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**Air/Qi Connections and China's Smog Crisis: Notes from the History of Science**

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**Abstract**

This article explores the relationship between *qi* and air in Chinese medical and scientific history in order to illuminate current approaches to air pollution and *wumai* (smog) in contemporary China. The modern concept of air is expressed in Chinese using terms related to the word *qi*. However, *qi* is a complex, multivalent term with a long history in Chinese cosmology and Chinese medicine and does not hold a clear one-to-one correspondence with air. *Qi* provided a resonating transcendent link between humans and their environment, yet pathogenic forms of *qi* arising from the environment could invade the body, causing illness and death. During the late nineteenth century, laboratory definitions of air as gas were introduced to China through the term *qi*, enabling some turn-of-the-century Chinese physicians such as Tang Zonghai to establish creative correspondences between air and *qi* that encompassed gas, vital energies, and even God. Such correspondences with their transcendent, potentially sacred valences appear to be unavailable today, even as contemporary Chinese embrace traditional medicines to ward off the effects of *wumai*. By probing the significant spaces between air and *qi*, this article suggests that the history of science in China has implications for how we might cope with and confront our current atmospheric crisis.

**Keywords:** *qi*, air, translation, *wumai*, Tang Zonghai, Traditional Chinese Medicine (TCM), PM 2.5

In February 2013, a strange phenomenon appeared on the campus of Beijing University. The air that winter had been particularly bad, reaching Air Quality Index levels higher than 700 on a scale where 300–500 is deemed hazardous. One morning, Beida's students awoke to find that all of the statues of human forms on the campus had been outfitted with *kouzhao* (white masks), the ubiquitous face wear that Beijing's citizens don to cope with *wumai* (smog). The statue of Cai Yuanpei sported a *kouzhao*, as did those of Li Dazhao and Miguel de Cervantes. Images of the prank went viral on Weibo sites, prompting China's netizens to add their own humorous captions and use the images as an opportunity to express their frustration about the

poor quality of the capital's air. As one Beijing resident opined, "If they had to breathe this air without their masks, the statues would collapse!" (Bing 2014).<sup>1</sup>

One of these images was particularly eye-catching: a statue of a male *taijiquan* (tai chi chuan) practitioner, in the graceful "single whip" pose, the stark white of the face mask contrasting with the rich bronze of the statue (figure 1). The statue had been erected on the Beida campus in 2008 to commemorate Chinese traditional physical culture in the Olympic year ("Aoyun zai Beida" 2012). The image of a statue struggling to breathe polluted air mirrored other images that circulated from subsequent moments of "airpocalypse" in China, including photographs of actual *taijiquan* practitioners attempting to do their *qi*-work outdoors in dense smog (figure 2).



Figure 1. Beijing University statue of a *taijiquan* practitioner wearing a face mask.  
Source: ChinaFotoPress/Getty Images.  
[http://slide.tj.sina.com.cn/travel/slide\\_48\\_33503\\_215337.html#p=5](http://slide.tj.sina.com.cn/travel/slide_48_33503_215337.html#p=5)



Figure 2. Doing *taijiquan* in the smog.  
Source: AP Photo. <https://www.dispatch.com/news/20170903/tai-chi-can-improve-balance>

Such images raise important questions. What do practitioners of traditional Chinese exercises, including *taiji* and *qigong*, breathe in as they practice? If it is *qi*, what is *qi*? For that matter, what is air? What is the relationship between *qi* and air? This article considers historical interactions between air and *qi* in China, focusing on the ways that translators of Western science and physicians of Chinese medicine negotiated between these two concepts during the late nineteenth and early twentieth centuries. Used as an element in translations of terms such as air, atmosphere, and gas, *qi* has served as a bridge between the basic constituents of Chinese medicine and entities defined in the laboratory. This "translingual practice" (Liu 1995) generated productive intersections among these terms and ultimately allowed physicians of Chinese medicine to create compelling convergences between Chinese cosmologies and Western science. Despite points of convergence, the different ways that humans interacted with, perceived, and created knowledge

<sup>1</sup> This image was brought to my attention through my participation in the Airborne Project at the Centre for Advanced Study at the Norwegian Academy of Science and Letters. Thanks to Rune Svarverud and colleagues for the invitation and invigorating discussion during my visit in the summer of 2017.

about these entities ensured that significant gaps remained. By probing the space between air and *qi*, this article suggests that the history of science in China has implications for how we might cope with and confront our current atmospheric crisis.

### **Between Heaven and Earth: *Qi* and the Human Condition**

First, what is *qi*? Even the great early Chinese philosopher Mencius, when asked to describe *qi*, said “难言也” (It is hard to put into words). We must acknowledge that *qi* is a complex concept with multiple valences of meaning that have changed across time and from place to place. In the United States today, the term is often translated as “vital energy,” and it is associated with life-sustaining forces. But in traditional Chinese cosmology, *qi* was not limited to sentient beings, nor was it limited to organic things—*qi* was the basic stuff of everything in the universe, animate and inanimate, organic and inorganic. Whereas it is the basic physical substratum of all things, it is also the characteristic or force within things that propels change and transformation, simultaneously “that which makes things happen in stuff” and “the stuff in which things happens” (Sivin 1987, 47).

*Qi* was undoubtedly related to the stuff we call air today, but it was also much more. Experts in ancient texts have translated the term *qi* 氣 as “vapor” and suggest that within the character we can see “steam” arising from “rice”—*qi* as a sort of misty, yet nutritive entity, obviously related to ordinary air (Harper 1998). Yet one of the earliest texts on *qi*—an engraving on a small jade cylinder from about 500 BC—tells us the extraordinary things that humans could do with this vapor:

Swallow, then it travels; traveling, it extends; extending, it descends, descending, it stabilizes, stabilizing, it solidifies, solidifying, it sprouts; sprouting, it grows; growing, it returns, returning, it merges with Heaven. The heavenly forces are revealed in the rising of *qi*, the earthly forces are revealed in the descending of *qi*. Go along with this and you will live, go against it and you will die. (Michael 2015, 110)

It is obvious that *qi* could go far beyond any one-to-one correspondence with air as we understand it today: it is both immanent and transcendent, work-a-day and extraordinary at the same time. In ancient texts related to *yangsheng* or the skill set of “nurturing life,” *qi* was drawn into the human body through mundane tasks such as breathing and eating. Its cultivation through physical exercises—the forerunners of today’s *qigong*—could lead to excellent physical health and vigor. Neo-Confucian philosophers found the transformations of *qi* to be the fundamental manifestation of the universe and the transcendent material that linked all beings with Heaven. Daoists strove to circulate and transform the primordial *qi* in the body through the power of the mind, culminating in the cultivation of a divine embryo within the body—thus eliminating the need for breathing altogether and offering a vehicle for immortality (Robinet 1993; Kohn 2000; Lo 2001; Kasoff 1984; Campany 2002).

In Chinese medicine, *qi* formed the basic way of understanding the physical body in its potential for vitality and health as well as its vulnerability to disease and

pain. Physicians of Chinese medicine perceived the body as consisting of multiple manifestations of *qi*. *Qi* achieved from one's parents at birth (*xiantian*) helped determine the body's basic constitution, whereas *qi* acquired through eating and drinking (*houtian*) added to the robustness of the body's internal construction (*yingqi*). A defensive surface *qi* (*weiqi*), if properly maintained, helped guard the body from invisible external threats to health. Ideally, *qi* flowed freely in its proper courses through the body, but it could become blocked and stagnant, creating debilitating pain, fevers, abscesses, and catastrophic failures. The physician worked with *qi* on many levels, finding ways to strengthen the body's *qi* defenses, bolster the nutritive inner core, and promote overall flow within the system (Scheid 2018).

*Qi* also linked the human body and the external environment. The *qi* of the universe encompassed, penetrated, and filled the human body that moved suspended between Heaven and Earth. In one view, the body was a microcosm of the cosmos, resonating with the macrocosm through relationships of correspondence. The *qi* of nature and the *qi* of the healthy human body all moved in predictable ways according to the logic of yin and yang and the Five Phases—Earth, Wood, Water, Metal, and Fire—rubrics pegged to the waning and waxing of nature's rhythms: day and night, birth and death, and the changing seasons. But not all *qi* was predictable or beneficial to human health: medical classics are filled with many types of *xie qi*, or "deviant"/pathogenic *qi* that threaten to invade the body. The body was susceptible to being penetrated by *feng* (Wind), which could attack swiftly and without warning, leaving the body stricken by sudden chills and fever, sudden pains, or even paralysis (Kuriyama 1999). The internal environment could be influenced by deviant "evil *qi*" or "pernicious influences" (*xieqi*)—the *qi* of the body could become Damp and obstructed, or Dry and brittle, attacked by Cold or withered by Heat. The very land itself could give rise to pathogenic miasma-like *qi* (*zhangqi* or *liqi*), especially the lush, overripe landscapes of the exotic southlands. These could give rise to fevers, wrenching gastrointestinal disorders, and even death. Noxious effluvia could arise from other suspect sources, including the bodies of the sick, corpses, and blocked waterways, forming a pestilential *chouqi* (stinking *qi*) or *huiqi* (*qi* of filth) that could wipe out families, clans, and entire villages. Even corrupt officials could generate a noxious *qi* that would poison the environment (Hanson 2011; Hinrichs 2015). As Shigehisa Kuriyama has noted about ancient Chinese (as well as ancient Greek) medicine, "Once upon a time, human being was being embedded in a world" (Kuriyama 1999, 262). This embeddedness offered the potential for resonance and harmony between the body and the universe but also presented a body that was vulnerable to being penetrated by unseen pathogens.

Humans may have been suspended within the *qi* of Heaven and Earth, but they were not haplessly adrift in its flows. Although there were some collective options that could be undertaken in order to improve the environment, responsibility for fighting and avoiding *xieqi* ultimately landed squarely on the individual. Classical medical texts advised individuals to moderate their behavior, alter their diet, engage in *yangsheng* exercises, and, above all, adhere to a regular and moral lifestyle (Unschuld 1985). In practical terms, however, the best precaution was to ingest medicines that could bolster personal defenses and make bodily *qi* robust enough to withstand assaults from a dangerous environment.

The scholarly Chinese physician was the expert on the front lines of this invisible life-and-death struggle between healthy *qi* and pathogenic *qi*. Equipped with knowledge from ancient texts, experience in the human condition, and their own finely trained senses, physicians encountered, understood, and felt *qi* directly in the bodies of their patients. Like Daoist adepts who trained their mind and body to manipulate *qi*, physicians trained their own minds to sense the *qi* in the bodies of others by honing exquisite skills such as touching the pulse and observing the countenance. They combined knowledge of revered classics with their own intuition to redirect the forces of *qi* within the bodies of individual sufferers through subtle diagnosis and the marshalling of medicines (Peng 2006). *Qi* was real because humans knew and perceived it directly through intimate and immediate engagement. This reality would be questioned with the emergence of laboratory science and new definitions of the invisible elements of the world.

### **The Qi-Air-Gas Nexus in Translated Western Chemistry**

Modern encounters between *qi* and air ensued with the arrival of Western missionaries in late imperial China. The first Jesuit missionary to China, the famous Matteo Ricci, came to the Ming court with very specific ideas about air, and he found confusion and heresy in the concept of *qi*. Influenced by the writings of Song-period scholars such as Zhou Dunyi, Zhu Xi, and Zhang Zai, the Chinese scholars encountered by Ricci theorized *qi* as represented in the Great Ultimate (*taiji*), an undifferentiated “ground of being” that spontaneously unfolded to produce all things in the universe according to the deep principle of yin and yang. Ricci surmised that because neo-Confucian scholars believed that *qi* connected humans with the cosmos, they had little need for a spiritual God (Standaert 1988, 110–113). One solution to the problem of Chinese salvation, then, was to get Chinese elites to replace the idea of *qi* with the concept of “air.” Air, of course, was one of the Four Elements of Aristotelian natural philosophy—it had the qualities of being hot and wet, and it imbued materials with lightness. In spite of its ubiquity, it was certainly not a transcendent all-encompassing entity like *qi*: Aristotle clearly separated terrestrial air from the refined matter of the stars and cosmos (ether), whereas that which enlivened the human body was *pneuma*, a vital breath that was “the vehicle of the soul” (Lloyd 1968; Bos and Ferwerda 2008). Despite these notable differences, when the Jesuits translated the Four Elements into Chinese, they used the character *qi* as the equivalent translation for “air,” beginning a centuries-long series of connections and debates about the relationship between the two entities (Zhang 1999).

By the nineteenth century, Western scholars had developed new ways of thinking about the stuff we breathe. Practices recognizable as modern laboratory science began with chemistry, and the study of chemistry began with the “invention” of air (Johnson 2008). The British natural philosopher Joseph Priestley’s isolation of different kinds of gases in the 1770s was followed by the famous experiments of the French chemist Antoine Lavoisier, who identified oxygen and demonstrated that air was composed of different types of elemental gases. Indeed, the late eighteenth-century debate between Priestley and Lavoisier about the nature of air has been

seen as one of the central debates in the birth of modern science, and served as one of the case studies of “paradigm shift” in Thomas Kuhn’s 1962 classic, *The Structure of Scientific Revolutions*. The “invention of air” also heralded the birth of the laboratory. Knowledge about this invisible stuff was created with visible objects: apparatuses made of glass, metal, and rubber (Kuhn 1962; Shapin and Schaffer 1985; Holmes and Levere 2000). By containing, pressing, pumping, heating, and channeling air with these objects, Lavoisier and others went on to theorize that not just air but the entire world was made up of combinations of discrete elements that could be manifested, transformed, and controlled through forced interaction with objects. These experiments highlight a basic approach to comprehending reality that emerges in modern Europe, identified by the philosopher of science Davis Baird as “thing knowledge”: the idea that ontology is determined through apparatus, instruments within themselves contain and convey knowledge, and the laboratory has the last word in how physical existence is defined (Baird 2004). While the unseen embodied energy between Lavoisier and his wife portrayed by the French artist Jacques-Louis David in figure 3 is bountifully manifest, Lavoisier helped solidify a trend that privileged apparatus (pictured on the table and at the scientist’s feet) as the ultimate arbiter of what is real.



Figure 3. Instruments and the “invention of air.” *Portrait of Antoine Laurent Lavoisier and His Wife* by Jacques-Louis David, 1788. Source: <https://www.metmuseum.org/art/collection/search/436106>

These foundational experiments with air and apparatus feature centrally in the introduction of Western science into China, with important consequences for the history of *qi*. In the mid-nineteenth century, a new wave of Protestant missionaries sought to bring Western science to China. Benjamin Hobson, John Fryer, William Martin, and others, working together with Chinese scientists such as Xu Shou and He Liaoran, produced numerous translations of Western science books packaged as *gewu* (the investigation of things) or *bowu* (natural philosophy/history) (Elman 2005). These texts frequently began with a presentation of chemistry—or the study of change (*huaxue*)—as the most basic of sciences, central to any understanding of the natural world (Reardon-Anderson 1991; Wright 2000). The entire world was made up of matter, which came in three forms: solids, liquids, and gases. Chemistry was the way that the West mastered matter by *fen* (separating) and *he* (combining) its elemental constituents. This mastery of physical matter was conveyed primarily through experiments with gas, translated as “*qi*.”

The choice of *qi* to translate “gas” in nineteenth-century Chinese chemistry texts reflects Jesuit translation precedents, but it also reflects the creative “intellectual syncretism” that emerged from the strong involvement of Chinese scholars in the translation process. The collaboration between Western missionaries and Chinese scholars resulted in dynamic “sinicized” interpretations of science that Chan Man Sing has identified as the “direct consequence of the Chinese agency at play in intercultural exchange” (Chan 2012, 528). Although *qi* provided a flexible bridge between known and newly introduced concepts, translators still found themselves needing to work on the problem identified by Matteo Ricci: how to get a Chinese audience to distinguish between *qi* and air. Rune Svarverud has detailed the complex linguistic search for a Chinese translation that could capture the specific idea of this invisible stuff around us, a process he called “the terminological battle for air” in modern China (Svarverud 2014). Translators offered different terms, including *dìqi*, *tiānqi*, *kōngqi*, and *shēngqi*, to mean variously (and interchangeably) atmosphere, air, weather, and vital gases—but all of these terms relied on the cornerstone concept of *qi*. Translators carefully attempted to define the relationship between gas and air in their reworking of basic science and chemistry texts. These attempts, however, sometimes led to awkward phrasings and circular definitions, as illustrated by the opening sentence of Fryer and Xu’s *Huaxue weisheng lun* (Chemistry and hygiene): “Human life cannot exist without breathing in a certain type of *qi*, and this type of *qi* is known as the *qi* of the void [*kōngqi*, or air]” (1871, 1:1a). In phrasings like these, we see the birth of “air” in China as a thing linked linguistically and conceptually to *qi*.

Whereas terminology may have preserved a connection between *qi* and air, the techniques of the laboratory tried to create a clear distinction. Many texts provided schematic illustrations of apparatus, items of glass and metal (familiar from the domestic laboratories of the late eighteenth century), along with detailed instructions of how they were used to manipulate and manifest air (figure 4). Air existed because it occupied space in a flask turned upside down in water. It had weight because it could displace mercury in a barometer. *Qi* as gas was everywhere, but an air pump could render a sphere void of gas, thus creating a vacuum. Apparatus not only proved the existence of gas-*qi*; it also could demonstrate the



existence of different *types* of this *qi*. Chemistry in Chinese was literally “the study of change,” change that was produced by *fen* and *he*. The clearest examples of this ability to *fen* matter were Lavoisier’s classic experiments on air, which were reproduced in multiple Chinese science translations. “Nutritive *qi*” (*yangqi*, or oxygen) could be produced by placing “three immortals cinnabar” (*san xian dan*, or red oxide of mercury) in a glass tube and heating it with a flame. The resulting thick, odorless gas was then shown to be “nutritive *qi*” because it could support animal life (illustrated by a rabbit under a glass bell jar) or could cause fire to burn brightly (illustrated by a candle illuminated inside yet another inverted bell jar). Even liquid water could be divided into its invisible constituent gases of “nutritive *qi*” and “light *qi*” (hydrogen) by boiling water over a stove and channeling the steam into a tube containing iron filings. The “nutritive *qi*” in the steam combined with the iron, leaving the separated, elemental “light *qi*” to rise up out of the tube into an inverted flask (Hobson 1855, 1:10a–11b; Fryer and Xu 1871, 2:2a–b; Martin 1868). Indeed, early science translations read like do-it-yourself magic manuals, and science was performed with apparatus-crammed “magic kits.” For Western science, it was only through manipulation of visible matter (in the form of tubes and ovens) that the wonders of the invisible—in this case, *qi*-as-gas—could be revealed.



Figure 4. Chemistry instruments in translation. *Source:* Hobson (1855, 1:2b).

Although translations attempted, through terminology and experiment, to create a clear contrast between *qi* and air, they also generated similarities and connections. Just as in Chinese medical thought, this Western notion of air sustained life, but it was also the primary cause of disease. Air could contain deadly pathogenic gases from a variety of sources: sewers, deep mines, marshes, volcanoes,

decomposing corpses, and factories. These were the miasmas that so caught the imagination of Westerners exposed to virulent nineteenth-century epidemics such as cholera and the continued endemic threat of malaria (Rosenberg 1962; Corbin 1986; Nash 2006). To convey these forms of miasma, translators used words that were very familiar to Chinese physicians: *chouqi*, *huiqi*, *zhangqi*, and *liqi*. At the same time, science translations assured Chinese readers that Westerners had invented technological fixes for the scourge of miasmatic diseases through the chemical transformation of air itself. *Liqi* and *chouqi* were not mysterious influences but specific harmful compounds, including hydrogen chloride, “sulfuretted hydrogen,” ammonia, and phosphorus. By mixing these dangerous gases with other compounds, chemists in the laboratory would be able to remove the “*du*”—the poison—from *liqi*, and thus eliminate the pathogenic miasmas. If all else failed, then the recently invented charcoal filter mask—known as the Stenhouse Respirator after its Scottish inventor—could be used to remove noxious aspects of air, a boon that could help save millions of lives around the world. We can, perhaps, see this moment as not only the “invention of pollution” (Thorsheim 2006) but also the introduction of an optimism for finding a technological fix for this distinctively modern malaise (Johnston 1854, 2:257; Fryer 1890, 2:496) (figure 5).

**FIG. 197.**



**Breath Filter.**

Figure 5. The Stenhouse Respirator (“Breath Filter”). *Source*: Youmans (1862, 217).

Translated science privileged apparatus as the arbiter of the reality of invisible things, but at the same time some of these texts posited the existence of an important world that lay beyond the grasp of apparatus: the world of souls, spirit, and God. Mirroring a common approach in nineteenth-century European-American discussions of science, many missionary translators in China employed explicit natural theology language throughout their works, arguing that the complexity of

the natural world was direct proof of the existence of a Creator (Wright 2000, 72–99). Forces from chemical affinity to interplanetary gravitation were compared with the powerful bonds of Christian fraternity; even the telegraph functioned according to principles illustrated by God's boundless love for humankind as manifest in the sacrifice of Jesus. Significantly, the translators perceived that this spiritual world could not be defined through apparatus but had to be deduced through reference to ancient texts and directly experienced through the human senses and human experience.

Natural theology sometimes led missionary translators of Western science into contradictory territory. For example, in his *Ge wu ru men* (Elements of natural philosophy, 1868), W. A. P. Martin repeatedly argued that science showed the existence of invisible entities that possessed mass (such as gas) as well as invisible, formless energies that could move of their own accord (such as electricity). However, in a more religiously inflected scientific work, *Tian dao su yuan* (The origins of the way of Heaven, 1854), Martin argued, "There are only two basic entities in the universe, matter and spirit. Spirit can move of itself, but matter cannot" (Wright 2000, 82). The line between science and spirit in one text might seem clear, but in another the division could turn quite murky.

Some observers offered a way out of this difficult binary by denying apparatus the last say in defining physical reality. An unknown author, whose sobriquet was "Pisheng weishicao,"<sup>2</sup> penned a contribution to Shanghai's *Gezhi huibian* (Chinese scientific and industrial magazine) detailing the "Qi of Life" (*Shengqi*). According to this essay, *shengqi* provided "the spark of life, and is the unifying force that ties all living organisms to a common fate" (Pisheng weishicao 1878, 11b). The author speculated that this thing was of the "qi" category (*qilei*)—"without sound, color, smell, or taste"—similar to gases like hydrogen, helium, and oxygen, or perhaps similar to *dianqi* (electricity). Whatever its nature, this *shengqi* by definition was impossible for science to grasp exactly because of science's insistence on analysis and "thing knowledge":

Some Westerners say that chemists have learned of the composition of all things by employing the process of combustion, and yet they have not been able to discover the *qi* of life. I hold that it is impossible to use the methods of chemistry to find *shengqi*. As soon as you try to separate *shengqi* from the living body, it is already not living: therefore it is impossible to investigate it through analysis [*fenhua*, literally, "the process that separates objects into parts"]. (Pisheng weishicao 1878, 11b)

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<sup>2</sup> I have been unable to identify the author. Foreign contributors to the *Gezhi huibian* are typically tagged with their country of origin ("Mei," "Ying," "Fa," etc.), but Pisheng weishicao 毘生未是艸 is not marked as foreign. The essay's vitalist themes made sense in both Chinese and Western nineteenth-century perspectives.

In this essay, the author visits a common complaint levied by Chinese against Western medicine—that the anatomical knowledge it gained by probing dead bodies entirely overlooked the vital processes of life itself. “Pisheng’s” critique simultaneously acknowledges the reality of the laboratory’s many forms of *qi*—not only gas, but also magnetism and electricity—and argues that *shengqi* falls outside of the ability of apparatus to capture it. The “*qi* of life” could only be intuited through the human senses observing the natural world, similar to the way that missionary translators urged readers to perceive evidence of the Creator in nature—or, for that matter, the way Chinese physicians perceived the realities of *qi* within the human body. The author lyrically concludes his treatise by stating that the *qi* of life was not only easily perceived in living things but also clearly visible in “the movement of the stars and planets, the waxing and waning of the sun and moon, the changing of wind and rain” (Pisheng weishicao 1878, 12b).

At the end of the essay, the editors of the *Gezhi huibian* appended a warning to its readers: “Although we have published this article, it contains aspects that are contrary to Western science. The publishers do not necessarily approve of the entire content, but present it here for readers to evaluate for themselves” (Pisheng weishicao 1878, 12b). The editors, led by John Fryer, apparently oblivious to the ways that Westerners had long used “chemistry as evangelism” (Wright 2000, 72–96), seemed to take umbrage with not only the essay’s explicitly vitalist message but also the suggestion that the secular laboratory might not have the sole power to define the nature of *qi*. *Qi* in early science translations remained a multivalent and flexible term, its transition to the state of “gas” not entirely complete. This indeterminate state of *qi* allowed for novel reinterpretations in the hands of some of Chinese medicine’s most creative minds at the beginning of the twentieth century.

### **Tang Zonghai’s *Qi*: Turn-of-the-Century Convergences between Gas and God**

How did this formulation of *qi*-as-air/gas in Western science influence the ways Chinese physicians thought about the *qi* of their own tradition? Interesting interpenetrations of *qi* and air can be found in the work of Tang Zonghai, a physician of Chinese medicine now considered one of the “founding fathers” of so-called East-West convergence medicine. Born in inland Sichuan Province in the mid-nineteenth century, Tang was an accomplished Confucian scholar who was both a government official in the Qing and a devoted student of Chinese medicine. Tang’s frequent travels to treaty-port Shanghai in the 1880s brought him into deeper contact with Western medicine and science. In his 1908 magnum opus, *Zhongxi huitong yijing jingyi* (The essential meaning of the medical classics, from the perspective of the convergence of Chinese and Western medicine; hereafter, *Convergence*), Tang discussed the basics of Chinese medicine in light of his understanding of Western science—an understanding that was clearly influenced by his reading of early missionary translations (Pi 2008; Lei 2014, 71–78).

Discussions of *qi* and its relationship to Western Learning figure prominently in Tang’s *Convergence*. In one example, the treaty-port world of combustion and steam power helped Tang Zonghai find commensurabilities between Western and Chinese *qi*. As Sean Hsiang-lin Lei has vividly demonstrated,

Tang creatively combined his reading of Western anatomy texts and Chinese medical texts to discover that the urinary bladder functioned like the burning chamber of a coal-fired engine and thus was the source of the body's *qi*. The heat of Fire classically associated with the "Gate of Life" in the lower abdomen "boiled" the water held in the bladder, giving rise to a steamlike *qi*, which Tang called *qingqi* (light *qi*). Because of the light nature of this *qi*, it rose up from the body's nether regions and began its energetic circulations through the body, powering human existence like steam powers the movement of machines (Lei 2012).

Other forms of *qi*-as-gas further animated Tang's understanding of the *qi* of Chinese medicine. Tang discovered an important East-West convergence to explain respiration, or the process of sustaining life through the act of breathing. In Chinese medicine, Tang explained, humans received yang from Heaven through breathing. This heavenly *yangqi* (陽氣) in turn nurtured the body's internal *qi*. Tang found a useful equivalent in chemistry: "The Western Study of Change states that humans live by breathing the *yangqi* (養氣) of the void. This so-called *yangqi* is none other than the yang of Heaven" (Tang 1908, 1:2b). Here, the impact of translations in early chemistry texts, in which the word used for "oxygen" was composed of two separate characters (the character for "nurture" [*yang*] and the character for gas/*qi*), is clear. Tang linked this Western flame- and life-nourishing *qi* (*yangqi* 養氣) to the Chinese concept of "*yangqi*" (陽氣). This second "*yangqi*," though pronounced similarly, is a different word. Tang's "*yang*" is the yang of "yin-yang"—*yang* as a quality embodying movement, speed, brightness, and heat. For Tang, the word for "a gas that feeds the flame of life" served as a linguistic bridge helping him to create commensurabilities between Chinese and Western medicine.

It is important to point out that Tang's *yangqi* (陽氣) was not just a *thing*: it represented an overarching transcendent category that ordered the entire universe. Tang allowed that Westerners had hit upon the equivalent of "the yang of Heaven" with their idea of oxygen in the air humans breathe, but he criticized Westerners for missing the obvious existence of the yin of Earth, present in the food that humans eat. In Tang's estimation, without the ordering categories of yin and yang, Western science texts simply introduced a jumble of *bowu* (myriad things), and thus lacked the superior fundamental principles of Chinese science. Tang did try to discern the fundamental principle of Western science—an equivalent of yin and yang—and he turned to a rather surprising place to find it:

Western medicine speaks of a "Lord of Creation" that benevolently nurtures humanity. This so-called "Lord of Creation" is in fact the god/spirit [*shen*] of Heaven and Earth. This is similar to the basic Chinese principle that "humans are born of Heaven and Earth"—the idea is more or less the same, but the words are slightly different.... "Heaven" and "Earth" are nothing more than yin and yang, which transform *qi* to produce the Five Phases and the Six Climatic Influences. (Tang 1908, 1:2b)

As we have seen, regardless of the technical nature of their texts, missionary translators often emphasized the central role of "The Creator" in their work.

Inspired by his careful reading of missionary science texts, Tang discerned that the starting point for Western science is God. Whereas Tang acknowledges that the West defines The Creator as a transcendent spirit, he finds a Chinese equivalent in the far more imminent idea of yin and yang. For Tang, the “Lord of Creation” is best captured by the Chinese idea that humans are inextricably embedded in the natural world, a world that is *qi* ceaselessly cycling through yin and yang. Tang sees this “Lord of Creation” as a Western personification of the patterns of the cosmos, an invisible force manifest in the myriad things of the universe in the same way that *qi*, through yin and yang, is manifest in the “ten thousand things” that make up the universe. Tang seems unconcerned by the spiritual nature of this Lord of Creation; he takes no pains to separate spirit from matter, the natural from the supernatural. Instead, he toggles back and forth between God and gas, without concern about how to distinguish one from the other.

Tang’s *Convergence* does include some explicit mention of something that could be directly translated as “spirit”—the resident *shen* (spirits) of the five *zang* (organs) of Chinese medicine: the Heart, Liver, Spleen, Kidney, and Lung (Pi 2008, 373–385). Tang defines these spirits as “refined, animating *qi*” that resides within the organs and adheres to the patterns of the Five Phases. These animating entities are directly linked to the powers of perception and certain types of emotion, and even dreams. The Heart is the keeper of the *shen*, which controls human consciousness of the external world—Tang describes it as a “fire” or energy that illuminates the brain, allowing it to perceive. The *hun* is the refined yang essence that animates *qi* and is stored in the Liver. Its activities facilitate a variety of physical functions, including the acts of vision, sleeping, and dreaming. It resides in the eyes during the day, allowing sight, and returns to the Liver at night, facilitating restful sleep. An unsettled *hun* can lead to nervousness, anxiety, and frequent dreams (Tang 1908, 1:17a). In a brilliant rhetorical move, Tang demolishes the Western reliance on apparatus to define reality by using the example of dreams:

Westerners have the same human experiences as Chinese. This being the case, we might ask them: this thing that appears as a murky image in our sleep at night, perceived as if we see it, what sort of thing is it? On the cause of dreams, they are silent. They cannot know the cause, because *hun* is not something that can be revealed through dissection, and dreams are not something that can be measured with machines. (Tang 1908, 1:17b)

For Tang, Chinese medicine had a clear understanding of dreams—they were caused by the restless wanderings of *qi*-based *hun*. But Westerners, with their reliance on machines, were at a loss to understand the phenomenon, even though they could be readily understood by reliance on human experience and perception. Tang viewed Western science as an inelegant empirical hodge-podge, a complex but ultimately futile manipulation of tubes, flasks, and Bunsen burners. In the end, these manipulations only revealed the existence of certain limited types of *qi* that Chinese medicine had long understood without the aid of any apparatus. Westerners had missed the larger underlying truth about *qi*. For Tang, *qi* was like oxygen and *qi* was

like God. There was no need to separate the two. *Qi* was a simultaneously transcendent and immanent entity that could be known through a deep understanding of classical heritage and the mindful perception of the human senses.

### **Qi and Contemporary Crises of Air**

How might these considerations of the history of air-*qi* connections, schisms, and convergences shed light on China's current airborne crisis? How do Chinese medicine and such practices as *qigong* square *qi*—the transcendent, life-giving force/stuff of the Heavens and Earth—with modern China's *wumai*? Are sensibilities about air-as-matter inflected at all with valences of transcendence? Are there reserves of traditional concepts that can be called upon to offer understanding and solutions?

Contemporary China is awash in newfound enthusiasm for traditional *qi*-based techniques. This fervor has involved a complex rediscovery of the benefits, mysteries, and potentially disruptive powers of *qi*, a popular reconnection with the “vital energy” flowing through the universe and the human body (Chen 2003; Palmer 2007; Farquhar and Zhang 2012). However, in public forums discussing the compromised state of China's air, and particularly the current crisis of *wumai*, the state of “*qi*-that-is-not-gas” is typically not the first item of concern. Instead, the harm to the body in times of bad *wumai* is presented primarily through terms grounded in the chemistry of air: respiration, oxygen, particulate matter, and specific harmful gases. On websites dedicated to the “ancient arts” of *yangsheng* and *qigong*, practitioners are warned of the harmful health consequences of inhaling polluted air, with particular attention paid to PM 2.5, the tiny particles of 2.5 microns or less that can lodge in the lungs, exacerbating asthma and heart disease, producing chronic bronchitis, and even causing cancer. Practitioners of *qigong* are cautioned to take their activities indoors, where they can continue to focus on their breathing but avoid inhaling harmful particulate matter. Even the steps of walking *qigong*, such as the popular Guo Lin *qigong*, can be modified to allow practice in smaller spaces such as exercise studios or urban apartments (*Teng xun shi pin* n.d.). If going outside and breathing harmful air cannot be avoided, *qigong* still offers restorative techniques, such as knocking the teeth, combing the scalp, and massaging the *dantian* (丹田),<sup>3</sup> once the practitioner has returned indoors (“Wu mai tian jianshen bu danwu, jianshen qigong shinei ke xing” 2014). Practitioners can also do Six Healing Sounds *qigong* (*liuzijue gong*) in the environment of their room, exhaling the sounds of *xu*, *hu*, *he*, *si*, *chui*, and *xi* in order to clear the *qi* of these sounds' corresponding organs: Liver, Heart, Spleen, Lung, Kidney, and Triple Burner (Yi 2014). In general, the harm to the human body is conceptualized in scientific terms, but the method of mitigating the harm shares resonances with premodern approaches. Individuals must strengthen the internal *qi* of their bodies and build resistance, but if all else fails, it is best to avoid the harmful external air by changing location. Perhaps *qigong* practitioners should not be so sure of the protection

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<sup>3</sup> An area of the lower abdomen thought to be the primary seat of the body's *qi*.

offered by retreat to the four walls of their domiciles: findings of European and Chinese atmospheric scientists published in *Nature* suggest that the air *inside* Chinese homes may contain up to a thousand times more volatile organic compounds and particulate matter than those found in European homes (Kulmala 2015). Whereas *qi* may be everywhere, alas, air is everywhere as well.

On occasion, deeper resonances with traditional Chinese cosmology emerge in websites dedicated to *qigong* and the *wumai* crisis, but the element of *qi* itself is missing, and is supplanted by a clearly environmentalist discourse. Some *qigong* authorities critique air pollution as an indication that “humans have violated the laws of nature.” Not only has unchecked industrialization caused environmental unbalance, but blame can also be found in “our anxious society, an education system only concerned with personal monetary success, and the ruthless exploitation of nature.” Under these circumstances, smog is only one way that nature exacts “revenge.” If humans do not awaken to this moral problem of society, then “natural disasters such as floods, earthquakes, freezing snow, and smog will become the norm, and humans will suffer the consequences.” This “awakening,” though, is primarily a matter of changing individual mental outlooks. Not only do individuals need to practice *qigong*, avoid going outside, and practice self-massage, they also need to “cultivate an attitude of cherishing nature,” a personal change of heart that would somehow result in a better world (“Wumai tianqi hua yangsheng” 2016). “Offshore” websites maintained by the banned spiritual organization Falun Gong contain even more ominous warnings of the ways that moral corruption—particularly by government officials—can lead to environmental disaster such as smog, but there is little discussion of the role of *qi* itself in mediating this process (“Beijing jizhong wuranwu shi shenma” 2013). In the modern era, ideas of moral resonance between Heaven, Earth, and humans persist, but this crucial relationship lacks a substratum that binds the nexus together and accounts for its functioning.

What do contemporary authorities in the world of state-sanctioned Chinese medicine have to say about *wumai*? Over the past five years, commentaries on how Chinese medicine should conceptualize, diagnose, and treat the health consequences of smog have begun to emerge as a subgenre in official traditional Chinese medicine (TCM) publications. Despite minor debates about the correct way to relate smog to standard TCM categories, several common approaches are apparent. All define *wumai* first from a scientific perspective detailing the invisible pathogens as PM 2.5, sulfur dioxide, and nitrogen oxides. Discussion then shifts to parallels between modern air pollution and the various forms of pernicious *qi* described in premodern texts. For these authors, *wumai* is not a new phenomenon: such “hazes” were mentioned in the *Huangdi neijing* (Inner canon of the Yellow Emperor), and the character *mai* (霾) can even be found inscribed on tortoise shells from the Shang dynasty. *Wumai* is analogous to *shangang zhangqi* or *lingnan duwu*, the miasma that rises from the mountains of the southlands—a somewhat inaccurate claim, since premodern *zhangqi* was seldom associated with urban environments or industrialization. Defining *wumai* as analogous to certain forms of *xieqi* is primarily a philological move that facilitates the entry of smog into the logic and language of TCM. Some physicians classify *wumai* as a form of “special externally contracted pernicious *qi*” that impacts the body in a way similar to the six



(natural) climatic influences, even though this form of *xieqi* does not originate in nature. Using a combination of science and Five-Phases thinking, *wumai*'s scientifically defined metallic nature indicates that it will invade the lungs, since Lung corresponds to the phase of Metal. Its nature is Dry (another characteristic of the Metal phase), but at the same time, since it also contains water vapor, its nature is also Damp—a seeming contradiction that can be explained through yin-yang dialectics. Once *wumai* is in the body, its Dry and Damp characteristics create *tan* (phlegm) and impede the lung's ability to transform *qi*, thus harming the Triple Burner and the Spleen with internal dampness. But *wumai* is far worse than typical "Damp" *qi*. It also possesses a sort of *duqi* (toxic *qi*) that can lurk in the body undetected for years and eventually lead to death (Ma 2015; Zhang 2015).

In spite of the seriousness of *wumai*-induced illness, Chinese medicine has ways of treating and even preventing it. Through a variety of pharmaceutical action pathways, including clearing heat and releasing poison, dispelling dampness, moistening dryness, and bolstering *qi*, dozens of botanical and mineral substances from *materia medica* (the Chinese medical genre concerning medicinals derived from animals, plants, and minerals) can be combined in formulas to disrupt the pathogenic power of PM 2.5 (Shen 2017). Several authors claim that resistance to airborne disease can be achieved by strengthening the body's *qi* with proper diet and Chinese medicine, since an "externally contracted" illness cannot take hold unless internal weakness is already present. With this logic, even if harmful particulate matter is inhaled, it will not become truly harmful as long as the individual takes proactive steps to manage his or her own health.

Seizing on the idea that traditional Chinese medicine can shield the body from the effects of modern air pollution, several Chinese pharmaceutical companies (including the venerable Tong Ren Tang) have produced and marketed different types of "anti-smog tea" ("Lao Zhongyi wumai qingqing cha" n.d.). These over-the-counter concoctions are designed to "clear the lungs" or "boost the lung *qi*" with proprietary ancient Chinese formulas. Not only do these teas claim to lessen the impact of smog-borne toxins, but they also claim to be able to protect against toxins from secondhand smoke, car exhaust, and even the noxious fumes from air conditioners. Although these products are widely marketed and well received by desperate urban dwellers, critics in the Chinese media have railed against them. Some have likened Tong Ren Tang's anti-smog tea to the *fu shui* (talisman water) used by superstitious boxers (Chen 2017). No less a personage than Liu Quanqing, the president of the Beijing Hospital of Traditional Chinese Medicine, recently warned consumers that such teas are not only entirely useless against smog, they actually "contain ingredients that may cause health problems if taken for a long time" ("Chinese Medicine Expert Says 'Anti-Smog' Teas Ineffective" 2017).

One advertisement for "Qing Fei Yin" (lung-purifying beverage) is particularly illuminating of the air-based anxieties and the *qi*-based promises that fuel sales of this kind of tea. The advertisement features a threatening gray haze looming over an equally gray earth, with nothing but darkness on the horizon. The ad features the Chinese character *mai* (haze) with an English caption, "What's The Matter?" The Chinese is more poignant, proclaiming *shijie zenmale* (What is the matter with this world?) To the right appears an organic-looking brown paper bag

containing “lung-purifying beverage;” beside it sits a dose of the inviting amber-brown tea in a clear glass. Beautiful green leaves swirl around the tea, while in the background an image of a flourishing green tree with long branching green roots represents the freshness of the lungs after drinking this tea. The ad states, “Cherish every breath of air that we take. Purify our brittle and weakened lungs.” The advice is poignant and hopeful, but the contents of the brown paper bag seem like a flimsy defense against the environmental apocalypse looming on the horizon (figure 6).



Figure 6. Chengdu Guoyitang Pharmacy advertisement for “Qing Fei Yin” (lung-purifying beverage). *Source:* Youzan.<sup>4</sup> <https://detail.youzan.com/show/goods?alias=3f3z9ijylz0vp>

These remedies for the harms caused by *wumai* harken back to some of Chinese medicine’s most basic premises. Individual behaviors and precautions can cultivate *qi* in order to conquer disease. What matters most is the nurturing of one’s defensive and constructive *qi*: harmful external *qi* can be deflected by boosting one’s personal powers of resistance. Even if the environment is out of balance, even if the seasons have lost their natural rhythm, even if disastrous smog envelops the world, a “righteous *qi*” can still be found, cultivated, nurtured, and used to defend human health. Whether this is a valuable lesson or a misleading fallacy in the face of China’s contemporary air crisis is an interesting point for further discussion.

In almost all of these considerations of *wumai*, there is no *qi*, just air. *Qi*, with its potential for an explicit mode of connecting nature to the internal body and its transcendent, even sacred valences, has been displaced by oxygen, nitrogen, carbon, and particulate matter. The potential for the emergence of a discourse on a crisis of *qi* is encumbered by the complex historical relationship between *qi* and air. The gap between the two entities is formed by differences in how *qi* and air have

<sup>4</sup> Youzan (<https://www.youzan.com/>) is a third-party marketplace provider that allows purchasing via WeChat.

been perceived and how their ontologies have been formed: in essence, the historical differences in the relationship between the human mind and air, and the human mind and *qi*.

We have seen how Daoist adepts, practitioners of traditional health techniques, neo-Confucian philosophers, and physicians of Chinese medicine all understood *qi* as something of the work-a-day world and at the same time transcendent, linking the human body directly to the cosmos. The seventeenth-century Jesuits considered this understanding a threatening form of spirituality because it seemed to preclude the need for God and manifested an everyday sense of the sacred found in eating and breathing—the most basic functions of life. By the nineteenth century, air emerged in Western science as an object defined by laboratory apparatus and analyzable discrete constituents, but debates about its nature still allowed for creative air-*qi* intersections.

In our contemporary era, it seems that a Tang Zonghai-style convergence is no longer accessible. Tang felt no need to elevate or substitute science for Chinese medicine and cosmology. His own tradition was the primary carrier of truth, supplemented by interesting asides when a study of Western science uncovered similar concepts, but such similarities were not used for proof or verification. A large part of the reason that turn-of-the-century physicians such as Tang could discover points of convergence between Chinese medicine and Western science was that Western science itself—particularly the way it was translated by Christian missionaries and their Chinese collaborators—presented a multivalent cosmology full of invisible forces, some of which were imbued with transcendent, if not sacred, qualities. Tang interpreted Western science from this perspective and perceived the life-sustaining *qi* of Heaven in oxygen, discerned the rising of bladder *qi* in a steam engine's gases, and even saw an approximation of God (the root of all Western science) in the ineffable patterns of yin and yang.

As Lei has pointed out, the intervening “scientization” of Chinese medicine during the twentieth century separated Tang's era of convergence from the present day. For many Chinese reformers after Tang, making Chinese medicine modern meant overthrowing the idea of *qi*-transformation as the theoretical basis of Chinese medicine and seeking instead the “material basis for certain selective aspects of *qi*-transformation” (Lei 2014, 254). Others insisted that Chinese medicine should exist in a place apart from science in order to maintain its uniqueness. The resulting “mongrel” of Chinese medicine exists as “neither donkey nor horse,” an awkward hybrid that neither completely adheres to scientific precepts (despite the best efforts of some researchers) nor functions entirely in a separate realm. Lei suggests that this paradoxical situation in fact best captures the true nature of modernity, which, as Bruno Latour has claimed, was never really able to create a purified realm of scientific rationality. For Chinese medicine, however, this modernity is not without its anxieties and discontents. The distance between the comfortable chemical convergences of Tang Zonghai and today's TCM *wumai* researcher is proportional to the distance represented by the air/*qi* divide.

Some practitioners in China today, self-labeled adherents of an outside-the-establishment (*tizhiwai*) classical Chinese medicine, may exemplify an approach that comes close to a type of convergence that has been absent for more than one

hundred years. As fruitfully examined by Mei Zhan, these practitioners “quietly challenge some of the most deep-seated assumptions” of state-sanctioned institutional TCM with forays at once playful and mindful into ancient philosophies and practices (Zhan 2016, 247). Far from simply injecting a forgotten “spirituality” into Chinese medicine, these practitioners eschew the polarization of reality into secular and sacred, and delve into both Daoist practices and biomedical science “without establishing their ontological priority” (2016, 259). Most revealingly, they insist that Chinese medicine is an “immanent ‘way’ (*dao*) to inhabit mundane and profoundly disharmonious worlds and lives” (2016, 247). If we look beyond state-sanctioned publications and commercial websites, we may find that practitioners of mundane *yangsheng* activities in today’s cities may also select from a wide range of ideas to create a bricolage of survival strategies that can both elevate daily life and challenge the status quo (Farquhar and Zhang 2012). There is still potential to find *qi* in the air, to apply the mind to thinking about what is being breathed in beyond the analysis of its constituent components. Perhaps such a reorienting from air to *qi* could provide a social awareness—beyond a concern about carbon dioxide or parts per million—that could be the basis for a social transformation of China’s air.

Of course, as recent events have taught us, such concerns about breathing are not limited to China but are global concerns that are experienced close to home (wherever that may be). *Zhangqi* is difficult to escape. Articles about the 2017 Northern California fires frequently compared the air quality in San Francisco with that of Beijing in order to highlight how truly bad the air was (Murphy 2017). Whereas commentators in the U.S. media cautioned that it was too early to link those fires to climate change, scientists have already clearly demonstrated that urban China’s bouts of bad air are not simply the direct result of the factory fumes and car exhaust produced in that country alone; they are instead brought about by the steady and ongoing alteration of global weather patterns— melting glaciers in the Arctic, storms in Siberia, the stilling of winds over Central Asia—all linked to global warming (Meyer 2017; Zou et al. 2017). Like the Beijing *qigong* practitioners who mistakenly think they can avoid ill health by retreating indoors, we must all confront the fact that “air” is everywhere, and increasingly we are left with no place of refuge. Perhaps it would be useful for all of us who live “between Heaven and Earth” to consider, with every breath we take, the possibility that what we are breathing is more than just air.

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### About the Author

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