Dao Companions to Chinese Philosophy

Series Editor
Yong HUANG
Department of Philosophy
The Chinese University of Hong Kong
Shatin, New Territories, Hong Kong
E-mail: yonghuang@cuhk.edu.hk

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Xiaogan Liu
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Editor
Xiaogan Liu
Department of Philosophy
Chinese University of Hong Kong
Shatin, New Territories
Hong Kong SAR

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Chapter 24
Daoism and Science

Lisa Raphals

At first glance, there may appear to be little connection between early Daoist philosophy and science. This essay tackles the problem of teasing out their relationship, on three fronts. The first concerns what we mean by Daoism and what we mean by science. The second addresses Daoist approaches to health and well-being in the broadest possible sense, including self-cultivation practices, medicine, and longevity techniques. The third turns to the association of early Daoism with various technical disciplines such as astronomy, mathematics, and cosmology.

Part of the problem is a tendency to associate Daoism with the *Daodejing* (also known as the *Laozi*), and to read that text anachronistically as a work of quasi-Buddhist mysticism. The *Daodejing* is a profound philosophical and mystical work of antiquity that uniquely combines poetry, aphorism, practical advice, and features a diversity of subject matter. Indeed its subject matter is so diverse that it is not easy to characterize, still, it consistently seems to criticize "knowledge," craft, and cleverness. The "sage" who rules the people:

> empties their minds, fills their bellies, weakens their wills, strengthens their bones. He always keeps the people without knowledge and without desires, and ensures that the wise dare not act (chap. 3).
>
> When the great Dao diminished, cleverness emerged, and there was great hypocrisy (chap. 18).
>
> Eliminate sages; get rid of the wise and the people will benefit a hundredfold .... Eliminate ingenuity; get rid of profit and there will be no more thieves and bandits (chap. 19).

L. Raphals (✉)
Department of Comparative Literature and Foreign Languages, University of California, 92521-0321 Riverside, CA, USA
e-mail: lisa.raphals@ucr.edu

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> The more people have crafts and cleverness, the more there will be anomalous events (chap. 57).
>
> The ancients who were skilled at Dao used it not to enlighten the people but to stupefy them. The reason people are difficult to govern is that they are too clever (chap. 65).

What are we to make of these statements? One explanation is epistemological. The *Daodejing* rejects the Confucian emphasis on the regulation of human society and focuses on the natural world and cosmos. It describes its brand of "meta-knowledge" as *abandoning* knowledge. But the *Daodejing* is also famous for its description of the sage who "acts without acting" (*wuwei* 無為). If that "action" is also applied to political control; our "Daoist" may also be a totalitarian ruler who controls his state by keeping his people ignorant or innocent of knowledge, wisdom, cleverness, craft, and ingenuity. Whichever interpretation we prefer, despite its apparent interest in the natural world, the *Daodejing* does not seem to encourage anything like an interest in science (Liu 2005).

A very different picture emerges when we turn to the other major texts from the received tradition of early Daoist thought. In immediate contrast, many passages in the *Zhuangzi* extoll the abilities of specialized craftsmen who possess highly technical skills. These stories liken mastery of the Way to mastery of a craft. They also emphasize the technical skills of commoners. Commoners, rather than rulers, are presented as sage-like figures. These technical experts include arrow makers, bell-stand carvers, boatmen, butchers, cicada catchers, potters, sword makers, and wheelwrights (Raphals 2005).

Most detailed is the exegesis of the skillful butcher PAO Ding, (cf. 135–36) who describes the process of mastering his skill. His method is initially analytic; he begins by studying oxen as wholes, next as parts, and finally with faculties beyond ordinary vision (chap. 3). The story of Wheelwright BIAN makes the general claim that skill is not teachable. Bian himself has the knack of chipping wheels at precisely the right speed, but he cannot explain it or teach it to his son (ch. 13). The *Zhuangzi* also contains references to the nature of *qi* and yin and yang, and their relation to health and longevity.

Other passages of scientific interest appear in the "Daoist" chapters of the *Guanzi*, as well as the *Huainan Annals* (*Huainanzi*), which includes technical treatises on astronomy, calendrics, and mathematics.

1 Which Sciences? Which Daoism?

The question of the relation of Daoist philosophy and science is complicated by several factors. What do we mean by science in the context of early China and early Daoist philosophy? Should we be looking at "science" or at "technology"? Which sciences, and where in the hierarchy of value is that knowledge? An ongoing debate on the nature of Chinese science, initially arising from the pioneering work of Joseph Needham, focuses on the question of why (or whether) the revolution

that transformed scientific disciplines in Europe did not take place in China. That debate has focused on the mathematization of science and on the activities of court astronomical officials (Needham 1956, 1979). But are these areas the right places to look to understand the relation of early Daoism to the origins of science?

In particular, which sciences are relevant to Daoist philosophy? As Nathan Sivin (1990) has argued, Chinese accounts focused on specific sciences, rather than a unified notion of science. These sciences were both quantitative and qualitative. Most important for our purposes are the qualitative fields of astronomy or astrology (*tianwen* 天文) and medicine (*yi* 醫). *Tianwen* included the observation of celestial and meteorological events whose proper reading could be used to rectify the political order. Medicine included "nurturing life" (*yangsheng* 養生), what Needham termed "macrobiotics." This broad category included a wide range of self-cultivation techniques. In later periods it also included *materia medica* (*bencao* 本草) and internal (*neidan* 內丹) and external (*waidan* 外丹) alchemy.[1]

Medicine, astronomy, and cosmology appear in the last two sections of the Bibliographic Treatise of the *Han Dynastic History* (*Han shu* 30).[2] The fifth section, "Numbers and Techniques" (*shushu* 數術), includes *tianwen*, as well as calendars and chronologies (*lipu* 歷譜), Five Phases (*wuxing* 五行), divination by turtle shells and yarrow stalks (*shigui* 蓍龜), miscellaneous divination (*zazhan* 雜占), and morphoscopy (*xingfa* 刑法). The sixth section, "Recipes and Methods," includes works on medicine and longevity, including medical classics (*yijing* 醫經), classical recipes (*jingfang* 經方), sexual arts (*fangzhong* 房中), and immortality practices (*shenxian* 神仙). The bibliographic treatises of some later dynastic histories combine these two sections into "Arts and Techniques" (*shuyi* 術藝) or "Skills and Techniques" (*shuji* 術技).[3] These chapters reflect the concerns and expertise of the technical and ritual specialists closely associated with the "Recipe Masters" (*fangshi* 方士) associated with the Han court. But their concerns also appear in early Daoist philosophical texts, and the separation of Daoist philosophy from the categories of religion and science is artificial and problematic (Harper 1998, 1999; Kalinowski 2004).

Another initial problem is the anachronistic understandings of the nature of early Daoism. These include an oversimplified emphasis on the schools and legendary authors of Daoist texts. There is also a problematic distinction between the "philosophical" Daoism (*Daojia* 道家) of the *Daodejing*, *Zhuangzi*, and *Huainanzi* and the "religious" Daoism (*Daojiao* 道教) of longevity practices, popular religion,

[1] Quantitative sciences included Mathematics (*suan* 算), Mathematical harmonics or acoustics (*lü* 律 or *lü lü* 律呂) and Mathematical astronomy (*li* 歷 or *li fa* 歷法), in relation to harmonics.

[2] The six sections of the *Han shu* Bibliographic Treatise are: (1) the Six Arts (*liuyi* 六藝) or Classics (*liujing* 六經), (2) Masters (*zhuzi* 諸子) texts of Warring States philosophy, (3) Poetry (*shifu* 詩賦), (4) Military works (*bingshu* 兵書), (5) Numbers and Techniques (*shushu* 數術), and (6) Recipes and Methods (*fangji* 方技).

[3] *Song shu* 宋書, "Benji" 本紀 9 (Taipei: Yiwen, 1987), 180; *Sui shu* 隋書, "Zhi" 志 (Taipei: Yiwen, 1987): 32, 903–909.

and organized Daoist churches. As Nathan Sivin (1978) pointed out in an article 30 years ago, simplistic stereotypes of Daoism as mystical or naturalistic obscure understanding of the relations between Daoism and science. Other scholars have identified the Daoists as scientists of early China. Joseph Needham described Daoism as "religious and poetical, yes; but it was also at least as strongly magical, scientific, democratic, and politically revolutionary" (1956: 32). The *Daoist Canon* (5,305 volumes, completed in 1445) attests to Daoist expertise in astronomy and cosmology, biology and botany, medicine and pharmacology, chemistry and mineralogy, and mathematics and physics. Ancient Daoists were active observers of the natural world, but they were not professionalized in the manner of contemporary scientists. Their own interests, questions, and priorities fell in the areas of medicine, longevity, and literal physical immortality, rather than scientific demonstration or abstract knowledge for its own sake.

Much of the Daoist engagement with science after the Han dynasty is relegated to *Daojiao*, and often in ways that obscure the relation between Daoist philosophy and science in early China. The following discussion concentrates on intersections between early Daoist philosophy and science in medicine, cosmology, astronomy, and early Chinese traditions of technical expertise.

2 Qi, Medicine, and Longevity

Early Daoist texts express the need to preserve one's person, self, or essential nature, beginning with the *Daodejing*:

> Therefore the sage puts his person last and it comes first,
> Treats it as extraneous and it is preserved. (chap. 7)

One way to do this was to maintain health by nurturing life (*yangsheng*), an area of common ground for Daoists and practitioners of traditional medical arts. The term *yangsheng* first appears in the *Zhuangzi* and then throughout a range of second (BCE) century medical literature. In the Han dynasty, "Nurturing Life" techniques became a major concern of the Recipe Masters of the Han court (Ngo 1976). Texts on Nourishing Life include methods for absorbing and circulating *qi* in the body—for example, breathing and meditation exercises, diet, drugs and sexual techniques. Discussions of the cultivation of *qi* for health, longevity, and literal physical immortality appear in a wide spectrum of texts that in fact link the Daoist philosophical classics to other traditions of technical expertise and religious self-cultivation.

In the third chapter of the *Zhuangzi*, "Nourishing the Ruler of Life" (*Yang sheng zhu* 養生主), the expert butcher PAO Ding instructs Duke Hui of Liang, who responds that PAO Ding has taught him how to nurture life (*yangsheng*). Another passage in the Outer Chapters refers to some of these exercises. It contrasts "real sages" who follow the way of heaven and earth with (among others) practitioners of "nourishing life" traditions who:

> blow out, breathe in, old out, new in, dormant like the bear, neck-stretched like the bird, their only care for longevity; these are the practitioners of "guide-and-pull" and "nourishing the body" who desire the longevity of Pengzu (ch. 15).

The passage continues. Real sages:

> cultivate [their persons] without benevolence and righteousness, govern without merit or fame, are at ease without needing rivers and seas, attain longevity without "guiding and pulling," forget everything but lack for nothing, placid without limit, things of value follow upon them (ch. 15, cf. Graham 1986a: 265).

Since the whole point of the *Zhuangzi* passage is to oppose "guiding and pulling" and other longevity techniques to true sagehood, it does not dwell on their details. We can get a better idea of what he might have been talking about from other sources. Some of these ideas are elaborated in a chapter of the *Guanzi* titled "Inner Cultivation" (*Nei ye*), which describes the cultivation of *qi*, as well as vital essence (*jing*), and spirit (*shen*). It describes Dao as literally pervading the body or the person of a sage:

> When the wellspring is not drained, you can freely circulate throughout the nine borders. You can then exhaust Heaven and Earth, and spread over the four seas. (*Guanzi* 16.3a8–3b1; Roth 1999, chap. 15).

The *Zhuangzi* and other texts refer to the figure of the numinous person or *shen ren* 神人 as someone who has effectively transformed the physical body, and the *qi* that constitutes it. The *Zhuangzi* describes the *shen ren* of Guye, who concentrates his *shen*, avoids the five grains, rides the clouds, and, through the concentration of his *shen* "protects creatures from sickness and epidemic and makes the yearly harvest ripen" (1: 28; cf. Graham 46). This passage suggests that a sage can have a nurturing effect on the world by acting at a distance, possibly as an unintended by-product of self-cultivation practices. The *Zhuangzi* clearly identifies *qi* as the basis of the physical constitution of the body: "Human birth is caused by the gathering together of *qi*" (22: 733). The *Zhuangzi* also describes harmonizing or taking charge of the six *qi*.

> The *qi* of heaven is not in harmony, the *qi* of earth is tangled and snarled. The six *qi* are maladjusted, the four seasons are disordered. Now I want to harmonize the essences of the six *qi* in order to nurture life (11: 386).

Similarly, the *Springs and Autumns of Master Lü* (*Lüshi chunqiu*) describes sages as making their numinous essences (*jingshen*) tranquil, and preserving and increasing their longevity (3.2, pp. 3b–4a).

In all these texts a sage or numinous person achieves that status through both meta-physical and physical means. This is the focus of Daoist "Nurturing Life" techniques.

Medical and divinatory texts excavated from tombs make it clear that a wide range of longevity techniques had been developed before the Han dynasty (Harper 1998: 33). Most important is a corpus of medical manuscripts excavated from Mawangdui 馬王堆 (Changsha, Hubei), dated to 169 BCE. This tomb is best known for its two versions of the *Daodejing*, but it is meaningful to locate those texts among other texts of a scientific provenance found in the tomb (Zhou and Xiao 1987; Harper 1998, 1999; Ma 1992; Zhou 1994).

Six of the medical manuscripts are concerned with nourishing life in various ways. "Harmonizing Yin and Yang" (*He yin yang* 合陰陽) and "Discussion of the Realized Way of All Under Heaven" (*Tianxia zhidao tan* 天下至道談) are concerned with sexual cultivation. They refer to the movements and postures of animals as whole-body metaphors for sexual techniques. An example is the description of ten postures in "Harmonizing Yin and Yang":

> The ten postures: the first is "tiger roving"; the second is "cicada clinging"; the third is "measuring worm"; the fourth is "river deer butting"; the fifth is "locust splayed"; the sixth is "gibbon grabbing"; the seventh is "toad"; the eighth is "rabbit bolting"; the ninth is "dragonfly"; the tenth is "fish gobbling." (Harper 1998: 418)

These texts emphasize that sexual activity is a natural process, but one that must be regulated. As the "Realized Way of All Under Heaven" puts it, people know by nature how to breathe and how to eat, but everything else is a matter of learning and habit. "What assists life is eating; what injures life is lust. Therefore the sage when conjoining male and female invariably possesses a model." (Zhou and Xiao 1987: 431; Harper 1998: 432).

"Recipes for Nurturing Life" (*Yang sheng fang* 養生方) consists of 87 recipes, including food, drugs, and beverages, along with several sexual cultivation exercises. "Eliminating Grain and Eating Vapor" (*Quegu shiqi* 卻穀食氣) specifies diet and breathing exercises to be performed in the morning and evening, and a seasonal regimen of breath cultivation through consuming six *qi* and avoiding another five (Harper 1998: 25–30). Another text, the "Ten Questions" (Shi wen 十問) gives advice on techniques for nurturing life (Harper 1998: 22–30), for example:

> Yao asked Shun: "In Under-heaven what is most valuable?"
> Shun replied: "Life is most valuable."
> Yao said: "How can life be cultivated?"
> Shun said: "Investigate yin and yang." (Zhou and Xiao 1989: 379; Harper 1998: 399)

Finally, the "Drawings of Guiding and Pulling" (*Daoyin tu* 導引圖) is a series of 44 drawings of human figures performing exercises, some with captions. Some are described in another excavated text from tomb no. 247, Zhangjiashan 張家山 (Jiangling, Hubei). The "Pulling Book" (*Yinshu shiwen* 引書釋文) from Zhangjiashan describes exercises that refer to or are named after animals, including inchworms, snakes, mantises, wild ducks, owls, tigers, chickens, bears, frogs, deer, and dragons. Both exemplify a tradition of exercise for both therapy and health known as *daoyin* (pulling and guiding).

The "*yangsheng* culture" of these texts emphasized control over physiological and mental processes, both understood as self-cultivation, through the transformation of *qi*. "Self-cultivation" in this context included moral excellence, health, and longevity (Lo 2001).

We can get a broader notion of what these techniques were like if we turn to the list of titles from the Recipes and Methods section of the *Han shu* bibliographic treatise. It includes the well known *Internal Classic of the Yellow Lord* (*Huangdi neijing*) and titles of medical works on nurturing life, health, and longevity. The classical recipes (*jingfang*) section includes titles such as "Recipes for Married Women and Infants" (*Furen yinger fang* 婦人嬰兒方) and "Food Prohibitions of

Shen Nong and Huang Di" (*Shennong Huangdi shi jin* 神農黃帝食禁). The sexual arts section includes "Recipes of Huang Di and the Three Sage-Kings for Nurturing Yang" (*Huangdi Sanwang yang yang fang* 黃帝三王養陽方) and "Inner Chamber Recipes of the Three Schools for Having Children" (*Sanjia neiju youzi* fang 三家內房有子方). Other sections describe physical exercises and therapeutic techniques, such as the "Stepping and Pulling Book of Huang Di and Other Masters" (*Huangdi zazi bu yin* 黃帝雜子步引 (*Han shu* 30).

Another medical text from Mawangdui is a recipe (*fang* 方) manual titled *Recipes for Fifty-Two Ailments* (*Wushier bingfang* 五十二病方, translated and discussed in Harper 1998). Recipe texts also have been excavated from Zhangjiashan (Li 1993, 2000). In addition, the Mawangdui tombs also contained hexagram divination texts and charts and diagrams on cloud divination and physiognomy, including the oldest known representation of a comet (Li 1993).

In summary, most of the above texts can be described as part of a *yangsheng* culture, which offered and emphasized control over physiological processes of the body and mind that were understood as transformations of *qi*. What is the relation of these detailed technical texts to Daoist philosophy? These technical arts form a continuum with Daoist philosophy because their transformations were understood as self-cultivation in the coterminous senses of moral excellence, health, and longevity (rather than medical pathology), and physiological transformation through the manipulation of *qi* (Lo 2001).

We can go further. Mark Csikszentmihalyi (2004) describes them as part of an "embodied virtue" tradition of self-cultivation practices that are not restricted to Daoism. These practices and the concepts behind them structured much of early Daoist philosophy and medical theory, and also had profound effects on early Chinese ethics and metaphysics (Lo 2005). Such "material virtue" traditions held that the body-mind was constructed of *qi* and that embodied self-cultivation practices could transform *qi*. These views informed Warring States accounts of dietary practices, exercise regimens, breath meditation, sexual cultivation techniques, and other technical traditions associated with *fangshi*. Material virtue traditions also had important links with Daoist texts, southern schools, and the "moralization" of health in traditions that culminated in the *Huangdi neijing*. Accounts of these practices appear in passing in the texts of the received tradition. Many more come from texts excavated from tombs.

3 Daoism, Cosmology, and Astronomy

It is almost impossible to separate Chinese ideas of body, state, cosmos and "nature."[4] Over the course of the last three centuries BCE, Chinese understandings of the physical world developed to reflect, and mirror, political consolidation

[4]Nathan Sivin (1995: 3n1) points out that there is no indigenous term for "nature" in China before the nineteenth century.

(Sivin 1995). These new ideas of cosmic order—correspondence between microcosm (the body) and macrocosm (the cosmos)—appeared in new representations of the body, the state, and the cosmos that were based on systematic applications and correlations of the ideas of yin and yang and of the Five Phases (*wuxing*). They appear in medical texts such as the *Huangdi neijing*, in calendrics, in observational astronomy and the study of astronomical portents with political implications, and in the "correlative cosmologies" of many Han dynasty texts. Where did Daoism fit into this picture?

Theories of *qi* and yin and yang are not uniquely Daoist, but they are importantly pursued in early Daoist texts. New systematic medical theories based on these ideas were systematized in a cosmological framework in the *Huangdi neijing* (Veith 1972; Yamada 1979; Unschuld 2003). This complex and multilayered text, probably compiled in the first century BCE, presents a systematic cosmology that analogizes the body, the state, and the cosmos in complex systems of "correlative cosmology" (Graham 1986b; Sivin 1995; Lloyd and Sivin 2002). It describes relations and analogies between the body (including the emotions), the state and the cosmos, all expressed in terms of yin and yang and the Five Phases. For example, the *Huangdi neijing* describes correspondence between the articulations of the body and the cosmos, specifically between heaven and earth and the upper and lower parts of the body.

> Heaven is round, earth is square; people's heads are round, their feet are square and thereby correspond to them. Heaven has the sun and moon, people have two eyes; Earth has nine regions, people have nine orifices. Heaven has wind and rain, people have joy and anger; Heaven has thunder and lightening, people have the notes and sounds. Heaven has four seasons, people have four limbs. Heaven has five tones, people have the five depots; Heaven has six pitches, people have six palaces. Heaven has winter and summer, people have cold and hot [ailments]. Heaven has ten days, people have the hands' ten fingers ... Heaven has yin and yang; people have man and wife. The year has 365 days; the body has 360 joints (*Huangdi neijing lingshu* ch. 71).

The apocryphal "founder" of scientific thought in China was ZOU Yan 鄒衍 (305–240 BCE), who is associated with the Yin-Yang school (*Yinyang jia*). ZOU Yan is credited with combining and systematizing yin-yang and Five-Phase theory (Needham 1956: 231–34), but none of his works survive. SIMA Qian's biography of him (*Shiji* 76) describes ZOU Yan as a member of the Jixia 稷下 Academy, originally from the state of Qi (in present day Shandong):

> he examined deeply into the phenomena of the increase and decrease of yin and yang, and wrote essays totaling more than 100,000 words about their strange permutations, and about the cycles of the great sages from beginning to end. His sayings were vast and far-reaching, and not in accord with the accepted beliefs of the classics. First he had to examine small objects, and from these he drew conclusions about large ones, until he reached what was without limit. First he spoke about modern times, and from this he went back to the time of Huang Di. The scholars all studied his arts. Moreover he followed the great events in the rise and fall of ages, and by means of their omens and (an examination into their systems), extended his survey (still further) backwards to the time when the heavens and the earth had not yet been born, (in fact) to what was profound and abstruse and impossible to investigate.

> He began by classifying China's notable mountains, great rivers and connecting valleys; its birds and beasts; the fruitfulness of its water and soils, and its rare products; and from this extended his survey to what is beyond the seas, and men are unable to observe. Then starting from the time of the separation of the Heavens and the Earth, and coming down, he made citations of the revolutions and transmutations of the Five Powers (Virtues), arranging them until each found its proper place and was confirmed (by history). (*Shiji* ch 76, slightly modified from Needham 1956: 232–33).

The *Han shu* describes ZOU Yan as a *fangshi* or Recipe Master. This term was applied to a wide range of practitioners of mantic and technical arts (the *shushu* and *fangji* sections of the *Han shu* Bibliographic Treatise). *Fangshi* practiced divination and claimed to possess secret texts and formulae. They gained great influence during the earlier part of the Han dynasty, though their influence waned by the later Han. The *fangshi* used yin-yang and Five-Phase cosmology. They seem to have originated from the Shandong peninsula. They were particularly associated with the mantic arts, including the use of the sexagenary cycle of stems and branches, the *Yijing*, and divination by stars, dreams, physiognomy, the winds, and by the use of pitch pipes (Li 1993, 2000).

Another important aspect of cosmological interest is observational astronomy or astrology (*tianwen*). Specifically Daoist interest in the heavens, like so many things, first appears in the *Zhuangzi*, which raises questions about the natural world and its movements:

> How heaven wheels! How earth abides! Do the sun and the moon contend over their placements? Who plays chief and directs? Who binds them and connects? ... How does a cloud become rain, or rain become clouds? (14: 493)

Within a Daoist context, questions about the nature of the heavens were pursued by the *fangshi*. *Fang* expertise also included divination by the heavens, both by the stars, and by interpreting subcelestial phenomena, including weather, clouds, mists, and winds (Ngo 1976; Li 1993). These activities were not invented by the *fangshi*. Evidence of royal interest in stars and winds dates back to the Shang oracle bone inscriptions. The *Han shu* Bibliographic Treatise also provides evidence of *fang* activity through the titles of lost books. Other evidence comes from late Warring States and Han texts such as the *Lüshi chunqiu* and *Huainanzi*. The *Huainanzi* contains several chapters of astronomical interest. One passage describes the technical interests of the sage emperor Yu, who ordered his officials to measure the distances to the ends of the earth:

> Emperor Yu ordered Taizhang to walk from the eastern extremity to the western extremity: 233,500 *li* and 75 steps; after this he ordered SHU Hai to walk from the northern extremity to the southern extremity: 233,500 *li* and 75 steps (chap. 4:56, Raphals 2002).[5]

The third chapter of the *Huainanzi* ends with a section on the use of the measurements cast by shadows (gnomons) to calculate distances. This passage is

[5]The "step" was a double stride, conventionally reckoned at about 2 m. There were 360 steps per *li*. A *li* was roughly equivalent to a mile.

probably a later addition, but for our purposes, its inclusion in the *Huainanzi* is indicative of the scientific concerns of the text. It gives directions for a series of measurements, including how to determine the directions of sunrise, sunset, and the cardinal directions. It also explains how to measure the "breadth and length of east, west, north, and south":

> If you wish to know the figures for the breadth and length of east, west, north, and south set up four gnomons to make a right-angled figure one *li* square. More than ten days before the spring or autumn equinox sight along the northern gnomons of the square on the sun from its first appearance to its rise above the horizon. Wait for [the day when] they coincide. When they coincide they are in line with the sun. Each time take a sight on it [the sun] with the southern gnomons, and take the amount by which it is within the forward gnomons as the divisor. Divide the whole width and divide the length [between] the standing gnomons in order to know the measurements east and west from here (*Huainanzi* 3:53–54, translation slightly modified from Cullen 1976: 116).

Another area of Daoist interest in astronomy as calendrics, based on detailed observation of seasonal changes. One example is the Monthly Ordinance (*Yueling* 月令) calendars of the *Huainanzi*. Monthly Ordinances use Five-Phase correlations to specify the correct social, ritual, and agricultural activities for each season. Rulers could use these texts to regulate state ritual activities over the course of the year. The ordinances cover such topics as state activities (fortification, planting, etc.) and the consequences of performing activities at incorrect times. These are the first texts in the received tradition to link the 28 lodges to the months of the year, associating each month with a lodge, which indicates the position of the sun among the stars for that month.[6] The calendric tables list the days of the year in stem-branch sexagenary order, with annotations on the nature of different kinds of days, and which days were auspicious or inauspicious for particular activities.[7] They also included monthly and seasonal correlates. For example, the lodges were associated with the position of the sun, and dusk and dawn correlated to the five pentatonic tones, pitchpipe notes, numbers, tastes, smells, color of the emperor's clothing, presiding deity, and yin and yang sacrificial organs, all described in terms of the Five Phases (chap. 5, Major 1993: 220–225).

These correlations seem a far cry from either the free-spirited cosmological speculations of the *Zhuangzi* or empirical science in any modern sense. Between those extremes stand the mostly lost arts of technical traditions described in the *Han shu* Bibliographic Treatise: astronomy, medical, pharmacological, and mantic arts, whose practitioners were the counterparts and potential competitors of Daoist philosophers (Lloyd and Sivin 2002). Expertise initially developed by diviners and technical specialists became part of the *Daodejing*, *Zhuangzi*, and *Huainanzi*. It was also incorporated into the systematic cosmology and medicine of the Han.

[6]Ancient Chinese astronomers divided the celestial equator around the pole star into 28 "lodges" (*xiu* 宿), each named by a star within it and each comprising some 13° (*du* 度) of the circle.

[7]Such calendars also appear in almost identical form as chapters in the *Guanzi* and *Lüshi chunqiu*, and were incorporated into the *Liji* in the Later Han dynasty (*Guanzi* 3.8 and 3.9, Rickett 1985 I:148–192).

4 Conclusion

In conclusion, this brief account addresses important issues in the role of Daoism in the early history of science in China. Instead of turning to the *Daodejing* or Han theories of yin-yang-based "correlative cosmology," I have focused on the relation of Daoism to the qualitative sciences of medicine and astronomy, and their relations with early Chinese philosophy overall. I have deliberately focused on technical traditions, referring to the Bibliographic Treatise of the *Han shu*, which delineates a culture concerned with astrocalendrics, medicine, and techniques for "nurturing life." New research and the evidence of recently excavated texts is transforming our understanding of the scientific aspects of Daoist thought.

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