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The 'Problem' of Science in China

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Abstract The overall 'problem' in early accounts of science and/or medicine in China seemed to center upon whether or not China possessed or could acquire modern Western science. However, in the twenty-first century there is now little debate over whether or not China has science. Yet, questions and concerns about science in China linger. The 'problem' of science in China has moved away from a paradigm focused on possession or capability, to that of the correct or ethical application of Chinese science and technology. In this essay, I will argue that the shifting of the so-called problem of Chinese science reflects larger Western concerns about the definition and control of science itself, the rise of China as an international power, and the ability to 'compete' in a global market predicated on the creation and application of new science and technologies.

Keywords China · Science and technology studies · Western science · Chinese science · Globalization

> China is what one might call a secondary reference point, the focus of important discussion that contribute to debates about central common meanings. Richard Madsen, China and the American Dream
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> Where will we see the next great scientific achievement? Will it be here in the United States? Or will it be in China? U.S. Senator Christopher Dodd, said on the Congressional Floor, March 2005

In April of 2007, an intense U.S. Congressional spotlight was focused upon the dual issues of education and international competition with China and other Asian

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nations. Much of the discussion on the Senate floor centered on the United States' ability to maintain its hegemony over the production and retention of new science and engineering professionals, which were themselves viewed as providing the United States with a competitive advantage over the rest of the world. The "America Competes Act", legislation that would fund better educational packages for universities and increase funding for basic research—all in an attempt to bolster the United States' international competitiveness—was signed into law by President Bush in August of the same year. The public record of bipartisan support for the act highlighted underlying economic woes; as many Congressmen argued in the Act's defense, a lack of funding for higher science education had—and would continue to have—direct ill-effects on American business and industry. Both Republicans and Democrats decried the resultant loss of the U.S. advantage in relation to its main perceived challenger—China. Supporters of the "America Competes Act" repeatedly posited China as an emerging powerhouse of scientific research and technology. Thus, China was often rhetorically cast as a direct challenge to, and competitor with, the United States because of its growing scientific and technological prowess.

Yet, this more recent view of China as a rising center for scientific excellence seems in odd juxtaposition to past accounts of the poor development of science within "The Middle Kingdom". In early modern discussions of China, the 'problem' of science seemed to center on a series of interrelated questions: Did ancient China have science? If so, then what happened? Why did a country with the fundamental concepts of science and/or rationality stop progressing? Why didn't China have its own scientific revolution? Science being, in these formulations, the largely Western conception of it—the social institution of Science that uses the scientific method, objectivity, inductive reasoning, and progresses into a specific definition of modernity through meticulous experimentation. In his book, *The Problem of China*, the early twentieth century philosopher Bertrand Russell lamented that the Chinese lacked only Western science to save themselves from being overly manipulated by foreign powers like Japan or America. What had made the West "superior" to China were not the modern trappings of civility, manners or literature, but rather "Newton and Robert Boyle and their scientific successors" (Russell, 36). Science here is akin to knowledge and modernity writ large. One could have no true or real knowledge or progress unless one came into it through the process of Science.

At the start of the twenty-first century, there now appears to be little debate about whether or not China possesses such 'Science'. Throughout its recent development, China has acquired a Western version of science and readily adopted it to Chinese practices and problems. Questions about science in China, however, still linger. But instead of asking whether or not China *has* science, the overarching question now revolves around whether or not China *practices* science correctly, if it utilizes science ethically or rightly, and if it has anything of its own to offer modern (Western) science. The development of a so-called *Chinese science*—defined for the purposes of this essay as any scientific or technological practice and/or research being performed by native Chinese scientists within China's national borders—has been transformed into one of the central problems of Chinese and Western exchanges and interaction. In this essay, I will argue that the recent U.S. concern

over China's scientific competence underlines a dramatic shift in how 'science' in China has been conceptualized and/or problematized in the West.[1]

China is continually being posited—in both popular and official accounts—as a nation that 'steals' Western scientific techniques, technology, methods and knowledge only to re-brand them in its own name. In a statement echoing many of his colleagues and their constituents, U.S. Senator Evan Bayh decried China's complicity in the 'stealing' of intellectual property on the Congressional floor in 2005: "The cheating, and as I have said, that is what it is, comes in many forms, such as the theft of intellectual property. I am told that more than 80% of the business software in China today is pirated" (Congressional Record S 4370). In addition to being labeled as 'thieves', China has also been cast as an authoritarian government possessing a secretive science, or one that does not adequately share information or cooperate with Western scientists.[2]

In many recent Western narratives touching upon the topic of Chinese science, akin to those briefly alluded to above, China betrays international scientific standards of intellectual property and ethical conduct. Yet, these transgressions are not seen as a problem of science itself, or with the individual conduct of Chinese scientists, but as problems of government and inadequate regulation. Borrowing an image of China from Judith Farquhar as 'suffering from deficiencies and excesses' (155) in both its bodily and national form, I point to the dual notions of excess and deficiency in relationship to Chinese science and technology, where scientific techniques are thought to be *in excess*, whereas an adequate understanding of and/or ethical relationship to the scientific method or practice is increasingly defined *as deficient*. Chinese science is, then, an *insufficient science*. The notion of an insufficient, or badly applied, Chinese science disavows the 'myth'—in Richard Madsen's use of the term—of the American and/or Western dream of progress, liberalism and truth, where truth is intrinsically linked to what is 'good'. China's practice of science troubles the Western ideal that science and its rationality will 'triumph' over the world, ultimately paving a smooth path toward greater freedom and democracy.

Throughout this essay, I will both echo and attempt to answer similar questions with which my foray into the 'problem of science' in China began: What *kind* of science is a *Chinese science*? And what are the consequences of its application? Is democracy central to the practice of an 'ethical' science, or intrinsic to the very definition of science itself? Or does the development of a so-called Chinese science call any linkage between democratic values and the practice of science into question? What other types of questions might a Chinese brand of science pose for

[1] By the West, I generally refer to the U.S. and European view of the East (typically both Eastern and Western Asia). Although most of the materials examined throughout this essay are "American", I am in no way conflating or confusing the "American" with "Western". I am, however, suggesting that the "American" can often be indicative of the larger "Western" viewpoint. For an interesting British example of this phenomenon, see P. Shetty, "Will Britain be sidelined by the rise of Asian science?" in The Lancet, Volume 369, Issue 9564: pp 813–814.

[2] Accusation of secrecy and calls for greater transparency are especially poignant in the field of public health vis-à-vis the need for international cooperation to prevent global outbreaks of diseases such as avian influenza or SARS.

us as researchers—and for the discipline of science and technology studies as a whole?

In the first section, I will begin by examining a few early texts on China that help to illuminate the long history of attempts to locate and/or promote the development of 'Western science' in China. Then, I will track the shifting of the problem of science from initial attempts to locate science in China to more recent efforts to define, describe, and examine the development of modern science in China. Finally, I will end by briefly analyzing current texts dealing with the practice of a uniquely 'Chinese' science, either from an academic or a larger political and cultural perspective. For each section, I have purposefully selected texts quite randomly and widely—some by well-known authors that have had a great impact on the field of China studies, such as Joseph Needham, and others by authors that are less recognizable but whose work arguably offers another window into how Chinese science both was and is conceptualized. The intent is to provide the broadest possible overview in a too-small amount of space, and thereby to provoke further research.

In the conclusion, I will suggest that the 'problem' of science as it is located within narratives concerning China, or so-called sinologized or Chinese science, is a problem of interpretation. In question is the definition of science as a fundamentally 'democratic' practice. At stake is not only the ability to define what science itself is and can be, but to shape and control its direction, to evaluate its 'proper' or 'ethical' use, and to direct the course of future research programs.

1 From Rehabilitation to Nervous Optimism: Efforts to Find 'Science' in China

Before returning to my central focus of the ways in which formulations of the 'problem' of science in China are changing, I would like to begin this essay with a brief examination of prior efforts to locate a Western-defined 'science' within China. An analysis, however cursory, of early and modern attempts to answer the question of whether or not China *possessed* 'science' are integral to understanding the eventual shift that took place in relation to the 'problem' of what would come to be seen as a uniquely Chinese science. Missionary texts and histories written about life in early China, some dating to the middle of the thirteenth century, provided later scholars with evidence for locating science, technology and/or rationality in early Chinese society (DeGroot 2003 [1912]; Doolittle 2006 [1876]; Gernet 1962; Van Gulik 1996 [1961]; Wittfogel 1957). These authors, chosen as much for their present-day obscurity as for their thorough analyses of Chinese life, religion and culture, provide modern researchers with a snapshot of how 'science' in China was conceptualized by early China scholars.

For J.J.M. DeGroot, a scholar who studied and lived in China for 6 years during the late nineteenth century, the Chinese had never developed "a correct science of Nature" (9), as in the West. Instead, they relied upon what DeGroot termed 'universism', viewing the entire universe as a living organism. For DeGroot, such beliefs were no more than "hocus-pocus masquerading as wisdom" (171), even though it undergirded much of Chinese medicine or 'science'. In the end, DeGroot believed that only modern Western science would save the Chinese from their illogical ideas, pushing them into the twentieth century.

The missionary Justus Doolittle, writing as early as 1876, aimed to give Western readers a 'rationale' for the entirety of Chinese culture (vii); no detail or minutia of daily Chinese life is left out of his two-volume opus. Doolittle goes to great pains to give his readers an accurate picture of China. Indeed, his fondness for the people of the country he spent over ten years in is obvious, despite the harshest judgments of their customs, their opium addiction, love of gambling, reliance on superstitions, and the overall state of their souls in his account. Doolittle does not spend a great deal of energy on the state of science in China—partially because he thinks that they do not have it. He writes that: "Little true science is taught" (Doolittle, 435). Doolittle attributes this to the fact that the Chinese people are "very practical", and do not find much use for abstract subjects like "science, or philosophy, or history" (409).

Jacques Gernet, writing in the 1960s about the medieval period in China, agreed with Doolittle. Gernet's question in writing about daily life in the thirteenth century seemed to revolve around a single puzzle: why had China not modernized? He finds his answer in the educational and social system of China—one that stifled individualism and development. If the Chinese were refined, they were also 'irrational' (Gernet, 247). In a passage describing the formidable medical knowledge of the Chinese, Gernet writes that although Chinese traditional medicine might have something to offer modern medicine, the Chinese made no use of their "detailed observations" (167). Rather, in China, Gernet argued that: "Theory preceded observation, and observation, even when it was original and constituted a discovery, was never followed up for its own sake, but always integrated into the theory" (167). Yet the Chinese theory itself was flawed; it was not "of a scientific character" (Gernet, 169). In his study of the sexual life of ancient China, Van Gulik agreed with Gernet's assessment of Chinese medicine, suggesting that China was "weak in anatomical science", but strong in its understanding of sexual psychology (38). For both Gernet and Van Gulik, it was Chinese society and culture that blocked the development of logical thought—and with it, science. But for Karl Wittfogel, it would be the development of the autocratic and/or despotic governmental state that would block the modernization of China. Wittfogel argued that the need to control water resources led to the need for grand hydraulic projects. Thus, China had no lack of engineering prowess. Great technological knowledge was required to run an increasingly strong state apparatus. But technology here is arguably not the same thing as 'science' for the sake of knowledge; rather, it is applied knowledge. In Wittfogel's argument, we can see already discern an early instance of the modern problem of science in China, or the problem with its use or application.

In sum, for these early authors themselves, science in China was both a peripheral interest and a persistent question mark. But not one author writing about China failed to look for the fundamentals or rudimentary beginnings of a Western 'science' in China. This question of whether or not China possessed science was taken up most effectively by Joseph Needham, who performed an exhaustive multi-volume study of science in China and its relationship to Western science. It is to the largely *rehabilitative* quest of Needham's to locate the beginnings of a modern science in China to which I will turn first.

For Joseph Needham, science was conceptualized as "an essential ingredient in the development of human culture" (1). In other words, for Needham, himself a scientist, 'science' was an unproblematic term, a concrete notion of rational inquiry

defined by the milieu and time in which he practiced. Science was inextricably linked to notions of progress, modernity and development. Thus, the central question which China posed for Needham was not one of what *kind* of science could be found in China, but why China had never developed modern science in the first place. Needham's project was to retrace the history of science in China, and to highlight the contributions that Chinese thought might have had on Western science. For Needham, early Chinese 'science' or rational thought was 'quasi-empirical' (2). The Chinese might have lacked sufficient 'theoretical ideas', but from Needham's vantage point they were largely "amenable to the application of science" (2).

The problem, for Needham, rested in how the Chinese conceptualized 'reality'. For a modern scientist like Needham, reality was something measurable and knowable only through the scientific method. Through the process of objective experimentation, one could know something about things, forces, and chemical substances *as they existed* in the natural world. For the Chinese, however, science proceeded less 'rationally'. Confucianism and Taoism has left China in a state of utter scientific confusion, where the connections between magic and science were never fully severed (37). Chinese thought thus operated under a rubric that Needham termed 'scientific humanism' (53), where one could only know something about things, people and forces through their relationships with other things, people, and forces. This, for Needham, was at the crux of the difference between science in China and in the West. The West thought of reality in its *substance*, whereas the East thought of reality in its *relation* (78). Although in Needham's final analysis, the early Chinese were adequately skeptical and empirical, they lacked the fundamental 'method' by which science progresses. *They were missing the scientific method*, as it was commonly understood in the West (191). For Needham (1978), the Chinese enjoyed a 'spirit' of technology without the sufficient 'theoretical background' necessary to develop it (103). Consequently, scientific progress had stopped short in China, while it had continued to advance in Western society. Western science, though it might have benefited from cultural exchanges with China throughout the ages, had in essence leapfrogged over China to become the paramount leader in modern science and technology. The early 'genius' of China had been transferred to the West.

Scholars like Needham and Doolittle, who had intimate contact with China and who could speak and read Chinese, were more likely to defend China's grasp of 'science' than to argue that the Chinese were somehow inherently ill-suited for the pursuit of modern knowledge. Not a few researchers of science and medicine in China who followed Needham also tried to *rehabilitate* early accounts of Chinese science or traditional medicine, or to recover Chinese science from the common, largely Western, scientific view that it was somehow *deficient*. A student of traditional Chinese medicine, Judith Farquhar is a pertinent recent example of this phenomenon within anthropology. Farquhar, although writing about present-day China, can in many ways be conceptualized as a descendant of Needham's view of Chinese science. Farquhar not only locates a 'science' of medicine in China, she is optimistic about what it can teach Western science. Yet, unlike Needham, Farquhar's work shows evidence of a shift in the question, from whether or not China *has* science, to one focused more upon the *practice* of science—in this case, of medicine. Her book, *Appetites*, provides us with an appropriate theoretical bridge between earlier and more recent authors.

Farquhar argues that modern biomedicine and traditional Chinese medicine both share a common conceptualization of the body. As Farquhar explains: "Both locate disease processed within and immediately around individuals; neither has the time or resources, nowadays, to devote much attention to the more population oriented practices of preventive medicine or public health. Moreover, disease (or at least disorder) is their common problem" (25). Yet, even for Farquhar—a defender of Chinese medicine, there are stark differences. Chinese medicine is not only efficacious, but contains within it a different power structure from biomedicine; one that is not, for Farquhar, what we in the West might be tempted to call 'political' (47–48). She does not locate the Western notion of 'biopower' in the body of traditional Chinese medicine. Rather, as she argues, the "experimental side to Chinese medicine encourages a personal micropolitics, as patients seek to govern themselves and their immediate environment using techniques that fuse thinking and feeling, forming habits that make sense to their own senses" (Farquhar 2005, 66).

What is needed then, according to Farquhar, is an analytical approach to Chinese medicine that navigates the rocky terrain of both structuralism and functionalism. She writes: "If ethnography searches for a 'logic of the concrete' or a 'science of the tangible', then, it must always work on both sides of these somewhat oxymoronic terms. That is, both logical-scientific forms of knowledge and concrete characteristics of the social life must be kept in play" (Farquhar, 58). From this argument we can see that 'science', for Farquhar, is definitively *not* Needham's monolithic Science. For her, science "is a representational practice" (Farquhar, 219). By using Western methods of science to define and locate object like 'sex' in China, the study itself helps to construct the object of inquiry (Farquhar, 220). But construct it for who? For the Western researcher, or for the Chinese themselves? Farquhar points out that the Chinese researchers are not immune to the standards set for them by the Western scientific community. Thus, the Chinese scientists' use of concepts such as 'civilization' and 'development' are tied to the dual notions of 'modernity' and a 'chronic lack' (Farquhar, 227). It is China that is 'chronically lacking' or *deficient* in modernity here—which, in this kind of construction of the 'problem' of science in China, is equated to a lack of access to modern scientific techniques, equipment, methods and theories. It is to this more recent notion of a Chinese deficiency or lack, or what I will denote as a formulation of *insufficient science*, that I will explore throughout the following section.

2 A Post-Tiananmen Shifting of the 'Problem' of Science in China: From Theory to Practice

> To take such an attitude is to seek truth from facts. "Facts" are all the things that exist objectively, "truth" means their internal relations, that is, the laws governing them, and "to seek" means to study. We should proceed from the actual conditions inside and outside the country, the province, county or district, and derive from them, as our guide to action, laws which are inherent in them and not imaginary, that is, we should find the internal relations of the events occurring around us. Mao Tse Tung, "Reform Our Study" (May 1941)

The above quote from Chairman Mao illustrates the 'relational' view of reality that Joseph Needham pointed out as the fundamental difference between the Western and Eastern conception of 'science'. But if Mao's science was a Marxist–Leninist, or, one might say a socialist science, then during the post-Mao period of China Deng Xiao Ping effectively ushered in a 'reformed' science. It has been commonplace in recent Western analyses of Chinese history to assert that post-Mao China's newfound attention to the development of a modern science and the importation of modern technology led to a rampant policy of 'scientism' or 'technicism', where science became cast as the politicized cure for all that ailed China. Science was the pivotal key to economic and technological development; it was the solution to every problem. As Merle Goldman and Denis Fred Simon argue in their co-edited volume on science in post-Mao China, the goal of modernizing China "became something of an obsession" for the Chinese political elite (3). Modern warfare, said the then president of the Chinese Association of Science and Technology, would be 'intellectual' in the future, and waged upon the battlefields of science and technology (Goldman and Simon 1989, 4). Now that China has 'opened up' to the West and had accepted Western science, the question of whether or not China had or possessed 'science', became moot. The overriding questions for Western observers of China, especially in the wake of the Tiananmen Square incident in 1989, became: (1) Can China develop an advanced science?, and (2) Will that science lead to 'structural reforms' that in turn lead to political change? (Goldman and Simon, 18)

In this section, I will attempt to trace out the shifting terrain of the 'problem of science' in the post-Tiananmen period. Once China possessed Western techniques, methods, and knowledge of science, there was no longer any doubt about the direction of future research in China. It was assumed, in large part, that China would continue down the Western scientific path, seeking to advance its techniques, skilled personnel base, and research knowledge. However, in the aftermath of the clash between the government and students in June of 1989, Western observers began to worry about whether or not the science that they had 'given' to China in a Promethean-like manner, would be utilized in the 'wrong' ways. This generated what I will call the 'first rush' of concern about the *practice* of science in China. It is Goldman and Simon's book, *Science and Technology in Post-Mao China*, itself published in 1989, that will provide me with the framework for my analysis of the 'science problem' paradigm shift.

First, Goldman and Simon laid out their terrain; they would examine the recent history of science in China. Their book's stated aim was to explore new advances and setbacks in the adaptation of Western science to Chinese thought. Within this formulation, science is posited as struggling against traditional forms of Chinese thought, or coexisting in an uneasy alliance. For Goldman and Simon, Chinese culture naturally "inhibits questioning, uncertainty, alternative views, and intellectual pluralism" (18). For it to develop in China, Western science would need to uproot any cultural attributes that thwarted it. The argument here reminds one of Wittfogel's view that China is an exemplar of a *successful* regime of oriental despotism—capable not only of authoritarian control, but of effective technological advances (if not *true* science). Yet, for all its attempts to import Western science and its attendant values, it is not China's fault—yet, at least—if it is not successful. For Goldman and Simon, China's very history and societal structure prevent it from realizing its goal

of a modernized science. China is too 'backward' to provide soil fertile enough for science to take root and flourish.

Throughout a series of scholarly articles in Goldman and Simon's volume, China is continuously described as being hamstrung by a 'traditional culture', having never experienced either an 'industrial' or a 'technological' revolution. The Confucian literati were poorly suited for science, because "their mental processes limited the development of science and technology" (Goldman and Simon, 4). In addition, China had no *spirit of inquiry*, no passion for hands-on experimentation. As explained by Goldman and Simon: "They did not develop the mental ethos associated with scientific investigation—such as skepticism, innovation, and inquiry into the unknown, processes associated with scientific and technological development" (5). Scientific method, if it was used at all in 'old' China, was used only to rehabilitate the 'sacred texts' of the Confucian literati (Goldman and Simon, 5). Given all these carefully enumerated, inherent cultural 'limitations', it is "not surprising that China did not develop modern science and had difficulty in absorbing Western science and technology" (Goldman and Simon, 5).

During the May 4th era in China, the so-called Confucian intellectual 'vacuum' was filled by an obsession for science and technology. 'Scientism' replaced the belief in 'Confucianism' (Goldman and Simon, 6). Goldman and Simon go on to argue that the Chinese "*uncritical embrace of Western science and technology reflected little understanding of what it was*; they did not absorb even the spirit of skepticism and inquiry into the unknown necessary for its development" (6) [emphasis my own]. Partially, they argue, because during the Mao era, control over scientific research remained in political hands. For both authors, this was a crucial problem. If the leaders had a poor understanding of science, the argument ran, then any attempt to facilitate the development of an applicable science would come to naught (Goldman and Simon, 7).

Post-Mao China embraced Western techniques, yet early versions of a Western-style science in China were too overtly politicized and centralized for it to be considered a 'true' science. Western science was still considered to be, however, *the* "catalyst in China's modernization program" (Goldman and Simon, 11). There could be no progress without science, despite the fact of it being a largely imperfect science. Goldman and Simon warn us that: "Having access to advanced technology is one thing; being able to assimilate it effectively is another" (12). The Chinese could not be counted on to help themselves. They *had* science, but not the correct theory to *apply* it. The emphasis here is not on a knowledge of or access to scientific theory or method, but on the *practice* of science itself. The Promethean fire of the scientific method, it seemed, could not be controlled effectively within China.

It should be noted that Goldman and Simon never question the close association of science and values. For them, Western science and the values of freedom, independence and democracy are inherently and absolutely linked. They assert that in an acceptance of Western science, it is completely impossible to "keep out Western values" (Goldman and Simon, 14). Or, to put it another way, they argue that: "There is no way to let in one element of Western culture—its science and technology—and filter out the rest" (Goldman and Simon, 14). For Goldman and Simon, China's acquisition of scientific techniques would be a Trojan horse, smuggling into China the seeds of political change. In their final analysis, Goldman

and Simon conclude that "China has the potential for developing modern science and technology", but only if it can overcome the political system based upon its outdated cultural traditions and Marxist–Leninist–Maoist thought (20). The strong link sketched out between science and values is not unimportant here, for it will hold the key to understanding why concern over China and science shifted from one of possession to one of practice.

Goldman and Simon were not alone in their post-Tiananmen assessment of science in China. Nor were they alone in thinking that a greater access to science would necessarily lead to the development of democracy in China. For scholar H. Lyman Miller, these were foregone conclusions, heralded by the role of scientists in the student-led protests of 1989. For Miller, science in China had been politically appropriated by both Marxists and liberal-minded scientists alike (4). He suggested that:

> For scientists such as Fang and Xu, the antiauthoritarian norms of science translated easily into a classically liberal politics. The message these scientists carried into the larger political arena defended above all the sanctity and worth of individual autonomy and conscience above the claims of state and society. They advanced a pluralist politics rooted in appeals to reason. (Miller 1996, 4)

Again, we see Western values and ideals being packed into the science. Science, as it is defined here by Miller, is not dissimilar to Richard Madsen's idea of the social institution as "a moral enterprise, a set of sanctioned norms giving direction and shape to the way we live" (xvii). Science in these terms is part of a linear evolution of forms; from greater science to greater technology to greater production to greater economic freedom to greater democracy. One necessarily leads to another, in quick-fire rapid succession of progressive goals and values turning into social facts. For Miller, science was the last and greatest hold out of the "liberal myth of China as a troubled modernizer" (Madsen 1995, 29). In Miller's formulation, a science naturally linked to 'liberalist' values and ideals—being inherently 'pluralist' (7)—would save China from her worst characteristic of political oppression. But only if it could be wrested out of the hands of so-called scientism.

Those who espoused a scientism-like belief in science had their own ideals about what science should be, ideas that stressed 'practice' as the final criterion of policy correctness" (Miller, 9). Practice here being a derisive term, linked to Deng Xiao Ping's argument that only what worked in practice, or what served Party goals, should be accepted as good science. Science in Deng's era became the ground on which political decisions were made, eventually leading to a situation where state and science had become problematically intertwined (Miller, 6). In Miller's account of the post-Mao period, science in China had been largely co-opted by the state, and made a handmaiden to the Communist authoritarian government (6).

As for the scientists themselves, they provided a foil for political dissent. Physicist Fang Lizhi, the leading figure in Miller's narrative, argued that philosophy should serve as a tool of science, but should not impose itself on it (161). Science, in other words, should have no larger authority other than itself. Scientists in China understood the values of science as being under attack by the government, and practiced an "open, liberal dissent through the reform years" (Miller, 17). Enlightened and Western-trained scientists were, however, ill-equipped to hold out

under the pressure of such dismal political circumstances. Miller suggests that: "Disillusionment with and antagonism toward Marxist–Leninism threatened confidence in science itself. By the late 1980s, the Dengist reforms had made some scientific intellectuals a stranded and alienated elite" (18). In Miller's analysis, then, the trouble was not due to a lack of good science, but a dearth of political openness and its attendant ability to practice good science. Yet, Miller's argument is similar to that of Goldman and Simon here in that it suggests that the environment and current society of China were unfit for the practice of modern science. At stake was the very definition of 'practice', as defined by both modern science and Deng's brand of communist thought. The point is underscored in the following quote:

> With respect to science, this tension was manifested in the problem of deciding who directs concrete work in specific fields of scientific research, paralleling the similar problem of delineating authority between Party officials and enterprise directors in the industrial team.... This tension was also manifested more abstractly in the problem of specifying who could legitimately interpret the significance and meaning of science's results, especially as they bore on the reinterpretation and revision of Marxism itself. (Miller, 66)

What I find of specific interest in this quote is the emphasis on who has the power to define what terms, and who has the cultural authority to *interpret* the meanings of the science which was being performed. The notion of interpretation is important here. It not only suggests that the Chinese were *misinterpreting* Western science, but also highlights the admission that different interpretations or translations of the meanings of science were at stake. The problem of interpretation left the proverbial door to the democratization project open, and caused scholars of both science and politics in China to question any easy assumptions about how and when science and technology transfer would positively affect the political system in China. Progress, development and modernization began to look like fuzzier terms. In post-Tiananmen China, hopes for a quick transition to democracy started to fade.

The dual problems of interpretation/translation and values/ethics are what are at issue in the next formulation of the 'problem of science' in China. If China now had a hold on the 'modern', had science merely become a tool for the "Red menace"? Moreover, how was that possible, if science held the key to great democracy? Was science being practiced poorly? Or had the "diplomats of science" failed (Madsen, 95)?

In the concluding article from Goldman and Simon's volume, Richard Suttmeier posits the new problem of science in China as one of *theory versus practice*. He charges the Chinese state with practicing a "'technological nationalism' in which 'choice-of-technology' decisions are expanded beyond the bounds of strict economic, or even more general instrumental, rationality to include considerations that seem to have both political and psychological overtones" (Suttmeier 1989, 378). It is the 'political and psychological overtones' which are meant to be universally damning. As Westerners, and products of objective science, we are meant to understand intuitively that true science is not political or psychological. Or is it?

Decades of science studies research has suggested otherwise. The paradox of Chinese science, which Simon labels as "*the maladjustment of theory and practice*" (Simon 1989, 379), is a common attribute of all science, including our own Western

brand of it. However, willfully or not, Suttmeier is largely ignorant of this postmodern definition of 'science' as culturally, socially, and sometimes overtly politically, produced. Suttmeier goes on to argue in his conclusion that: "Chinese science has a capacity for theoretical understanding, but an incapacity for linking theory to practice" (Suttmeier, 379). In the next section of this essay, I will attempt to unpack what implications this bifurcation of theory and practice will have for any understanding of 'the problem of Chinese science', or a Western science that has been rhetorically cast as *sinified*.

3 "What Culture is Chinese Science?": New Formulations of an Old Problem

After reviewing earlier work on 'science' in China, in this section I will begin my analysis of current academic research by exploring three recent texts—each one based on extensive fieldwork completed in China since the beginning of the twenty-first century and published within the past two years. After an analysis of the questions and concerns which these authors both raise and endeavor to answer, I will then attempt to determine myself what kind of 'problem' seems to ground these new surveys of science in China. Each author deals with science in China from a distinctive ethnographic vantage point: one from an examination of the pseudoscience of qigong; another from participation in a HIV/AIDS study in Yunnan Province; the last from both a participation in and analysis of population science and policy in China. What ties all of these works together, despite their disparate concerns and approaches, is an attention to both the *practice* of science in China, and the *ethics and/or values* which they see as framing that practice. Each work highlights the ties between a uniquely *sinified* science and a Western science, as well as the ways in which Western science gets interpreted and applied. Each author also delineates why Chinese science remains incomplete, or insufficient, to its task at hand.

3.1 Qigong as a Bridge Between Competing 'Sciences'

In his book, *Qigong Fever: Body, Science, and Utopia in China*, David Palmer asserts that qigong is "an invented tradition", which is neither an ancient practice nor a modern science (5). Palmer argues that during the early years of the Communist Revolution and throughout the reform era, qigong became a potent example of an authentic Chinese 'science' that could be used to counter the import of Western science. Qigong would be a super-science that would initiate the fourth scientific revolution, and thereby surpass or make void Western science. The practice of qigong, or a series of breathing and/or movement exercises, was seen by its Chinese supporters as a way to strengthen not only their own bodies, but their nation. Palmer argues that: "The technologies are traditional, but the qigong movement which diffused them in the second half of the twentieth century is a product of the Chinese socialist project of modernization" (13). As such, qigong was promoted by early Communists as a modernization project. The following decades, however, would see qigong slowly transform into an object of derision for a newly 'modern' China.

The practice, promotion and proliferation of qigong, for Palmer, questions the distinctions usually taken for granted between 'state' and 'society' (17). Qigong is

rather one of the formational links between the government and its people. Palmer writes:

> Thus, in qigong, the official campaign to promote science and technology as the foundation of Deng's Four Modernizations, was enthusiastically taken up by the qigong milieu and recast as a call to encourage the mass propagation of breathing exercises as a stage in China's cultural and scientific renaissance. (22)

Qigong was an effort by the Chinese to bridge the gap between what was then perceived as Western scientific prowess and Chinese backwardness; if qigong could be proven to be scientific, it would in effect *rehabilitate* traditional Chinese culture and medicine. Qigong was positioned as both traditional and uniquely modern. As Palmer suggests, it "aimed to achieve a perfect synthesis between Chinese tradition and the modern cult of scientism" (116). Even Qian Xuesen, the then president of the Chinese Association of Science and Technology, thought that qigong "offered the solution to the renewal of Marxism", and might hold the key to interlocking both the wisdom of China's past and the scientific discoveries of the modern China (Palmer 2007, 111). Thus, any new scientific revolution, said supporters of qigong, would have to take place in China (Palmer, 116). The logic of scientism, as it played into both the promotion and circulation of qigong, was thus: "Science will save China; China must accept science; qigong is Chinese science" (Palmer, 118). However, after Qian Xuesen was replaced and China felt itself to be firmly on the path to modernization, official party rhetoric about qigong shifted; qigong quickly became an emblem of China's 'backwardness' and a harbinger of 'fanaticism'.

Because Palmer's focus is on the object of qigong, he does not directly provide us with an interpretation of Western science, nor the interplay and exchange between Western and Chinese science. What his analysis of qigong does provide us with, however, is a lens with which to read China's *reaction* to the different phases both of the importation of Western science into China, and to the building up of its own brand of 'Chinese' science. Palmer's overriding question concerns the history of qigong—and the ways in which qigong was first embraced, and then shunned by those in power. He traces this to the growing scientism of first Mao's, and then Deng's, China—or the so-called blind belief that science would 'save' China. Palmer also argues that Chinese party members, as well as many scientists, were concerned with becoming modern as quickly as possible, where the 'modernizing' process would not only be a steady scientific progression, but would provide China with homegrown scientific breakthroughs. The China in Palmer's narrative of the history of qigong is not only concerned with mimicking Western science, it is obsessed with *surpassing* it. What is interesting here is that the *practice* of qigong or 'science' is overtly political, whether or not it is seen from a Chinese or a Western vantage point. The history of qigong is shadowed by the history of Western science—one cannot approach any understanding of it without understanding both the scientific, social and political milieus in which qigong first surfaced and then sank. I would argue that the question of 'science' in Palmer's narrative is qualitative: What *kind* of science will China develop? What *kind* of science is qigong? What were the political and social effects of the *practice* of qigong, or science?

3.2 A Science Not Unlike the Rest: Practicing Epidemiology in Yunnan

Sandra Teresa Hyde is an anthropologist who began her career in public health. For her book, *Eating Spring Rice: The Cultural Politics of AIDS in Southwest China*, Hyde both worked—helping to complete an HIV/AIDS survey during the early days of the Chinese epidemic, and researched in Yunnan—interviewing local people and sex workers in various 'entertainment' bars. Her work focuses on the *practice* of a Western-based epidemiology in China, specifically in the impoverished region where she worked and lived for nearly two years. The object of her inquiry is, in her own terms, a persistent 'epidemiological prejudice' that she locates in both the planning and performance of an HIV-related survey in Yunnan (Hyde 2007, 8).

For Hyde, the science is flawed from the outset. The very choice of the survey's location reveals the Chinese government's reliance on the use of ethnic categories to pigeonhole non-Han people as already at-risk, or diseased. Hyde writes that: "How representatives of the Chinese state first responded to the epidemic points toward what is particularly unique about the Chinese approach to infectious diseases and what is also shared globally and transnationally" (2). From this quote alone, we can see an interesting division already beginning to emerge in Hyde's narrative: on one side, there is a global and/or transnational science; and on the other, there is a 'Chinese approach' to science.

After locating a specific kind of Chinese epidemiology operating in Yunnan, Hyde will then trace out what it means to study a nascent, and largely hidden, epidemic in China with a 'prejudiced', or flawed science. Her investigation will necessitate giving consideration "simultaneously to the rise of science and public health in post-reform China and to the stories of lives touched by public health in China's borderlands" (Hyde, 3). Science, then, is at the heart of the story that Hyde wants to tell about the Chinese construction of the HIV/AIDS epidemic, as well as any efforts at its prevention within their borders. By pushing the epidemic out to the borderlands of Yunnan, and locating HIV/AIDS in ethnic bodies, Chinese authorities are practicing a racialized science. This approach, however flawed, was still successful. Hyde writes that "Dr. Wu's perceptions of the Chinese epidemic, while considered prejudiced and even AIDS-phobic by public health workers and AIDS activist communities in the West, had a certain logic to it" (7). The traffic—both of goods and people—across the Chinese border and into Laos, *did* appear to increase the spread of HIV. Yunnan *was* 'ground zero', or the epicenter of the HIV/AIDS epidemic in China. And so, the Chinese science was both 'prejudiced' *and* effective. Yet the Chinese *approach* to epidemiology is considered 'AIDS-phobic' by scientists and health workers in the West.

I would argue that Hyde herself engages in a *typing* of Chinese science as somehow *more flawed* than the Western science she engages in (and to which she also turns a not uncritical eye). Hyde argues that: "Chinese public health and social science research studies proliferate in linking HIV to ethnic culture and its culturally specific behaviors, when actually, poverty and drug trafficking drive much of the epidemic" (19). And although Hyde also strongly condemns U.S. science for its controversial use of '4-H risk categories', prevalent during the beginning of its own epidemic, she is arguably more concerned about the *quality* of the Chinese science that she experiences in Yunnan. Chinese authorities are not only following in

American 'prejudiced' footsteps, but they are *secretive* about it as well. China is prone to 'hiding' information about their HIV/AIDS cases. Hyde writes:

> The difference between the official and unofficial estimates results from partial and incomplete reporting in rural and remote areas, widespread fear of HIV/AIDS and the stigmatization often associated with an HIV diagnosis, the expense of confirmation tests, and the relative inaccessibility or unavailability of antiretroviral drug therapies. (49)

These discrepancies, or hidden numbers, irritate the Western scientists working with the Chinese team in Yunnan, providing proof that China is not practicing an open or *honest* science.

Also in question are the methods by which the Chinese are proceeding. The science utilized might be 'global', but it is not Western enough for the non-Chinese scientists working with Hyde. An American scientist confides to her his opinion that "'scientific survey methods were not being adhered to'" (Hyde, 63). Hyde suggests that in addressing the issue of the Chinese application of Western survey methods, the American scientist had taken a typical "Western international aid and scientific perspective" on the matter (62). In other words, it was normal for Western scientists to be critical of their Chinese counterparts. At issue was not the methodology itself, but its *practice* and/or application. Hyde's book highlights the practice of Chinese science—at least in this instance—as being insufficiently objective and methodical. Indeed, Hyde's narrative of the HIV/AIDS survey in Yunnan sketches the outline of a distinctively *insufficient* science, one that ultimately leads to the *wrong* conclusions about the causes of the AIDS epidemic. I would argue that, like Palmer's analysis of qigong, the question of 'science' in Hyde's narrative is also one of quality: What *type* of epidemiology is practiced in China? What were the political and social effects of the *practice* and *application* of the HIV/AIDS survey? How and why did Chinese science *lack the proper scientific methods*? How did China's science support a *false* image of HIV/AIDS?

3.3 The 'Culture' of Chinese Science: Weak Science, Bad Practice, and the Shaping of Policy

Anthropologist Susan Greenhalgh, in her book *Just One Child: Science and Policy in Deng's China*, asks the pivotal question: "What culture is Chinese science" (xvi)? Greenhalgh argues that prior studies have focused too much attention on the 'rise of science' within China, and not enough on its 'cognitive core' (5). Following that vein of thought, Greenhalgh goes on to ask: "How is scientific knowledge in China constructed? How do PRC scientists rework the methods and ideas of Western science to fit the context of a Chinese and a late-communist society?" (5). Indeed, Greenhalgh uses the term *sinified population science* to describe the central object of her inquiry. She is interested in how the People's Republic of China (PRC) used 'science' to make sense of its population problem, and how and why that science came to undergird the imperfect one-child policy. However, it should be noted here that 'science', for Greenhalgh, is viewed from a strict science studies vantage point. Science is as 'an authoritative knowledge' that 'produces truth' and helps to

legitimize power—in this case, Chinese state power (Greenhalgh 2008, 8). Western science is conceptualized not as a monolithic or hegemonic given, but as a carefully constructed *social institution* which lends itself to the representation of the world, producing facts and unassailable truths in its wake. It is the Chinese *use* or *practice* of this science as defined through the lens of science studies that interests Greenhalgh.

Greenhalgh argues that previous critical analyses of the one-child policy have been confined to the notions of 'communist coercion' and 'Western science' (2). She explains that "the pervasive discourse on China as intellectually backward and politically repressive has contributed to a view of the one-child policy as a product of the PRC's (restrictive) politics, not its (weak) science" (Greenhalgh, 2). And yet, for the Chinese themselves, the policy is not about coercion, but about Western science (Greenhalgh, 2). However, the Chinese use of, or, to use Greenhalgh's terms, the *absorption* of Western science is itself *selective* (3). This problematic pickiness, for Greenhalgh, can be explained by the history of 'science' in China. Although typical modern histories of China would suggest that the "Mao-to-Deng transition was one of ideology to science", in Greenhalgh's view this was merely a replacement of one ideology with another—scientism (20). Post-Mao science is akin to a religion (Greenhalgh, 281), or a 'new theology' (Greenhalgh, 316). But this is not the only 'problem' of science in China.

For Greenhalgh the problem of science in China is multi-layered: first, science is subordinated to the CCP; second, in China, Marxism is also considered a 'science'; lastly, China is prone to 'scientism' or 'technicism', or the view that science and/or technology are the sole answers to the problems of its economic development and modernization (23–24). In Greenhalgh's analysis, it is the *quality* of Chinese science and scientific understanding that is the fundamental problem behind the flawed one-child policy. She writes that "the Deng regime's adoption of science—including population science—was shadowed by an intensely scientistic culture in which the exaggerated enthusiasm for the powers of science was coupled with a worrying lack of understanding of it" (Greenhalgh, 76). Science here was dictated by CCP ideology and effectively shaped the reality of the Chinese population as that of a 'problem' which could not be managed by anything except a forced 'one-child' policy (Greenhalgh, 82–83). This Chinese 'office science', as Greenhalgh terms it, effectively cut off from any real practice of demography, was *insufficient* for understanding the realities of Chinese life (82). The science—though technically reliant on imported Western statistics and techniques—was not effectively put to good *use*. China had committed the error of importing Western science without its attendant *values*, or *ethics of practice*. Greenhalgh ultimately calls this a 'follow-the-leaders demography' (84), or a 'follow-the-leaders' science. To complicate matters, Chinese scientists had no access to accurate population numbers, in part because there had been no real 'science' of population due to years of repression during the Mao era (Greenhalgh, 62–63). China's mistake, in addition to using a 'follow-the-leaders' science, was that it relied on a science of 'no numbers', or what I might term flawed numbers.

The problems of flawed or non-existent numbers, in addition to the selective choice of method, ultimately led the Chinese to practice an insufficient population science. The cyberneticists responsible for constructing the 'one-child' policy had

imported an already defective science, one that ignored the cultural and social problems of viewing population as a strictly mathematical problem. Western critiques of the cybernetics approach were either 'unknown' to Song Jian, the 'father' of the one-child policy, or ignored. Either way, Song maintained a 'messianic fervor' about the cybernetics of population (Greenhalgh, 135), based on an insufficient knowledge of the original Western approach. Greenhalgh argues that "the Chinese scientists deeply believed that the Club's[3] work represented the very best international scientific thinking on population" (144). She goes on to argue that: "When it was transported to China, what had been merely a scientific exercise in Europe was transformed into a concrete policy proposal for use on a real population—a different prospect altogether" (Greenhalgh, 163). In effect, Chinese scientists falsely assumed that Western "models were transferable to other localities, and they prioritized politics over demography" (Greenhalgh, 205). This is a key example of what Greenhalgh terms the 'scientization of policymaking' and the 'politicization of science' (272).

Indeed, for all of Greenhalgh's criticism of Chinese science, her ultimate condemnation rests with its overt blending of science and policy. Greenhalgh admits that all science relies on a scripting of narrative and a massaging of numbers to produce 'facts'. She argues, however, that the Chinese case was 'out of the ordinary' due to the "unusual political context in which it was introduced" (Greenhalgh, 147). As she later writes: "The China population policy case thus provides an excellent exemplar of the coproduction of the natural and sociopolitical orders" (Greenhalgh, 197). Unlike Western science then, Chinese science is conceptualized here as having committed a fatal error—it produced theory *before* practice, it implemented policy *before* ascertaining what good science was. Or, to use Greenhalgh's own terms, in China 'ideology' precedes 'science' (45). The population scientists' role was not to provide data for policy making, but to provide 'truth' or 'facts' with which to hold up policy positions already in place (Greenhalgh, 117). Thus, Chinese science commits the grave error of 'politicizing' their science. It is the *quality* of their science that suffers.

In fact, the entire development of science and technology in China, Greenhalgh suggests, "has been plagued by qualitative problems that range from lack of scientific creativity and technological innovation to a seemingly widespread pattern of scientific misconduct and fraud, often covered up and protected" (317). These are stern charges, indeed. The description of Chinese science given here runs counter to every assumed Western scientific value. The Chinese, it would seem, do not practice an ethical science. This is, however, attributed to the faults of Chinese 'scientism-in-practice' (Greenhalgh, 317), where "excessive adulation of science co-existed with ignorance of it" (Greenhalgh, 318). The problem was not that Song Jian's work used the *wrong science*, but that his work "*deviated from the European original* in arbitrary, radical, and highly significant ways" (Greenhalgh, 318) [emphasis my own]. Greenhalgh charges that Song committed a form of "scientific malpractice—*inappropriate application of science* and scientistic exaggeration of the efficacy of science" (343) [emphasis my own]. Greenhalgh writes: "Chinese experts have been

[3] The Club here refers to the Club of Rome, with Erlich's 1968 book, The Population Bomb, being the most prominent example of the Club's thinking.

creating a set of scientific facts that bear the unusual imprint of the politics and culture of the PRC" (340). Or, to sum up Greenhalgh's position in one statement, science in China has 'run amok' (323).

In the end, it is Greenhalgh's judgment that China's policy needs to be *brought into line* with international thinking (327). In Greenhalgh's opinion, it is important to understand the 'nature of Chinese science' because it has a vital effect on "our understanding of what counts as 'science' in the margins of the Western-dominated international science" (Greenhalgh, 341). Greenhalgh ultimately argues that "a pattern of problematic science and policymaking" is prevalent in China (343). This insufficient science has created the monster of the Chinese 'technocratic state' (Greenhalgh, 331). This so-called technocratic state is problematic in itself, because Greenhalgh believes that China is fast becoming a 'world power' in science and technology. If and when it does, then Chinese science might become the dominant mode for defining science and how it is practiced in the future. I would argue that the science in Greenhalgh's narrative of population science in China is similar to Palmer and Hyde's—it is definitively a qualitative problem. The question of whether or not China *possesses* science has all-but disappeared in Greenhalgh's account of population science. Left in its lurch is a new question, related to one with which Greenhalgh begins her study: What *kind* of science is Chinese science? Or, better yet: What is *Chinese Science*? How is it practiced? And what are the effects of that practice?

4 A Chinese Science Rising: Worries and Ideas About the Future of Global "Science"

> China produces far more engineers than the United States each year. Fewer well-educated scientists and engineers means fewer inventions, fewer high-tech exports, and fewer jobs for Americans. Senator Hilary Clinton, Senate Floor, April 25, 2007 (said in support of the America Competes Act)

In the last section of this essay, I will examine present-day discourse concerning Chinese science in an effort to both highlight directions for further research and to ask what might be at stake in a new formulations of the old 'problem' of science in China. Through a brief analysis of recent news articles, U.S. Congressional records from 2005–2008, and commentary in science journals, I will attempt to answer some of the questions posed above, namely: What is Chinese science? What are the effects of its practice? Finally, I will end by endeavoring to answer some of my own questions: Why does so-called Chinese science matter so much? What might really be at stake in the various debates over the quality, direction and ethics of China's scientific practice? In a concerted effort not to reify the dichotomy between East and West, or at least to blur any easy division, I will blend both Chinese and more 'Western' source materials. Instead, I will trace out a loose chronological account of recent narratives, exploring the problems and development of modern 'Chinese' science.

In 1998, the late biochemist Chen-Lu Tsou, writing in Science magazine, sketched out his view of the condition of Chinese science. For Tsou, the long history of Confucianism in China, with its emphasis on the social over the individual, had

handicapped Chinese scientists. In his own words, "knowing one's place" had led to a lack of the "curiousity and creativity" fundamental to "abstract science" (Tsou 1998). In this view, Tsou would concur with his Western counterparts (see Goldman, Miller and Suttmeier's assessment in section two above). In Tsou's history of science in China, and echoing Bertrand Russell's assessment, Chinese leaders only promoted the development of Western science in order to defend themselves against 'foreign invaders'. As such, science in China from its very conception had been linked to the development of better technology (Tsou 1998). As Tsou writes: "the link between science and technology is so intimate that they have merged into one term in the Chinese language, 'keji', which means scitech" (1998). For the Chinese, then, science is all about its application; the two concepts cannot be divorced. As such, basic science research in China had always lagged behind the development of science for technology.

Tsou took great pains, however, to point out that progress had been made, and was hopeful—if cautious—about the future of science in China. For Chen-Lu Tsou, Chinese science 'hung in the balance'. The problems of science in China were legion: first, the pressure to publish and garner popular support caused a lack of rigor in research; second, Chinese science was too political, relying as it did upon the good graces of the party for funding; third, Chinese people were still too ready to believe in 'pseudoscience' like qigong, which hurt the acceptance and understanding of true science; lastly, too many years of isolation from the international scientific community has caused Chinese scientists to have a deficit in the understandings of the 'rules of the game' of international science. Tsou also pointed out, however, that Chinese scientists also faced 'prejudice' from their Western counterparts. What Chinese science needed, Tsou suggested, was better engagement with the West, better funding, and an emphasis on 'serious' research—not done just for the sake of technological application. Chinese science then, from Tsou's account of it, was struggling to find its own course, to compete and to fit into a more 'globalized science'. But if this was the case in 1998 when Tsou was writing for *Science*, then by 2002, the 'game' had already changed.

Reports from Chinese newspapers during the 16th National Congress of the Communist Party in 2002 were more optimistic, and overtly proud, about Chinese science. The Chinese had learned the lessons of globalization well, asserting that knowledge production was the key to successful international competition on the world market (People's Daily 2002). Everything turned on the pivot of producing good, innovation, science that could be used to spur on economic growth. At the Party Congress, party leaders reinforced the need to continue to develop Chinese science and technology, "by placing the development of science and in an unprecedented strategic height that concerns the rise or decline of the country and the life or death of the nation" (People's Daily 2002). Research was important, but only if it could be applied. Yet, as newspaper accounts suggested, China was confident of its scientific progress. After 200 years of 'humiliation' at the hands of Western aggressors, China was finally on a path—thanks to the efforts of scientists and engineers—to international glory. According to an article in the China Daily (2002), the Chinese achievements of the successful development of the nuclear bomb and space satellites had settled the question once and for all of whether or not "China could develop its industry, science and technology by itself".

Yet the international community remained unconvinced that China possessed a 'good-enough' science. Those fears were played out perhaps most evidently in the 2006 scandal over the discovery of 'faked' or false research by an internationally known and respected Chinese scientist. Chen Jin, who was "a national hero in 2003 when he said he had created one of China's first digital signal processing chips" was disgraced after someone tipped off the international community that Chen's 'science' was a "fraud" (Barboza 2006). Reaction in the so-called West—epitomized here by a representative article in The New York Times—was almost unanimous. U.S. scientists were "beginning to question whether China is pushing its leaders too hard to innovate and catch up with the West" (Barboza 2006). Underscoring the nature of modern science as providing a competitive advantage, the writer goes on to argue that "China desperately wants to show it can compete as a scientific and technological power" (Barboza 2006). The article also pointed to the China as a "notorious" thief of intellectual property, casting China as a nation that is famous for "stealing technology and skills from the West" (Barboza 2006). The trouble, it seemed, was that China—as Tsou had himself seemed to suggest years earlier—did not play by the 'rules' of the international scientific 'game'.

Reaction to the scandal in the journal *Science* was more measured, but echoed many of the opinions registered in the 'paper of record' in the United States. Written by Hao Xin, the *Science* article called China part of the "scientific Wild East"—where a bevy of scientists had recently been "accused of cheating—from fudging resumes to fabricating data—to gain fame or plum positions" (Xin 2006). Lacking any real peer review and vying for the money that comes along with research glory in China, Chinese scientists were largely deficient in any standard (read Western) scientific ethics. An open letter by prominent Chinese scientists calling for more exacting standards had "reignited a debate about whether China's research system is in need of an overhaul" (Xin 2006). China had ranked ninth in terms of total number of scientific publications, but only 124th in citations (Xin 2006). A mitigating article in the same issue of *Science* suggested that the recent Chinese science scandal had made it more obvious that international scientific "standards of conduct" should be cultivated (Marshall 2006). Chinese science, then, practiced science incorrectly or *unethically*. It was not a fault of the scientists themselves, but of the culture of Chinese science in specific.

By 2008, however, the narrative of Chinese science had changed once again. It seemed that everyone in the so-called West—especially in the United States—was worried about the rise of China. As the world prepared for the 2008 Summer Olympics in Beijing, everywhere one looked—newspapers, magazine stands, television news, and movies—China was paramount. Whether portrayed as a cuddly panda, an impoverished developing nation reeling from pollution or natural disasters, or, as on a recent front cover of the Economist, a surly dragon, China was visibly omnipresent in the present-day Western consciousness. If, in 2006, President Hu Jintao had predicted that in the twenty-first century China would become "an innovation-oriented society", by "leapfrogging in research" (Suttmeier et al. 2006), then by the summer of 2008 China's ascent seemed unstoppable. In May of 2008, China was given an award recognizing its "contribution to groundbreaking research", having doubled the amount of its patents in just 4 years (Thomson Reuters 2008). Chinese science was now heralding as shifting from an

emphasis on quantity to that of quality of research (Thomson Reuters 2008). Native Chinese scientists were stunned by the how far Chinese science had come—both in terms of the quality of lab equipment and the competitive salaries and funding on offer. Many Chinese scientists were making the decision to repatriate to work in Chinese labs (Normile 2006). An editorial in *Science* magazine cautioned against viewing the nascent rise of Chinese science as a threat, and urged instead a greater cooperation between East and West (Leshner and Turekian 2007).

Perhaps nowhere was this dual sense of competition and threat in relation to Chinese science more palpable than on the U.S. Congressional floor beginning as early as 2005 and spiking in 2007 with the passage of the America Competes Act. For U.S. Senators and Representatives alike, China was not only an economic threat, but a scientific threat. As Representative Jackson-Lee of Texas argued on the House floor:

> We don't need to hear the statistics again of how many engineers China graduates, for example, compared to the United States. This workforce cannot be prepared for the 21st century without actual investment by this country, and understanding that without researchers and scientists and engineers, we do not create work. (Cong Rec H 4013 2007a)

As the quote above suggests, scientific and economic progress are intrinsically linked in the modern world market economy. Scientific prowess leads to economic gains. At issue is nothing less than international competitive advantage. One Senator lamented that the U.S. was 'losing ground' to China when it came to science and technology (Cong Rec S 4825 2007b). Another Senator equated China with a competitor quickly gaining ground in a technological race, worrying that the U.S. might eventually become 'subservient' and lose its 'economic power' (151 Cong Rec S 7403 2005b). But perhaps no one painted a bleaker picture—or made more obvious the underlying fears at issue in the growing attention to China's scientific achievements—than Representative Rohrabacher, stating that:

> Already we are seeing a flow of technology and of capital assets to China, which is a major adversary, maybe not an enemy now, but perhaps someday an enemy. Our schools are filled with graduate students from China and elsewhere, and they are learning the secrets that cost us billions of dollars of research to come up with. We are not watching out for the American people. (Cong Rec H 7480 2007c)

Here are laid bare the American concerns with the recent growth of Chinese Science. The rhetoric over Chinese practice of science, Chinese scientists' theft of Western (or, in this case, American) techniques and knowledge, their misconduct, and their questionable and non-conforming 'ethics' reveals something bigger at stake.

As visible in the texts explored in this section, both Chinese and Western scientists and political leads alike are concerned with the ethics and practice of science in China. However, no one here questions the Chinese grasp of Western science or its techniques. Instead, one can trace an escalating concern with the *practice* of science and the development of a science with 'Chinese characteristics'—or a Chinese science. Chinese science is insufficient in its underlying ethics if not its practice. Chinese science is somehow *different*. It is what this difference might mean to the future of science that is at stake in the debates over China's scientific practice.

5 Conclusion

Chinese science, then, *makes a difference*. But it is this difference of a sinologized science that has Greenhalgh, Goldman, Simon, Suttmeier, U.S. Senators and others like them decidedly nervous, if ultimately cautiously optimistic about the fate of modern science. Chinese science is Western science but with a chronic lack—a lack of values and ethical practice. It is an *insufficient Western science*—or a Western science that has been misapplied, misused, misinterpreted, or misunderstood. Chinese science, then, is *not* Western science.

But why should it matter if Chinese science is not Western science? What might be at stake in casting Chinese science as insufficient or unethical? I would argue that at issue is the very ability to define what science itself *is* or *will become* in the twenty-first century. If the discipline of science studies has shown us anything, it is that 'science' is an ever-shifting, culturally and socially defined practice. The scientific method and so-called scientific conduct are, for all purposes, what produce science. If the rules of the scientific 'game' itself are changed, then what are we left with? *What comes next?*

Susan Greenhalgh writes in the conclusion to her book that:

> How post-Mao China would 'go statistical' and 'go scientific'—how knowledge would be connected up to policy, power, and politics—would have very broad ramifications for the shape of Chinese modernity, for the organization of power, politics, the state, and state-society relations in the PRC, and in turn for the world China is now entering as a modern power. (308–309)

In this quote I see a nascent answer to the questions I have posed above. Chinese science will continue to shape—at least in part—the future direction of scientific inquiry. The inherent concern, I think, is that a "Wild Scientific East" will increasingly have the capability to make the scientific rules. Not the established "Scientific West". Western science might have been originally created and defined by the scientists at the Royal Society in London in the seventeenth century, but its definition and practice have never been static. As a 'globalized' or 'transnational' science moves and flows around the globe, it will take different shapes and forms. Chinese science is perhaps one of them.

Future studies of so-called Chinese science might help to better understand what present-day science is, how it is practiced and applied, and what the increased coupling of science and technology might mean for the future of science-at-large. Bertrand Russell once wrote that: "Our theories of politics are only true in the West (if there); our theories of forestry are equally true everywhere" (55). The challenge then, as Russell conceived it, was for China to "acquire Western knowledge without acquiring [its] mechanistic outlook" (55). For Russell, science was—and should forever be—quite separate from the concepts of morality and politics. If the old Science was the West's God and supreme ruler, as Russell asserted in *The Problem of China*, then as a solution he hoped for a future merging of both Chinese and Western beliefs in a *new practice* of science. He wrote that:

> The distinctive merit of our civilization, I should say, is the scientific method; the distinctive merit of the Chinese is a just conception of the ends of life. It is these two that one must hope to see gradually uniting. (Russell, 130).

Playing off of Russell's suggestion then, throughout this essay I have tried to trace out the new 'problem' of Chinese science. In the end, I have posed more questions than I have answered. I have also tried to trouble any easy connection made between 'ethics', 'politics', 'democracy' and 'science'. Rather than continuing to locate a poor 'ethics' or lack of democracy in Chinese science, perhaps we might begin to question whether or not the dual concepts of 'ethics' or 'democracy' have any inherent relationship to the practice of modern 'science'. Are Western values an intrinsic part of Western science, even when it is practiced outside of the West? In the end, I believe that China and other developing nations are helping to redefine not only the 'rules' of the scientific game, but the very practice of science itself.

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