of the He family had left their traces in Qing state records. Among them was He Guozong 何國宗, one of the most famous astronomers of the early Qing period. The richness of the records related to the He family and the roles it played in important junctures of the history of the Astronomical Bureau made it a perfect case study in this research.

To facilitate an understanding of the contents of this book, the next chapter will give an overview of the Qing Astronomical Bureau by describing its organization and functions on an institutional level, including the job requirements for each employee in the Bureau. This chapter aims to remove the difficulties that readers might have when reading this book or examining Qing state papers related to the Astronomical Bureau, rather than burdening them with too much detail.

Chapter 3 begins by describing the historical context of the Ming period that gradually transformed the profession of serving at the Astronomical Bureau from a mandatory career into an inheritable family interest. It then investigates the political concerns of China's new Manchu rulers that led Regent Prince Dorgon 多爾袞 (1612–1650) to promptly adopt the new calendar that the Jesuit missionary Johann Adam Schall von Bell (1592–1666) calculated according to Tyconic mathematical astronomy but to refuse Schall's request to dismiss the Astronomical Bureau officials who resisted giving up the Great Concordance (*Datong* 大統) system of calendar making.³⁶ This chapter ends by showing that, although some old astronomer families were suppressed and some withdrew from the Astronomical Bureau, family networks remained an important channel through which Schall could recruit new members for the Bureau and find suitable individuals to learn his New Western Method (*Xiyang xinfa* 西洋新法).

Chapter 4 examines how the Kangxi Calendar Dispute (*Kangxi lizheng* 康熙曆爭) (1664–1669) impacted the organization of the Astronomical Bureau and the demography of the hereditary astronomer families. After temporarily returning to the Great Concordance system of calendar making between 1665 and 1668, which was then referred to as the Old Method (*Gufa* 古法), the Qing court reinstalled the New Western Method and Jesuit astronomers to the Astronomical Bureau. However, as this chapter reveals, the Jesuits never regained the same controlling power over the Astronomical Bureau that Schall once had. The supporters of the Old Method remained in the Astronomical Bureau. As such, He Luoshu 何維書 and his son He Junxi 何君錫, two leading supporters of the Old Method, were able to keep their high offices gained during the dispute, thus laying the foundation for their descendants to grow into the most influential hereditary family in the Qing Astronomical Bureau.

Chapter 5 focuses on the interactions between the Kangxi and Yongzheng emperors and the He family. In particular, it shows how these two emperors utilized the mathematical talents of He Junxi's sons—the famous court astronomers He Guozong, He Guozhu 何國柱, and He Guodong 何國棟—and manipulated their careers. The He brothers, whose talents and loyalty could be guaranteed by

their father's service records, became the Kangxi emperor's favorite candidates for testing his vision of mathematics. However, the Yongzheng emperor, who was famous for his tremendous attention to administrative affairs, grew concerned about the expansion of the He family's powers. Within years of the Yongzheng emperor's accession, the fortunes of the He brothers declined precipitously.

Chapter 6 completes the discussion of the Yongzheng emperor and the He family presented in the previous chapter with a detailed study of the circumstances surrounding the solar eclipse of 1730. On the one hand, ministers and officials from all regions eulogized the emperor and denied that the Astronomical Bureau's prediction of the 1730 eclipse was a failure. On the other, the He family, Jesuit missionaries, the Astronomical Bureau officials, and even the Yongzheng emperor knew beforehand that the prediction was likely to fail. In the end, all Bureau officials, missionaries included, were forced into silence. Only the Yongzheng emperor, who staged a political performance, benefited from this incident.

Chapter 7 investigates the roles of astronomers and their family interests in the imperial state's management of reproducing astronomical knowledge. The first case studied here is the new compilation project of astronomical treatises that took place in the early Qianlong reign. Rather than representing a voluntary initiative from the Jesuits, this chapter argues that the project arose from hereditary astronomer families' need to obtain the mathematical knowledge that their Jesuit colleagues in the Astronomical Bureau had shrouded in secrecy since 1730. The rest of the chapter is devoted to a comparison between the mathematics program of the late Yongzheng reign and the College of Mathematics founded in the early Qianlong reign. The attempt to add mathematics into the curriculum of general education failed, and the Yongzheng mathematics program was terminated after just four years. It was replaced with the College of Mathematics, which aimed to recruit newcomers for the Astronomical Bureau and did not conflict with the hereditary astronomer families' interests.

Chapter 8 explains some of the patterns and strategies that hereditary astronomer families exhibited during their long careers at the Astronomical Bureau. It describes how members of the same families often clustered in one section of the Astronomical Bureau until they overcrowded that section and new members had to be reallocated to a different section. It then investigates the personal concerns and family interests that motivated some officials to choose to remain in the Astronomical Bureau as opposed to accepting higher positions in different government institutions. This chapter ends by describing some symptomatic features that declining astronomer families often exhibited.

Chapter 9 shows the importance of the administrators and the administrative system in the history of the Astronomical Bureau. European missionaries' continual loss of status in the Qing court resulted in their complete withdrawal from the Astronomical Bureau in 1826. By then, the Astronomical Bureau and the College of Mathematics had become stagnant and the periodical examination system had become formulaic. However, the stagnation gradually changed after May 1824, when the Daoguang emperor named Jingzheng 敬徵 (1785–1850), who was

famous for his administrative ability rather than his knowledge of astronomy or mathematics, as superintendent of these two institutions.³⁷ Aggressively utilizing the existing periodical examination system, Jingzheng ousted the old and incompetent He family from the Astronomical Bureau. New and proficient astronomer families arose. By the time Jingzheng retired from public service in 1845, the Bureau had repaired its astronomical instruments and had updated the constants used in the calendar-making process.

This book focuses more on Han Chinese than non-Han astronomer families for two reasons. First, because the majority of the members and their families found were Han Chinese, their records can be comprised into a relatively complete storyline. Second, early in the research process, it became apparent that administrative laws hampered the formation of non-Han astronomer families. The Qing dynasty maintained the social and legal divisions between bannermen (*qi ren* 旗人), the members of the social and military organization Eight Banners (*Ba qi* 八旗), and the conquered Han commoners (*Han ren* 漢人). The members of the Eight Banners were further divided into three ethnic categories—Manchu, Mongol, and military Han (*Han jun* 漢軍)—and endowed with different levels of legal privilege.³⁸ Section 4.2 of Chapter 4 is devoted to an assessment of the impacts that the ethnic categories had on Astronomical Bureau officials' career paths.

Based on the archival records, it is evident that throughout the Qing period, the Astronomical Bureau astronomers closely followed the traditional yet non-mandatory custom of using the same pattern of naming the newborns of the same generation. For instance, He Guozong and his brothers and cousins all had the character *guo* 國 in their names. Although there are not always enough surviving records to clarify the exact relations among the Bureau astronomers, their urge to express the bond among themselves and their belonging to certain genealogical groups are undeniable. In fact, both the ambiguity and belonging reflected the ways that their contemporaries perceived these astronomers. They might come to know or at least suspect that a Bureau astronomer was from a certain family but could not determine his exact relation to that family unless they became his acquaintance. Therefore, this book uses the term *family* rather freely to denote a group of Bureau astronomers with the same surname as long as some name patterns can be found among them. As such, this dissertation does not supplement or serve as a substitute for the genealogy of astronomer families. Rather, it examines the historical representation of the hereditary astronomer families.

While some hereditary astronomer families served the Qing dynasty until its last days, the narration of this book stops around the time that the He family left the Astronomical Bureau. Rather than presenting a complete survey of the history of the Astronomical Bureau, it highlights the historical events that best reflect the characteristics of the hereditary astronomer families of the Qing Astronomical Bureau and their interactions with the imperial state. This book ends with a conclusion that discusses the contributions that its research findings can make to the methodology and historiography of the history of astronomy in the Qing dynasty.