A Comparative Study of the Economic System of Dunhuang Monasteries and Egyptian Temples

Yimu Shi

Department of Broadcasting, Tianjin Normal University, Tianjin, China
yimushi0907@126.com

Abstract. Comparative research is an important method of historical research. The premise of the research is that the comparator needs to have the same or similar characteristics for the researcher to analyze and interpret. The subjects of the study is comparison of economic issues between Dunhuang monastery in ancient China and Thebes temple in ancient Egypt. Both are typical representatives of the development of religion in regional countries. The objective of the study is to reveal the similarities and differences between the two different types of monastic models in terms of economic operation, to summarize the important role of religion in the operation of the state and the important laws of civilization development. According to the research in the paper, the basic relationship between national politics and religion: if the two are in line with each other, they support each other and prosper, but if the two diverge from each other, there will be a corresponding decline. However, with the development of civilization, the dependence of state politics on religion has gradually weakened. State rule has gradually shown a rationalization trend. In line with the concept of historical progress. Therefore, in the contemporary era of the 21st century, science and reason have the upper hand, rational view of religious issues, scientific governance of the country, has become an important issue that cannot be ignored by heads of state.

Keywords: Comparative study · Egyptian temples · Dunhuang monasteries · Economic system

1 Introduction

1.1 Research Background

The historical authenticity of ancient Egypt is undoubted, but as a civilization with a large historical span, this study only starts from the New Kingdom period of ancient Egypt (1567-1085 BC). In order to ensure the specificity and pertinence of the comparative research, the foothold will focus on the Amun temple complex in the Thebes during the New Kingdom. The reason for choosing the Thebes is that since the 12th Dynasty during the Middle Kingdom, the power of Thebes has continued to develop, and the power of Amun, as the local god of Thebes, has continued to grow. Under the unprecedented prosperity of Egypt during the New Kingdom, the pharaohs of various dynasties have paid tribute to the god Amun with all their hearts, donating countless treasures, land,
slaves to the temple further increasing the power of the god Amun. By the time of the eighteenth dynasty pharaoh Amenhotep IV, there was a situation of opposing the Amun, establishing a new god Atun to curb the development of the temple of Amun. Therefore, the development of the temple in the Thebes during the New Kingdom period is representative. At the same time, considering that Dunhuang is a regional city under the rule in ancient China, the ancient Egyptian temple here refers to the Amun temple complex located in the Thebes area would be more specific and effectively circumvent some errors.

After BC, Buddhism was introduced to China. At the end of the Eastern Han Dynasty, Buddhism developed due to chaos. During the Southern and Northern Dynasties, Buddhism was strongly promoted by the emperors, monasteries occupied extensive land and owned large areas of temples. During the Sui and Tang dynasties, the monastic economy developed more comprehensively. This study places Dunhuang in the Tang Dynasty, which experienced the rule of the Tang Dynasty (618-781 AD), Tubo (786-848), and the Guiyi Army (848-905). During the reign of Tubo in Dunhuang, Buddhism flourished more than in early period. However, in order to curb the development of Buddhist monasteries, the rulers of the Tubo took economical and political measures to control it.

From the above background analysis, it can be seen that the economic development background of the two temples is similar which has received strong support from the rulers, and while the power is prosperous, the rulers see the hidden crisis behind and contain it. In the second part of the analysis, we can also see their similar economic development models and situations, as a way to demonstrate the comparability between the two.

1.2 Current Situation

The main references in the Thebes section of the study include: Firstly, The History of Ancient Egypt by Wenpeng Liu, which is currently the authoritative textbook for the study of Egyptian history in China, with several sections analyzing the way in which the New Kingdom was ruled and the relationship between kingship and religion. Secondly, other works on Egyptology include A Companion to Ancient Egypt - Volumes 1&2 by Lloyd Alan B, published by Wiley-Blackwell in 2010 are all comprehensive introductions to the development of ancient Egyptian civilization, from political, economic, cultural and other perspectives. Thirdly, foreign scholar J. H. Breasted’s Records of Ancient Egypt and domestic scholar Dantong Guo’s Translations of Ancient Egyptian Hieroglyphic Texts are important inscriptional materials for the study, the analysis of the original inscriptions enhances the credibility of the study. Fourthly, the main reference papers include Dantong Guo’s 1994 article An Experimental Discussion of the Temple Economy in the New Kingdom Period in Egypt published in the second issue of the Journal of Northeast Normal University (Philosophy and Social Sciences Edition), in which some of the points raised are also quoted in this paper. Such as Dantong Guo mentions that “the slave economy in ancient Egypt was moderate and underdeveloped”. On the basis of this research, the author have found that slavery in ancient Egypt, in addition to the above characteristics, is also characterized by ‘flexibility’.

The main references in the Dunhuang section of the study include Xuehua Lei’s The Monastic Economy of Dunhuang in the Tang Dynasty, published in 1989 in the
first issue of the Journal of the Central South Academy of Nationalities (Philosophy and Social Sciences), which provides a comprehensive overview of the development of the monastic economy of Dunhuang in the Tang Dynasty, which is an important reference for this paper. The second is Chengman Ming’s Review of Studies on Dunhuang’s Monastic Economy in Foreign Countries and Hong Kong and Taiwan, published in the second issue of Studies in Chinese Social and Economic History in 2013, which provides an overview of research on Dunhuang’s economy in recent years. The author have read some of the documents listed by Chengman Ming, including Selected Essays on Dunhuang by French Scholars, published by the China Book Bureau in 1993, to gain an understanding of the scholars’ views on the economic development of Dunhuang monasteries.

The comparative study of the monastic economy in the Thebes of ancient Egypt and the Dunhuang of ancient China is based on the above historical materials, including the collection and verification of historical materials, the identification and restoration of facts. Therefore, the following points of comparison are established, with corresponding comparisons and analyses based on historical traceability, source and quantity of land, labour and labor and land management, economic functions and property analysis.

The innovation of the study lies in the fact that there is no comparative study of the monastic economy in ancient Egypt and ancient China, and boldly compares the economic development of temples under two different social systems, in order to gain insight into the relationship between religion and political society, as well as to prove the historical concept of progress.

1.3 Research Methods

Historical comparative research is a method that compares historical phenomena according to certain rules under the guidance of clear theory. The famous scholar Mark Bloch is the author of “A Comparative Study of European Social History”. He once pointed out that “comparison is the selection of two or more phenomena in one or more different social contexts that can be seen at a glance as some similarity between them, and then depicting the development curve of these phenomena, revealing similarities and differences, explaining these similarities and differences to the extent possible, then strictly classifying and arguing, it is possible to obtain conclusions that are much less hypothetical and much more precise than making assumptions about facts” [1]. It is true that the comparative study method of history is of great significance to the development of modern historiography, but this research needs to follow certain principles.

The “principle of comparability” means that when comparing two or more historical phenomena in comparative research, there must be some common factors between the comparative items, without common factors, such historical comparison cannot be established. Under the principle of comparability, there are the following aspects. First of all, the things or phenomena studied in comparison must actually exist. If the historical phenomena that have not yet been determined, even things that have happened in history, they cannot be used as objects of comparative study. Second, the objects of comparative research needs to be two or more things or phenomena. Third, the things or phenomena must be of the same kind, they must have common factors and a common basis. Two unrelated historical things cannot be compared [2]. According to the methodology, the
economic model of temple groups in the Thebes of ancient Egypt and the monasteries in Dunhuang of ancient China are comparable.

1.4 Research Purpose and Problems

This study adopts the method of micro-comparison, locates the perspective of temple economic development, analyzing and comparing the side, partial, and specific aspects of temple economic situation in historical development. At the same time, it also intend to reveal the laws and patterns of economic development of ancient temples, hope that the results of research can be used for temple research in other regions.

2 Comparative Analysis

2.1 Historical Traceability

After BC, Buddhism was introduced to China, and Buddhist temples appeared everywhere. At first, monasteries were only residences for monks and places for translating Buddhist scriptures. They did not have their own economy, the monks’ lives were supported by donations from the devotees such as princes and ministers. At the end of the Eastern Han Dynasty, the world was in chaos, the people’s lives were difficult. Buddhism took advantage of the situation. During the Eastern Jin Dynasty, monasteries already had some land and engaged in some simple economic activities. During the Southern and Northern Dynasties, Buddhism received strong support from the rulers, Buddhist temples began to occupy extensive land, forming an independent monastic economy. During the Sui and Tang dynasties, the monastic economy developed in an all-round way.

The Amun temple economy is a slavery economy that gradually developed after the twelfth dynasty of ancient Egypt. The prosperity of temple was closely related to the eighteenth dynasty. According to an inscription outside the Karnak temple, Queen Hatshepsut, as wife of Thutmose II, assisted the young new pharaoh, Thutmose III, as regent after her husband’s death. In order to seize power, Hatshepsut invented the story of the divine birth, claiming that she was the child of the god Amun. In order to improve her political status, Hatshepsut continued to invest in the expansion of the Temple. After the death of Hatshepsut, Thutmose III officially ascended the throne and carried out a large-scale erasure of the imprint of his aunt Hatshepsut. He was an outstanding pharaoh in ancient Egyptian history who repeatedly attacked Syria-Palestine and opened up territory for Egypt. Thutmose III donated buildings, fields, herds, slaves, gold and silver treasures to the temple many times. For example, between the 15th and 22nd years of the reign of Thutmose III, when a temple in Karnak was completed, he donated to the temple “100 bundles of vegetables, 3 altars of wine, poultry, fruits, white bread, 1nd herbs and 1hd dates… His Majesty gave additional land, 2800 Statet is the land donated to God…” [3]. The above list is only part of Thutmose III’s donation to the Temple of Amun, which actually acquired more property and enjoyed a high economic status.

The comparison shows that the Amun Temple received rich donations from the pharaohs, including agricultural products, livestock, land, slaves, gold and silver jewelry, which are closely related to the strong international status of the ancient Egypt. Egypt
during the New Kingdom of frequent foreign hegemony, war booty was extremely rich, and the pharaohs reserved most of the spoils to the royal family or to the temple. The economy of Amun temple was closely linked to the development of the country, the temple economy was already an important social and economic foundation during the New Kingdom, occupying an absolute position, which was actually an underdeveloped slave state-owned economy [4]. This is fundamentally different from the Dunhuang temple. It is undeniable that Buddhism flourished in the Tang Dynasty, and the Dunhuang monasteries received support and donations from the rulers, but the monastic economy of Dunhuang has never played an economic role beyond the Dunhuang and radiated the whole country, if the essence of the temple of Amun in Thebes is an underdeveloped slave state-owned economy, then the Dunhuang monastic economy can be classified as a feudal private economy.

2.2 Source and Quantity of Land

The land of Dunhuang monasteries in the Tang Dynasty came mainly from land grants by emperors. The Tang Dynasty implemented the system of equal fields, monasteries, monks and nuns were among the state’s grants. Book 3 of the *<The Six Classics of the Great Tang Dynasty>* records that “every priest gave 30 acres of land, a female priest 20 acres, so did monks and nuns” [5]. This is for the private fields of monks and nuns in monasteries. In addition to the private fields granted by the state, temples were granted permanent fields. According to the edict issued by the ruler, the 100-person monastery occupies 4,000 acres of land, including 3,000 acres of private land for monks and nuns and 1,000 acres of permanent land for monasteries. Under the condition that the people were extremely inadequate, the number of land occupied by the monasteries was very large. According to the official records of the number of fields granted at that time, “Men (21 to 59 years old) gave 20 acres of Yongye land, 80 acres of Koufen land…Old men (over 60 years old), those with disabilities, give their 40 acres of Koufen land, the widows, give their 30 acres of Koufen land…” [6]. In contrast, it can be seen that the monastery occupy an extremely large number of fields, even more than the number prescribed by the state.

Ancient Egyptian temples occupied large amounts of land through donations from the pharaohs. According to the Egyptologist Liu Wenpeng, “the temple occupies two percent of the population, but controls nearly 750,000 acres of arable land” [7]. According to the scholar Christopher. Eype’s quantitative data on ancient Egypt shows that under the reign of Rameses III, national temple endowments of 1071780 arouras (1sq.km = 400 aroura), the figure accounts for 12% of the country’s floodplain. Papyrus Wilbour, of the reign of Rameses V, shows Karnak administering 17324 arouras in Middle Egypt [8]. From the above enumeration, it can be seen that most of the land occupied by temples in Thebes region also came from donations from rulers, which is similar to the ancient Dunhuang temples. And compared with the ordinary people, the land occupied by the two temples far exceeds the total amount of land occupied by the people. They are in an absolute dominant position in the local land occupation.
2.3 Labor and Land Management

Land management in Dunhuang monasteries includes leasing, self-farming, and tenant farming. This article mainly covers two types of renting. The first is rented out to people outside the monastery for farming. According to the document on the collection of a certain monastery in Dunhuang S1600 <Spiritual Temple Jiazi Xin Yourenshu Zhuqu Kitchen Field Rent and Other Accounts in Each Year> contains 600 kg of wheat was surrendered from various fields in Xin You, 240 kg from Judge Zhang’s field in the south of the city, 220 kg from Liu Sheng’s field, 120 kg from Judge Si, 200 kg from Shijia’s field and 0.5 kg of hemp [9]. This document recorded the situation of Judge Zhang, Liu Sheng, Judge Si, and Shijia who rented the wheat fields of the Spiritual Monastery to pay rent. Judging from the names of the lessee, Zhang and Si among whom the judges belonged, Liu Sheng and Shijia were also compared with the former, which shows that the relationship between the lessee and the monastery are free. The lessee has an independent personality. They may rent the monastic land in some form of contract and pay a certain tax to the monastery after the harvest.

Another way is for the temple households inside the temple to cultivate the fields. There are many materials in Dunhuang documents about monastic households borrowing grains to cultivate land, such as the BeituXianzi No. 59 <Jinguangming Temple Households Borrowed Wheat to Cultivate Fields> records that temple households borrowed grains from the monastery because they had no grain to cultivate in the spring, and when the autumn harvest was over, they “filled in according to the number” [5]. Different scholars in the academic community have different views on the definition of the nature of the temple. The first is that the temple is a type of tenant farmer attached to the monastery estate, similar to the banker and the banker, represented by the French scholar Denis Twitchett [10]. The second view that the temple household was neither a slave nor a free employee, and that his status was equivalent to that of a serf, is supported by most scholars. From the above materials, it can be seen that temple households can cultivate the land of the temple by borrowing money, and are not slaves affiliated with the temple in the traditional sense, and have a certain freedom. If they were slaves in the monastery, they did not need to rent the land by borrowing grain for food, but directly cultivated it, and handed over all the harvest to the monastery. However, Household does not have full freedom, and there is still a certain difference from freemen. This also confirms the strong attachment of temple households to the temple. However, as to whether the monastic households of the Dunhuang monastery belong to the status of serfs, the author will not make a judgment here. Because the definition of the nature of serfs is complicated and the reading of Dunhuang documents is insufficient, it can only be concluded that the monastic households are not slaves, but they are strongly dependent on the monasteries.

Ancient Egyptian temples had their own labor force—slaves, who were usually prisoners of war. During the New Kingdom, as foreign wars continued to occur, the number of slaves increased. Thutmose III gave Amun 1598 Syrian slaves in one go. It is worth noting that in the form of enslavement, in addition to the traditional large-scale enslavement of slaves for collective farming, some temples will also be allocated to slaves, adopting the method of leasing operation, and the tenant needs to pay 30% of the harvest to the temple as a tax every year. It is understandable that due to the large
amount of land occupied by the temple and the relatively insufficient number of prisoners of war, the above rental method was used for farming, indicating that the Egyptian temple adopted a relatively flexible and moderate slavery.

**Different Labor Forces**
The labor force of Dunhuang monasteries is mainly monastic households, and monastic households do not belong to slaves, but a group similar to serfs and have a strong dependence on monasteries. The main labor force in ancient Egyptian temples was slaves. Due to the differences in historical age and region, the temple labor force in ancient Egypt benefited from the frequent foreign wars, and the prisoners of war who were the spoils of war greatly supplemented the temple labor force. The labor force of the Dunhuang monasteries in ancient China, the monastic households, was mainly dependent on the monastic population, but they had more freedom than slaves. This essence is reflected in the different nature of society, ancient Egypt was a slave state, although there were slaves renting land in the temple, this was still classified as a flexible and gentle slavery. In the Middle Ages, Dunhuang, China, entered the feudal society, and the characteristics of the labor force in the monasteries were mainly reflected in dependency, and unlike slaves, in a sense, it could be called the serfs of the medieval feudal society.

**Similar Ways of Doing Business**
Both ancient Egyptian temples and ancient Chinese Dunhuang monasteries had the possibility of renting land to people outside the temple, but this can only be called similar, not completely equivalent. It is worth noting that the land of ancient Egyptian temples was state-owned and not privately owned, so the lessee leased the seeds in a sense also state land. The monasteries in the Dunhuang region of ancient China had the private nature of land, so the rent paid by the lessee actually belonged to the temple itself.

### 2.4 Economic Functions

During the Sui and Tang dynasties, Dunhuang monasteries developed into a manor economy based on a large amount of land and labor. P3774 `<The Title Deed of The Monks Yueguang Zhang and Rixing Zhang>` mentions “Pingduqu Manor”, this manor has Koufen field, Yongye field, threshing ground, car yard, well, forest orchard, various production and living materials, which is a manor of a certain scale [5]. The estates of the Dunhuang monasteries have an independent economy, engaged in various production activities. The temple produces grain, the gardeners provide fruits and vegetables, the herders provide livestock and products, the papermakers provide paper, the winemakers provide wine, the masons and carpenters engage in construction and so on. Therefore, from the above materials, we have to admit that the economy of Dunhuang monasteries is a self-sufficient manor economy, which can meet the needs of the monasteries’ economic and religious activities.

The ancient Egyptian temple of Amun has many economic components, in addition to the agriculture mentioned above, including animal husbandry, mining, handicrafts, commerce, and so on. In terms of plantation and animal husbandry, the pharaoh gifted
the temple with flax fields, vegetable plantations, vineyards, livestock, etc. According to Harris’ Great Papyrus, Pharaoh donated “countless vineyards” to the temple of Amun [11]. During the New Kingdom, the Amun Temple in the Karnak region had the power to mine minerals. In terms of handicrafts, the development of Egyptian temples was similar to the Dunhuang estate. The frescoes in the burial chamber of Vizer Leckmir of the 18th dynasty of Thebes depict scenes of metal handicraft production. In addition, you can see the work of some craftsmen such as carpenters, leather craftsmen, bricklayers, etc. The temple was also engaged in commercial trading activities. Merchants are temple workers who are mainly responsible for bringing surplus products from the temple to the market for exchange some of the products needed by the temple. In general, the temples of the New Kingdom, with their large and complete variety of handicraft workshops, a large number of livestock and mining powers, and also engaged in commercial activities, played an important role in the country’s economic activities.

From the above comparative analysis, it can be seen that the Dunhuang monastery manor and the Theban temple have great similarities in economic components, which are reflected in the perfection and complexity of economic components, which basically constitute a self-sufficient economic system. However, the difference between the two is reflected in the existence of economic exchanges between ancient Egyptian temples and the outside world, it is not yet certain whether the economy of monasteries in the Dunhuang area has economic exchanges with the outside world while satisfying internal self-sufficiency. At the same time, the temple of Amun in Thebes played an important regulating role in the country’s economy. Participation in the state redistribution system in the form of issuing salaries and providing for the people’s living needs. It cannot be separated from its own state-owned nature. However, the economic system formed by the Dunhuang monasteries was largely private, so it inevitably became the object of attention and containment by the rulers in the following time.

2.5 Property Analysis

The Dunhuang monastery is a religious unit composed of all monks, and the monastic economy is the economic security and material foundation needed to maintain the daily life of the monks. The things produced by the monastic economy are distributed by the monks in the monastery. Although Buddhism emphasizes the equality of all beings, class relations inevitably arise in the monastic system. The upper monks must have the power of the monastery economy, but they do not actually have the right to occupy, only the right to use and distribute, and the upper class monks must strictly follow the procedures when using the monastery property, and accept the supervision of the monks. Therefore, the Dunhuang monastic economy reflects the nature of collective ownership, also known as the monastic possession system [5].

Unlike the Dunhuang temple estate, the ancient Egyptian temple property had an obvious state-owned nature. The priests of the temple were also important officials of the state. The land and wealth of the temple belonged to the god Amun, but to some extent belonged to the state. Combined with the analysis of land management mode and economic components inside the temple, there are slaves with prisoners of war as the main body, but the restraint on slaves is relatively relaxed, and the situation of renting land to slaves appears, reflecting the existence of a relatively flexible and gentle
slavery system within the temple. The internal economic components of the temple are numerous, and not all of them are completed by slaves. It is clear that there are special staff engaged in it, reflecting the professionalism of the temple economy. In summary, the economy of the Amun temple can be classified as a relatively mild slave state-owned economic model.

From the perspective of labor and management methods, the two civilizations have the similar land management methods, because both hold huge land that cannot be cultivated by relying on the internal labor of the temple alone, so they need to rely on the way of leasing out the land. But there are also differences in the nature of labour and land. In the Tang Dynasty, the civilization of Dunhuang monasteries developed relatively high, and they got rid of the slave economy, but the so-called “temple households” appeared as a group that did not belong to slaves but were similar to serfs. However, ancient Egypt was still a slave society, and the main labor force in the temples was slaves, but the control of slaves was relatively mild, and there was a situation of renting land to slaves, which was a flexible and moderate slave economy. Secondly, it is necessary to note the state-owned nature of the ancient Egyptian temple land, while the private nature of the temple land in the Dunhuang area is obvious. From the perspective of economic functions, the Dunhuang monastery estate and the Theban temple have great similarities in terms of economic components, which are reflected in the perfection and complexity of economic components, and basically constitute a self-sufficient economic system. However, there were economic exchanges between ancient Egyptian temples and the outside world, but it is uncertain whether the economy of monasteries and estates in the Dunhuang area had economic exchanges with the outside world while satisfying internal self-sufficiency. The ancient Egyptian state temple even participated in the operation of the state apparatus and participated in the national economy as an important part of the national redistribution system. There is no such situation in the Dunhuang monastery estate.

3 Summary

The law of differentiation in the development of civilizations is consistent with the notion of progressive history. Ancient Egypt was part of the world’s ancient civilization, still in a slave society, and the main workforce in the temples of Amon at Thebes was still slaves. But due to the high degree of development of civilization, an economic specialization division of labor appeared in the temple, representing a progressive law of civilization development. Ancient China had already entered the Middle Ages during this period (7th-10th centuries AD) and was gradually entering a feudal society, with a major labour force similar to that of serfs and a deepening economic specialization in the Dunhuang monasteries. The comparison between the two reflects the differences in the development of civilization and the progressive nature of historical development.

Based on the above analysis, we can draw the basic relationship between politics and religion. If religion meets the political needs, it is strongly supported by the ruler, and the country becomes stable because of its religious beliefs. The relationship between the two reflects a mutual support for mutual prosperity. When religion diverges from the needs of the ruler, on the other hand, religion declines first, and without the support
of religious beliefs, state rule declines accordingly. The ruler’s approach to religion is particularly important. For example, in the late 18th dynasty of ancient Egypt, the temple of Amun grew in strength and became a serious threat to the rule of the pharaohs, so that Amunhotep IV opposed the belief in Amun and honoured a new god instead, but this dealt a serious blow to the country’s political stability. During the Tubo rule of Dunhuang, there were also instances where the rulers responded economically and politically to curb the growth of monastic power in Dunhuang. However, compared with the establishment of new gods in ancient Egypt, the Tubo rulers took more modest measures to alleviate the potential crisis caused by religious problems to the rule of the state.

The degree of integration of state politics with religion is noteworthy, as ancient Egypt had a strong belief in the main god, Amun, and the pharaohs often claimed to be sons of the god, hence the importance attached to the temples of Amun in Thebes, which rose to prominence and became involved in the running of the state economy. In contrast to the fervent belief and worship of the god Amun in ancient Egypt, Dunhuang Buddhism, a monotheistic faith that emerged in later times, exhibits a ‘rational’ approach. In ancient civilizations (the worship of the god Amun in ancient Egypt, for example), politics and religion were highly integrated, and politics was highly dependent on religion, with rulers relying on religious support to strengthen their political position. As civilization developed into the Middle Ages (in the case of Dunhuang Buddhism in ancient China), politics became less integrated with religion and religion played a lesser role in politics than in ancient Egypt during the ancient period, when state rule became relatively rationalized. The ruler’s support for Buddhist monasteries was relatively weak and did not involve them in the running of the state economy, but the ruler’s support still dictated the development of the Dunhuang monastic estates, which formed a large economic force at the local level, and their economic role could not be ignored. Thus, in the contemporary 21st century, when science and reason prevail, a rational view of religious beliefs and the scientific governance of the state have become important issues that cannot be ignored by heads of state.

References


Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.