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Insect Control in Socialist China and Corporate U.S.:

The Act of Comparison, The Tendency to Forget, and the Construction of Difference in 1970s U.S.-Chinese Scientific Exchange

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Abstract

In 1975, a delegation of U.S. entomologists traveled to socialist China to observe Chinese insect control science. Their overwhelmingly positive reports highlighted in relief the pernicious effects of pesticide corporations on U.S. agriculture; some entomologists hoped this would goad the U.S. to catch up to China in environmentally sensible insect control practices. Of course, insect control in socialist China carried its own political baggage, some of which -- for example, mass mobilization and self-reliance -- the state made highly visible to visitors, and some of which -- for example, harsh treatment of scientists -- it sought to obscure. For both the U.S. and the Chinese participants, the act of comparison itself was of primary significance in the exchange, allowing them to construct socialist Chinese science as refreshingly different from U.S. science. At the same time, however, this construction of difference meant forgetting the much longer transnational history in which U.S. and Chinese entomology had been intertwined.

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Introduction

During the early 1970s, scores of U.S. scientists traveled to China to witness the state-orchestrated spectacle of socialist Chinese science, in which scientists together with the "broad masses" made creative use of limited resources to meet social needs. It is hard now to recall the tremendous enthusiasm many of the U.S. participants felt for this vision. The years after Mao's death in 1976 produced a radical change in political and scientific values along with unavoidable revelations about the political calamities of the Mao era. The cumulative knowledge of the last several decades has all but erased those earlier positive feelings from historical memory.[2] At the same time, the perspectives of the 1970s visitors were themselves often the products of erasure. In order to experience science in socialist China as a breath of fresh air, U.S. scientists not only had to turn a blind eye to what they knew, or should have known, about the political persecutions that many Chinese people had endured, they also had to forget the intertwined histories and shared commitments of U.S. and Chinese science. This tendency to forget, moreover, was structured by the act of comparison that defined the entire system of scientific exchange that the Mao and Nixon administrations had inaugurated. Thrilled to be visiting an exotic land long closed to the vast majority of Americans, the U.S. scientists actively joined their Chinese counterparts in producing a picture of Chinese science as fundamentally different from U.S. science. And there were clear political reasons for this emphasis: the Chinese side sought to convince the world of the unique contribution China could make to international science, while some of the U.S. scientists sought in socialist China an alternative model capable of challenging aspects of U.S. science they sought to transform.[3]

In sifting through the layers of amnesia to reconstruct this key moment in U.S.-Chinese scientific exchange, we are helping to produce a transnational history of science.[4]

Zuoyue Wang has argued convincingly that even at the height of U.S.-Chinese hostilities in the 1950s, Chinese-born scientists educated in the United States contributed in two ways to transnational science. Those who opted to remain in the U.S. after the communist revolution of 1949 helped produce the "transnationalization of the American scientific community," while those who chose to return to China contributed to the "Americanization of international science."[5] The state-sanctioned exchanges of the 1970s, with their distinct forms of border crossings, marked a new stage in this history and unquestionably contributed in significant ways to the transnationalism of science as practiced in both countries.

Recognizing the significance of such border crossings may help us transcend nationalist histories that have "naturalized the nation as the most significant form of human solidarity."[6] Advocates of transnational approaches have further rightly called into question the way comparative history too has often served to naturalize the nation and construct national or racial difference.[7] And indeed scientists have been among the most globally connected and globally minded people of the modern era; if through comparative history we identify them simply as representatives of "their" nations, we do them and ourselves a disservice. Nonetheless, historians are not the only ones involved in reifying acts of comparison; the scientists we study have sometimes engaged in comparison, and with similar results. The 1970s U.S.-Chinese scientific exchanges did not simply usher in a new era of scientific transnationalism; in fostering active comparison of the two societies, the exchanges also constructed national difference, which required a *forgetting* of the long transnational history in which U.S. and Chinese scientists were already enmeshed. Thus in adopting a transnational approach, we will not be "giving up that analytical category [of the nation-state], but rather placing it in its proper historical context,"[8] and so

understanding more clearly how state-sponsored scientific exchange worked simultaneously to create and to obscure transnationalism.

This paper explores the act of comparison, the tendency to forget, and the construction of difference in 1970s U.S.-China scientific exchange through the experiences of three insect scientists. Robert L. Metcalf was a European-American scientist who traveled to China for the first time with the 1975 American Insect Control Delegation. Another member of the delegation, Huai C. Chiang (姜淮章), grew up in China but moved to the U.S. in 1945, became a U.S. citizen, and had never been back to China since. The third scientist, Pu Zhelong (蒲蛰龙), also grew up in China and also traveled to the U.S. for his education, but he returned to China in 1949, shortly after the communist victory; he hosted the U.S. delegation when it arrived in Guangdong. Tracing their histories will demonstrate the depth of their transnational connections and the ways in which forgetting those connections and constructing difference served them in their separate political contexts. We will begin our story on a rice paddy in 1975, where the paths of these three scientists crossed, though not in every case for the first time.

27 August 1975, Big Sand Commune, Guangdong Province, China

A bus pulled up and a delegation of American entomologists, full of roast duck from the commune cafeteria, quickly scattered into the rice paddies. Some hunted for insect specimens; others wielded cameras and cassette recorders to capture the sights and sounds of a large flock of fellow bug lovers chasing down their own meals at a rate of 200 insects per duck per hour. The scientists displayed remarkable energy, especially considering how long they had been traveling. Big Sand (Dasha) Commune was one of the last stops on their month-long tour of the People's Republic of China; the delegates had

already visited dozens of research institutes and farms, toured a number of famous sites, shopped in several "Friendship Stores," eaten many banquets, and suffered a few bouts of indigestion.[9] But given the historical moment it was no wonder that their spirits remained high. This was only the third year since the inauguration of scientific exchanges between the formerly unfriendly U.S. and China. Few Americans had set foot in China since the communist revolution of 1949. The delegates possessed a heightened awareness of their role as trailblazers and of how eagerly their friends, family, and colleagues would drink up the photos and stories they brought home. Hence their giddiness at the prospect of recording these charming feathered representatives of China's approach to insect pest management.

Academic journals, mainstream media, and community groups alike heralded these early scientific delegations, arranged between the China Association for Science and Technology and the Committee on Scholarly Communication with the People's Republic of China (CSCPRC), as landmark meetings of societies separated for twenty-five years. The travels were framed by the expectation of difference, the excitement of the foreign. The thrill of visiting a land so long closed to Americans, founded on fundamentally different political principles, whetted the delegation's appetite for discovery. What they found was what they had been struggling for at home: a sensible approach to insect control free from the pernicious influence of pesticide corporations. As entomologist Robert L. Metcalf wrote upon his return, "We were completely unprepared for the discovery that the Chinese are exploiting insect pest management on a massive scale," i.e. that China as a nation was committed to agricultural practices that prevented economic losses to insect pests while minimizing harm to the natural environment.[10]

For their part, Chinese scientists and political leaders greeted the delegates warmly with much talk of friendship. The foreign scientists' ability to provide scientific journals, biological specimens, and even opportunities to visit the U.S. made them valued friends indeed. But amid the outpouring of enthusiasm for these new relationships, older connections often went unspoken. In fact, some of these paths had intersected before. When Sun Yat-sen University entomologist Pu Zhelong introduced the American delegates to Big Sand party leader Mai Baoxiang, he did not mention that he already knew one of the entomologists or that he last saw him twenty-five years earlier when they were both Ph.D. students at the University of Minnesota. Huai C. Chiang did not know the reason for this snub, but Pu was not the first to avoid acknowledging his friendship. At Beijing University, Minnesota Ph.D. Ma Shijun similarly kept his distance.[11] Ma Shijun had also met Robert Metcalf in the U.S., but assuming Metcalf still recognized Ma, he was probably unaware that back in 1952, after Ma had returned to China, Ma had publicly accused him, along with a handful of other American entomologists, of involvement in germ warfare.[12]

On the eve of their departure for Beijing, the insect control delegates gathered in a Tokyo hotel for a meeting with Benjamin Schwartz, a leading historian of China who was making his first trip to China on their coattails.[13] As one delegate recorded, "Schwartz gave us a briefing on the Chinese thought and the present time in Chinese history reminding us that we will see only one time-frame in a long-evolving highly complex society."[14] This was sage advice and all the more significant because of the rapid changes China had recently undergone and would soon be undergoing again. But the delegates would have been still wiser to remember that they too were living in "only one time-frame" of their own "highly complex society," and that the entomology profession itself was in a continual process of historical transformation.

The American entomologists went to China at a time when many in their profession were deeply frustrated about the state of their field. The chemical insecticides that had promised so much in the 1950s had gradually proven sorely limited: insect pests had grown resistant, while environmental consequences became increasingly difficult to ignore. Meanwhile, the study of insects itself had undergone a profound shift: while entomology had grown up in the nineteenth century hand-in-hand with the science of ecology, and entomologists had identified as naturalists, in the mid-twentieth century chemistry came to dominate the profession as entomologists increasingly devoted their time to the search for effective insecticides. The shift was dramatic enough to cause, in one historian's analysis, a kind of "amnesia," such that the reintroduction of an ecological mentality felt radical.[15] Chemical corporations not only funded much entomological research, but wielded enormous influence over the specific research tasks scientists undertook. Indeed, some scientists argued (and still do) that the domination of insect control science by the pesticide industry was evidence that corporate capitalism posed inherent risks to scientific freedom and progress, in some sense parallel to the way Lysenkoism had become the poster-child for science gone wrong under state socialism.[16] While not all of the 1975 delegates to China would have framed the issue in this manner, it nonetheless formed part of their visit's larger political-scientific context.

On the Chinese side, 1975 was a time of great official certainty about the success of socialism. The specific historical narrative in use downplayed to the point of denying any scientific achievements from the days before "liberation" in 1949 and especially highlighted the progress made since the launch of the Cultural Revolution in 1966. Wherever the delegates went, they heard a consistent story of China's commitment to the goals of self-sufficiency, mass mobilization, and cultural revolution. This socialist context

for China's achievements in integrated pest control was prominently on display in every scientific institute and on every commune farm the delegates visited. However, other aspects of socialist Chinese science, and of Cultural Revolution science in particular, were far less visible: visitors did not witness the persecution of scientists, and the people they met were careful not to reveal any frustrations with policies that required them to spend lots of time learning from peasants and participating in political criticism sessions.

At the same time, there was another kind of "amnesia" operating with respect to the historic relationship of Chinese and American insect science. The Chinese emphasis on self-sufficiency masked the strongly transnational character of their work; influences from the U.S. and other countries—and the considerable foundation laid during the republican era (1912-1949)—rarely if ever surfaced in the picture the delegates saw. Twenty-five years is not in fact very long. While a lot of change was packed into that time in China, many of the key people were the same, and the relationships forged in the early twentieth century between U.S. and Chinese scientists—and thus U.S. and Chinese science—did not disappear with the revolution. Had the political context of 1975 been other than it was, had both sides not actively sought to highlight difference, the encounter might have been framed as a kind of reunion or homecoming rather than the exploration of an exotic land or the welcoming of strangers from afar.

Robert L. Metcalf and Integrated Pest Management in the U.S.

The pioneering U.S. scientists who visited China in the 1970s had no trouble finding audiences for their accounts of the exciting differences to be found in socialist Chinese science and society. At the opening session of the 1975 annual meeting of the Entomological Society of America, two thousand U.S. entomologists were treated to a

report from several of the members of the insect control delegation that had returned from China just a few months prior.[17] Robert L. Metcalf chaired the panel, and it was his remarks in particular that inspired the outspoken entomologist Robert van den Bosch to highlight the Chinese example in a polemical book van den Bosch was then writing, *The Pesticide Conspiracy* [1978]. From Metcalf's report, van den Bosch surmised that "the Chinese pest-control system has more going for it than does ours." Defending the portrayal against would-be skeptics, he added, "I know most of the panelists, some intimately, and would characterize them largely as politically moderate Middle Americans. In other words, they had no ax to grind on behalf of China and its Marxist political ideology but reported things as they witnessed and recorded them."[18] Van den Bosch certainly knew Metcalf well—they were formerly colleagues at the University of California, Riverside—and indeed Metcalf was no radical, though he was deeply committed to improving the effectiveness and safety of chemical insecticides. Nor did Metcalf have any prior stake in China: in fact, for Metcalf himself—though not for his fellow panelist Huai C. Chiang—China really was new territory; 1975 marked the beginning of his relationship with Chinese insect control science.

The trajectory of Robert L. Metcalf's (1916-1998) career parallels in interesting ways the general history of entomology in the United States. Metcalf grew up in Urbana, Illinois, where his father (Clell L. Metcalf, 1888-1948) was chair of the Entomology Department at the university. Clell and his co-author W. P. Flint dedicated their seminal entomology textbook, first published in 1928, to Stephen Forbes, a nineteenth-century naturalist noted for his contributions to the emerging sciences of entomology and ecology. A review of the 1939 edition credited the authors for careful consideration of the life history and ecology of each insect in determining methods of control, and the text clearly

emphasized not only the use of chemical insecticides, which were then increasingly popular, but also mechanical means of control (such as trapping with bait) and cultural means such as timing soil cultivation so as to disrupt the life cycles of the insect pests.[19] As Metcalf later recalled, "The kind of entomology that my father taught and I learned certainly didn't involve the mass application of insecticides, particularly to field crops like cotton and corn, which are the two primary ones that used the most chemicals. We never even considered such a thing. The whole emphasis was on the ecological approach. It was first enunciated by Stephen Forbes back in 1880."[20]

Robert became "enamored" with the study of chemistry in high school and completed a major in the subject during his junior year at the University of Illinois. He then decided that, given his family background in the "wonderful field" of entomology, "the application of chemistry to entomology might be one of the best things I could do." After completing an M.A. in his father's department in 1940, he quickly obtained a Ph.D. in entomology from Cornell in 1942. His first job, combating malaria for the Tennessee Valley Authority, provided an ideal opportunity for this chemistry-minded young entomologist. The chemical insecticide DDT, patented in 1939 by Swiss scientists, had just come to the attention of the U.S. military, which was eager to find ways to protect troops against insect-borne disease. Metcalf and his colleagues developed aerial means for dispersing DDT in jungle battle zones and then adapted the technology for use around the TVA reservoirs, after which they also initiated a house-spraying program.[21]

Had Metcalf then joined the faculty at the University of Illinois or any of a number of other centers for entomological research, he might have become part of the main stream of economic entomology that had come to embrace chemical control as the first or even only line of defense against insect pests. This was the era when, as one historian argues,

entomologists increasingly "took the chemist rather than the ecologist or biologist as their paragon of professional excellence."[22] Metcalf himself later undertook to quantify this assessment; he surveyed the contents of the *Journal of Economic Entomology* and found that articles relating to chemical control peaked at 76% in 1950, displacing research on biological, mechanical, or cultural methods of control.[23] Metcalf traced this pattern to activities of the chemical industry, which "descended on all the experiment stations and offered small research grants for testing products and tied up an awful lot of entomological time that should never have been used that way."[24]

Metcalf's critical perspective on the pesticide industry emerged during his long tenure on the faculty at the University of California, Riverside, which together with Berkeley formed the center for U.S. research on biological control of insect pests. As Metcalf later recalled, at Riverside he became "pretty well indoctrinated about pest management and the biological control approach in compatibility [with] the use of insecticides as last resort when other things failed." When he returned to Illinois in 1968 to join the entomology department of his alma mater, he found his new colleagues highly skeptical. "They thought I was... I don't know what. [laughter] I can remember some of the things they said about me."[25] While Metcalf himself never departed from his focus on chemistry, his close interaction with leading experts in biological control strongly shaped his attitudes toward chemical insecticides: that they should be used only when necessary, that their use should avoid disrupting the natural enemies of insect pests, and that entomologists should endeavor to develop more selective (and thus safer) types. Moreover, his own research offered strong support for his Riverside colleagues' arguments that chemical control on its own was ineffective and in fact destructive. Metcalf was one of the

pioneers of the effort to prove that insects could become resistant to chemical insecticides.[26]

Scientists at the Berkeley and Riverside campuses of the University of California were leaders not only in the area of biological control, but also in the emerging approach called "integrated control," later renamed "integrated pest management."[27] The first of these terms slowly made its way into the literature over the course of the 1950s. At first, it referred broadly to the consideration of the larger ecosystem (including multiple species of pests and natural enemies) in devising the optimal control strategy.[28] However, in an oft-cited 1959 article, "The Integrated Control Concept," four faculty members at Riverside and Berkeley (including Robert van den Bosch) put forward the definition that would dominate U.S. understandings from that time forward: "Applied pest control which combines and integrates biological and chemical controls."[29]

In 1962 Rachel Carson's *Silent Spring* helped propel the concept of integrated control to greater acceptance.[30] Metcalf at first had mixed feelings about the book. Toward the end of his life, he recalled initially feeling "insulted" by her depiction of entomologists, and especially of her characterization of entomology as a "stone-age science."[31] This bitterness surfaced when Metcalf was asked to comment on the President's Science Advisory Committee's report on pesticides, produced largely in response to *Silent Spring*. He wrote: "This document suffers from the overemotional and biased approach which has characterized the 'Silent Spring' and other inflammatory writings on the subject."[32] While Metcalf would always defend the positive—even necessary—contributions insecticides had made to human health and agriculture, his view on *Silent Spring* changed dramatically as the smart of the "stone-age" insult subsided. Indeed, his junior colleagues at the University of Illinois remember that Metcalf was "deeply moved by [Carson's] spirit," and

that *Silent Spring* was "one of the few books he always had out in his living room and was fond of picking up and repeatedly reading."[33] Speaking against her critics in 1982, Metcalf told the *New York Times*, "I don't see much she said that hasn't come to pass one way or another."[34]

In 1975, the CSCPRC invited Metcalf to join the first delegation of insect control specialists to visit China as part of the program of scientific exchange negotiated between the U.S. and Chinese governments. In 1973, an insect pheremone delegation from China had visted the U.S., and Metcalf's trip would provide some of those Chinese scientists with an opportunity to return the favor. While the invited U.S. scientists represented a range of fields in applied entomology, most if not all were active in developing and promoting integrated pest management. The committee could hardly have selected a specialist in insecticides more critical of over-reliance on chemical control or more supportive of integrated pest management than Robert Metcalf.

Before he arrived in China on 4 August 1975, Metcalf had already heard about the famous Chinese efforts to sweep away the "four pests." Intrigued, he decided to count for himself, focusing especially on flies and recording each sighting in his journal with the abbreviation "d" (probably standing for Diptera, the taxonomic order of true flies.) So, for example, his August 7th entry read: "Put down for lunch...at Shen-yang... Had century old egg, roast duck, best soup yet. After this magnificent meal, proprietor said, if we would give him a little notice he would have a much better meal when we returned. Saw 3d in toilet."[35]

Metcalf took copious notes at each of the scientific institutes, farms, and other sites the delegation visited. Most of these notes appear to have come straight from the horse's mouth: they reflect the Maoist discourse on science and society that pervaded every

official statement in Cultural Revolution China. Only occasionally did Metcalf record any pointed exchanges, but above the following entry, Metcalf later wrote "important."

> [Q.] Pesticide applicators and question of their health? How do you keep track of this problem?
>
> [A.] When we apply O-P [organophosphate] insecticide have rules established by Ministry of Agriculture—also dept in communes. If we use dangerous insecticides, how to use apparatus, protective mask or skin protection.
>
> Q. We also have rules but still have problems. Do you not have problems?
>
> [A.] Also have barefoot doctors. Sometimes we also have poisoning—"to very few persons."
>
> ...
>
> Q. Everywhere we go in People's Republic we smell BHC [an organochloride pesticide]. Is there concern about storage of B-isomer in human tissues or in human milk.
>
> A. This is also for the consideration of the Public Health Ministry, and also the station involved with health of man and health of animals.

Metcalf concluded: "No feedback from Ministry of Health to Entomologists making recommendations—the Entomologists seem to show concern?"

Such worries surfaced only infrequently in Metcalf's journal. Far more common were the myriad examples of environmentally sensible strategies, both mundane and innovative, to achieve pest control: for example, basic sanitation efforts, insect traps baited with sugar, release of parasitic wasps, use of chickens and ducks to eat larvae, and mass mobilization of agricultural laborers to monitor insect activities and determine the most effective moment to use limited quantities of pesticides. And peppering the journal were

Metcalf's notes on his fly census: "Pigery—large number, very clean, no flies. 1d in car"; "Pigs and cows cleanest I've ever seen. Virtually no flies. Cows in dairy nearly fly free. Saw perhaps 200 flies in entire farm area."

These notes formed the basis for Metcalf's highly favorable presentation on Chinese insect control at the 1975 Entomological Society meeting and for his glowing report in *Environment* magazine. But Metcalf appears to have at least temporarily erased from his mind even those few critical comments that made it into his journal. His article in *Environment* failed to mention concerns about organophosphate poisonings or the persistent smell of BHC. Rather, China was a model of health and productivity, carefully recycling wastes for agricultural uses to achieve self-sufficiency in feeding its people and become "the world's cleanest society." Demonstrating this last claim, Metcalf calculated (not very accurately) the "grand total" of his fly survey: 39.[36] But most important for Metcalf was the work that Chinese scientists had accomplished in environmentally sensible biological control of insect pests. The ducks of Big Sand commune got top billing here, with a charming photograph of duck herders accompanying the article, which the editors chose to title, "China Unleashes Its Ducks."[37] (Figure 1)

While his visit to China presented much good reason for excitement, it is surprising that Metcalf was not more critical of some of what he saw. Especially strange was his fascination with the near-total absence of flies. Within a few years of his return, Metcalf began speaking publicly about the fallacy of attempts to "eradicate" insect pests. He ridiculed the mainstream media of the 1940s for the blind faith in DDT that created such headlines as "Entire Towns Abolish Flies" and "No Flies in Iowa." He further noted the degree to which "well-established scientists" had let their wishful thinking run away with them such that they wondered what applications the field of entomology would have

"when all insect pests had been eradicated."[38] Attempts to achieve "99+% control" of an insect pest population were in fact counterproductive, he argued, citing literature going back to 1945 that suggested "an insecticide which kills 50% of the pest insect and none of its predators may be more valuable than one which kills 95% but at the same time eliminates its natural enemies."[39] This critical perspective led him to testify to U.S. congress against a proposed program to eradicate insect pests in cotton.[40] But such concerns appear not to have occurred to him when he was in China enthusiastically counting flies, nor apparently did he connect the lack of flies with the BHC that he smelled "everywhere." Rather, in the several articles he wrote on insect control in China he consistently credited the Chinese for working to limit or phase out use of persistent or dangerous insecticides.[41]

Metcalf was by no means the only one to write so positively. The delegation's official, book-length report went so far as to say, "Clearly, the Chinese have progressed beyond levels attained in the United States both in widespread enthusiasm for integrated control and, in many respects, in the application of the ecological principles fundamental to its development."[42] Other delegations had similarly positive things to say about socialist Chinese approaches to insect control. One British delegate reportedly told his Chinese hosts, "In Western countries people talk a lot about integrated control but do very little of it. You do so much work; you are our model."[43] The official report of the Swedish delegation similarly posited the relative backwardness of biological control in Sweden and suggested that knowledge should be sought in China, where biological methods and integrated pest control were more developed.[44]

The excitement with which these foreign visitors greeted the prospect of China as a model of integrated pest management arose from the frustrations they faced running what

van den Bosch and others liked to call the "pesticide treadmill."[45] At least for the U.S. scientists, the frustration stemmed in part from a sense that their profession had been undermined by pesticide corporations whose profit motive overrode not only conclusions reached through scientific analysis but even basic concern for human and environmental wellbeing.[46] In *The Pesticide Conspiracy*, van den Bosch recounted a frightening encounter that he and his colleague Vernon Stern had with a Mexican laborer in a California alfalfa field. The laborer was new to his job; his predecessor had fallen ill. The entomologists were horrified to discover that the sack the man carried was filled with the deadly insecticide parathion: "his body frosted with parathion dust, breathing it in and licking it off his sweat-moistened lips," he was "totally ignorant of his peril."[47] As Robert Metcalf told an interviewer near the end of his life, "There is absolutely no excuse in my estimate, and there has never been, for marketing compounds that [are] as hazardous to the applicators as they are to the insects that you are trying to kill. I have said that so many times. I don't understand yet why we have to have those things on the market... Sheer greed, I suppose. That's the only thing that I can conclude."[48] No wonder Metcalf and his colleagues eagerly discussed the possibility that without corporate greed a society could make rational decisions about insect control. No wonder that is what Metcalf saw when he went to China.

Huai C. Chiang and Insect Control in China, the U.S., and the Global Arena

Like Metcalf, Huai C. Chiang returned from China with a very positive assessment of insect control as practiced there, and also like Metcalf, he highlighted successful eradication of flies in his public comments. As the *St. Paul Dispatch* reported, "Socially he found that a high degree of regimentation existed among Mao Tse-tung's people, but said

he couldn't help but be impressed that such close ordering of daily life had resulted in some social benefits. 'There are virtually no houseflies,' he remarked... The people are coordinated to remove all their household trash and slops once a week on Thursday. Widespread, coordinated chemical spraying and garbage removal has eliminated the fly, along with the mosquito, even from barnyards where manure piles and pig styes [sic] provide fertile breeding ground."[49]

Born and raised in Beijing, Chiang might have been suspected of having an "ax to grind for China" (as van den Bosch put it), but his history left little room for speculation that he had anything to grind for "its Marxist political ideology." The *St. Paul Dispatch* article concluded unambiguously, "Asked if he would care to return today to live in China, Chiang said, 'No.'" His fate to become an American was sealed on 1 October 1949, when as a research fellow at the University of Minnesota he learned that the communists had won the civil war and established the People's Republic of China. As he remembered later, "At that point, my returning to the mainland was out of the question."[50] But his connection with American science went back considerably further; indeed, Chiang and his Chinese mentors are vivid examples of U.S.-Chinese connections in the history of insect control science. Had the political climate on both sides been different, the 1975 exchange could have been a moment to highlight that transnational history.

Chiang's road to becoming an entomologist began in 1935, after he had completed his first year at National Qinghua University in Beijing. He was selected that summer to become a student assistant for the entomologist Liu Chongle (C. L. Liu, 刘崇乐).[51] In 1937, when Japanese forces took Beijing, Chiang followed his university south first to Changsha, Hunan and then to Kunming, Yunnan to complete his studies. Following his

graduation in 1938, Professor Liu hired him as a research assistant, and in 1944 Chiang made the journey to Minnesota to begin his Ph.D. studies in entomology.

Once Liu took Chiang under his tutelage, Chiang's path from Kunming to Minnesota was in a sense overdetermined. During this era, Chinese entomology—and Chinese science in general—was heavily influenced by the United States.[52] The U.S. decision (under considerable moral pressure from the Chinese minister) to use excess Boxer Indemnity payments to fund educational opportunities for Chinese students and scholars in the United States created a solid link between the scientific worlds of the two countries. Qinghua University had been founded using Boxer Indemnity funds in order to provide training for Chinese students preparing to attend graduate school in China; its faculty consisted dominantly of Chinese men with Ph.D.s from U.S. institutions. Liu Chongle, for example, had a Ph.D. from Cornell in 1926, where he focused on biological approaches to pest management and completed a dissertation on the "natural control of the eastern tent caterpillar." Fellowships further supported scholars pursuing advanced research. In 1935, Liu received funds to travel to the United States to survey achievements in biological control there.[53] The entomologist Chenfu F. Wu (胡经甫), who received his Ph.D. at Cornell in 1922, returned to China to become a professor at Yanjing University and then later applied for a fellowship to study insect control of cotton, fruit trees, and cereal crops, focusing especially on "mechanical and cultural methods" in the United States.[54] Chinese scientists found U.S. universities good places even for researching the development of insecticides from Chinese plant material.[55]

American support of Chinese insect control efforts also came through funding from the Rockefeller Foundation, which from 1935 to 1937 underwrote insect control programs of China's National Agricultural Research Bureau. The bureau established laboratories for

the development of new insecticides, supplied spraying equipment for their application, and dispatched extension workers to bring the new technologies to farmers. It also heavily promoted cultural controls, for example mandating that farmers clear their fields after harvest to destroy the eggs that would create the next generation of pest. The work suffered from the disastrous economic, political, and military conditions of the day, but even in the small pockets of stability where reformers could concentrate their efforts, they failed to overcome the corruption of local government and win the trust of farmers so necessary for success in such endeavors. This, as Randall Stross has convincingly argued, awaited the social and political organization provided by the communists beginning in the 1950s.[56]

Upon returning to China, Liu Chongle had continued to dedicate his research toward biological control of insect pests. Chiang inherited this focus. His first research project under Liu's direction in Kunming was on the life cycles of local ladybugs, key players in the biological control of aphids. The work resulted in a paper coauthored with Liu and published in 1946.[57] Other research projects on the wax scale insect (used to produce candles and other items) and on insects damaging to pear crops gave Chiang an intimate understanding of the potential economic significance of entomology for impoverished rural areas and taught him the importance of cultivating good relations between entomologists and local people.[58] Liu used his connection with a former Cornell classmate, William Riley, to help Chiang in his application to the University of Minnesota, where he began doctoral studies in 1945.

After completing his Ph.D. in 1948, Chiang became a research fellow at the University of Minnesota charged with studying the corn borer, an insect pest that had just recently appeared in the state. This was his status on 1 October 1949, when the communists proclaimed victory in China. Chiang was naturalized as a U.S. citizen in

1953,[59] the same year he became a tenure-track professor at the Duluth campus of the University of Minnesota. The McCarthy era proved particularly threatening to Chinese-American scientists, whose past connections to a now-communist country put them in a vulnerable position. Nor were Chinese-American scientists immune from the racist prejudice faced by Asian people generally in the United States.[60] Still, Chiang's loyalty to his second country led him to defend his experiences there, and he frequently emphasized later in life that he rarely if ever encountered racism from Americans. Chiang even defended the U.S. government for repeatedly investigating his background and activities: he characterized the FBI officers as "courteous" and professed, "I as a citizen am glad that our government looks after the security of our nation."[61]

In 1961, Chiang transferred to the St. Paul campus (the flagship for agricultural sciences) of the University of Minnesota, where he continued to teach until he retired in 1984. His work, however, took him all over, from the university's field station in rural Waseca, Minnesota to the Food and Agriculture Organization (FAO) of the United Nations. Chiang's early experience in Yunnan making connections with local people helped him in his work in Waseca, where he not only conducted research on corn pests but also provided extension education for farmers. "The station provided open wagons for the visitors, mostly farmers, to make stops and see the field plots and experiments. During the day, there might be over a dozen wagon-loads passing each stop. I set up charts on an easel by my plots and described my studies, gave my results and answered questions. These occasions provided researchers an opportunity to establish direct contact with clients."[62]

Although Chiang was geographically far removed from the centers of the emerging philosophy of integrated pest management in California, his consistent work on biological control earned him a place at the international table: the FAO's Panel of Experts on

Integrated Pest Control. Chiang joined the panel in 1974, and that year he contributed a paper on integrated pest control in maize.[63] Soon, however, the demand for knowledge about China would lead him to become the point person specifically for Chinese approaches to integrated control.

After 1949 Chiang "never had seriously thought about going back" to China; the invitation to join the 1975 delegation changed all that.[64] For the CSCPRC, it was an obvious match. Chiang and other Chinese-American scientists "constituted the single most important factor determining the success and character of the transnational scientific network" that arose from the exchanges.[65] Chiang possessed not only valuable expertise in biological control, but also the language skills and Chinese background to help the entire delegation make the most of the trip. He did not know it at the time, but his invitation came only after FBI clearance; when he returned from the trip, the FBI interviewed him one last time, concluding that "his visit to the PRC was of a legitimate official nature in line with his profession as professor of entomology" and "it is not believed that Dr. Chiang presents security risk factors."[66]

After his return from China, in addition to co-editing the official delegation report, Chiang authored or co-authored seven papers on Chinese pest control, all published between 1976 and 1978, including a paper presented at the 1977 FAO panel of experts entitled "Integrated Pest Control in the People's Republic of China."[67] Chiang also quickly stepped into the leading role in the CSCPRC's work on insect control. He translated documents, reviewed Chinese pest control books, compiled a bibliography of Chinese scientific writings on biological control, and organized subsequent exchanges, not only of scientists but also of biological agents.

DRAFT

Like Metcalf, Chiang returned from China in 1975 apparently very impressed by what he had seen. In the FAO *Plant Protection Bulletin*, Chiang credited China for adhering "to the general concept of sound ecology and conservation," such that "chemical control is used in China only if proved effective, safe, and economical." He described Chinese commitment to prevention via cultural methods (e.g., removal of stalks after harvest and fall plowing to prevent populations from overwintering) as the first line of defense, followed during the growing season by "equal emphasis... [on] cultural, biological, physical, and chemical methods" and the further employment of "mass control," which tapped China's vast labor supply for manual methods of pest removal.[68] Also like Metcalf, Chiang brought his observations to a more general audience by writing for a popular magazine, in his case an article entitled "Why China's Crops Have Fewer Pests: In the People's Republic, the Insects Are Controlled by Collective Decision," which was published by *Horticulture* in 1978 . And as with Metcalf's *Environment* article, the editors at *Horticulture* were captivated by the ducks in the story: they devoted an entire page to amusing line drawings of men in stereotypically communist Chinese garb herding ducks.

A research entomologist who had always focused on field applications and agricultural extension, Chiang was sympathetic to socialist Chinese emphasis in these areas. To his eye, it was not that China neglected research (as had often been charged), but rather that scholarly publication tended to follow applications in the field and extension to farmers, while in the United States scholarly publication came first.[69] "Thus the image of Chinese entomology as ignoring basic research may be an oversimplification," he suggested, while a more accurate assessment would acknowledge "the priority the Chinese give to putting scientific results into operation."[70]

Many years later, in an autobiographical essay for a Taiwanese entomology journal, Chiang offered a perspective on his 1975 experience very different from anything he had published at the time. While he acknowledged that he had "listened to many reports of interesting work," he described facilities as "old, minimal, and poorly maintained." The rest of his description focused on political issues. He noted that "party functionaries" stood beside scientists during the briefings and that the scientists would occasionally "glance at the party person before answering questions." Once he even heard the functionary accede, "It is all right to mention it." It was in this essay that Chiang also disclosed the discomfort he experienced when his former colleagues at the University of Minnesota—and one also from his student days at Qinghua—avoided any recognition of their "special relationship" with him. He explained, "What I did not know was that my visit was during the 'cultural revolution' in China when many intellectuals were sent down to the 'countryside' to be 're-educated' and many others were under surveillance."[71]

This was the side of socialist Chinese science that was hidden from delegates—or perhaps, though it was often in plain sight, the delegates simply did not wish to see or report it. Chiang of course did know that this was the Cultural Revolution, and that many intellectuals had a great deal to worry about. In fact, during the Cultural Revolution he had stopped writing to his sister, a doctor in Beijing, for fear that letters from the United States would bring her trouble, and it was with great relief in 1972 that he saw her mentioned alive and well when Arthur Galston and Ethan Signer—the first U.S. scientists to visit Mao-era China—wrote about their visit to her husband, a plant scientist with a Ph.D. from Yale.[72] But aside from a few comments to journalists about "regimentation" of social life, neither Chiang nor any of the other entomologists on the 1975 delegation made much space for concerns or criticism in their overwhelmingly positive published accounts of

their visit to socialist China. The time for critical comparison between democratic and authoritarian political contexts would come later. In 1975, socialist China was expected to serve as an inspirational other, its difference celebrated for what it could teach the U.S. and the world.

Pu Zhelong and Integrated Control in China

When the communists prevailed in 1949, Chiang decided that going home was now "out of the question." However, two of his fellow Ph.D. students in entomology at Minnesota—Pu Zhelong and Ma Shijun—repatriated with considerable success and rose to prominent positions in Chinese entomology. Pu in particular seemed to thrive in the unique research environment of socialist China; he brought the entomological knowledge he had mastered in the United States and put it to work in a new political context. Thus Chiang and Pu represented the two different ways—remaining in the U.S. and returning to China—that Chinese-born scientists educated in the U.S. contributed to transnational science.

Pu was born into a well-to-do family in 1912 and grew up in the lively city of Guangzhou. As a secondary school student, he enjoyed visiting the neighboring rural areas, where (according to his obituary in a popular science magazine) the contrast between the beautiful scenery and the poverty of the inhabitants instilled in him a desire to study nature and transform the backward Chinese countryside.[73] Pu completed a B.A. (1931-1935) at Sun Yat-sen University in Guangzhou and then an M.A. (1935-36) at Yanjing University in Beijing, where he studied genetics with the up-and-coming Li Ruqi (李汝祺, Ju Chi Li, Ph.D. 1926, Columbia University) and entomology with Hu Jingfu (Chen-fu F. Wu, the Cornell Ph.D. we met above).[74] He then took a teaching position at Sun Yat-sen University, which in 1939 joined the wartime migration to Yunnan Province. There Pu took up the

study of forest insects, experimenting with the use of bacteria to control forest pests.[75] Thus Pu's trajectory shared much with that of the young Huai C. Chiang. Chiang and Pu both got their starts as field entomologists in southwest China, where they had separately migrated to escape war and occupation in the east. And like countless other urban Chinese youths of the early twentieth century, Chiang and Pu discovered rural Chinese poverty and developed a desire to to do something about it. (This is such a common story, it is truly a trope of modern Chinese history.) They had all this in common before they met as Ph.D. students at the University of Minnesota in 1946.

Pu completed a dissertation on the taxonomy of Chinese moss beetles and received his Ph.D. in October, 1949. His wife, Li Cuiying (Tsui-ying Li, 利翠英), received a master's in entomology from Minnesota the same year. Pu's intention appears already to have been to return to China after finishing the degree,[76] and the communist victory did not change his plans. Pu and Li arrived in the People's Republic less than a month after its founding. In February, 1951, they wrote to Li's adviser, Minnesota professor A. Glenn Richards, and his wife:

> We heard that the price of food and commodity in the States is going up but we don't think that yours [sic] living would be menaced by such happening. Our living is still hard, but the salary has been raised every four or five months... Probably, you have been hearing lots of news of China from newspaper or radio. We must [tell] you honestly that China is in progress. There is not any force that suppresses the people and the farm tenants are really liberated from the oppression of landlords who are real enemies of modernization of China.[77]

It is unclear if Pu and Li continued to have correspondence with their American teachers and colleagues after this point. Certainly, it would have been risky to make their

connections with the U.S. conspicuous while the two countries were at war. In 1952, Ma Shijun publicly testified to what he had heard in U.S. entomology circles that allegedly lent weight to accusations the U.S. had employed germ warfare against China during the Korean War, going so far as to name specific individuals (although none from Minnesota). Liu Chongle (Chiang's adviser from Qinghua) also participated in the allegations.[78] Whether they truly believed the charges were justified, or whether they simply sought to decrease the vulnerability associated with their American Ph.D.s, is unknown.

Pu, however, appears to have had little trouble fitting into the new political order. He quickly shifted his research focus from taxonomy to pest control, a subject with far more direct social benefit and thus more in tune with science in a socialist system.[79] In 1958, consistent with the Great Leap-era emphasis on mass science, Pu took an active role in promoting a worker, Li Shimei (李始美), who had developed an approach to controlling termites. Li Shimei entered Sun Yat-sen University to conduct research under Pu and Li Cuiying's guidance, and subsequently received promotion to the status of professor in the university's biology department.[80] Of course appearances were not always what they seemed, and many people participated actively in political movements during the Mao era, only to reject the principles underlying them in later years. But Pu Zhelong sounded unusually sincere about his love for working with the people when visitors to China interviewed him during the Cultural Revolution, and there do not appear to be the kind of published "scar" stories about Pu's Mao-era experiences that exist for many other intellectuals.[81]

Pu's specific adoption of biological control as a research focus was attributed by the *People's Daily* to his anger over the refusal of "imperialists" to sell insecticides to China. In 1953, he began researching the cultivation of the parasitic wasp *Trichogramma*, a

primary biological control agent internationally, to control sugarcane pests. He took this research into the field in 1956, and by 1958 he had achieved excellent results through "integrated measures" (*zonghe cuoshi*), combining cultural controls with mass breeding and releasing of *Trichogramma*. Here again Pu worked with the Great Leap tide, emphasizing mass participation in the trials, encouraging people on the ground to help modify the technology to fit local needs, and developing the means to release *Trichogramma* on the kind of scale (areas over 1,000 *mu*, or 67 hectares) that Great Leap philosophy encouraged.[82] Although the Great Leap Forward is typically seen as an almost unqualified disaster, we should note that the more positive results of Pu's research were not unique but rather find a parallel in, for example, the celebrated work of marine biologist C. K. Tseng to develop large-scale kelp farming in this period.[83] Pu's Great Leap-era work on *Trichogramma*, moreover, helped prepare him for his later, more sustained work with the wasps at Big Sand Commune.

Pu was certainly not the only scientist in China working on biological control. Still, in 1975 the U.S. delegates accurately noticed that China, like their own country, lacked any national-level coordination of biological control efforts. Indeed, since the 1950s, biological control in China had thrived but only in certain pockets of the country where scientists like Pu pursued their research against a larger pattern of insect control dominated by other methods. Cultural control continued to be a very important means of preventing damage to crops. And at the same time, China was actively seeking to increase its supply of insecticides. Nationwide, use of insecticides rose ten times from 1957 to 1965; by 1974 levels had reached twenty times those of 1957.[84] Despite increases in production, and despite the heavy emphasis placed on self-sufficiency, between 1950 and 1979, China imported more than 900,000 tons of insecticides.[85]

The emergence of the concept of integrated control followed a strikingly similar pattern in China as in the United States. China's first published reference to "integrated control" came in a 1952 article in the key entomology journal *Kunchong xuebao* (Acta entomologica sinica). Later the same year, "integrated control" appeared in a U.S. journal article that has since been recognized as a kind of locus classicus for the term.[86] Interestingly, the Chinese article's use of the term was much closer than the U.S. article's to the meaning it soon came to carry in the U.S. as well as internationally. However, rather than focusing on the integration of chemical and biological controls, as proponents of integrated control in the U.S. generally assumed, the Chinese article proposed that chemical insecticides should be used alongside cultural controls.[87] Moreover, according to an interview with the lead author in 1985, "the suggestion of integrated control was to emphasize the chemical control because pest control could not depend only on agricultural [i.e., cultural] control methods."[88]

Nineteen sixty-two was a big year for integrated control, but not only because of *Silent Spring* and not only for the United States. In January, scientists at the Chinese Entomology Conference agreed that the heavy use of organic pesticides over more than a decade in many countries had caused resistance and thus larger insect pest populations. Some called for increased attention into biological control, while others argued strongly for greater use of chemical insecticides in the short term.[89] In April, two scientists, including one who had been a pioneer of biological control (and specifically use of *Trichogramma*) in republican-era China, wrote an article for *Chinese Agricultural Science* promoting the "integration of chemical control and biological control." Consistent with the temporary waning of self-sufficiency during Mao's post-Great Leap Forward retrenchment, the authors highlighted the international attention that had been brought to this subject, and

they cited research from Canada, the United States, Germany, Australia, Egypt, the Soviet Union, and other countries.[90]

This cosmopolitan turn in science was not to last. Already by 1964, the political winds had shifted, and with the start of the Cultural Revolution in 1966 a nativist and populist approach to science triumphed. The international context of biological control would now be downplayed, but research into and application of biological control continued unabated. In fact, the Cultural Revolution marked a critical stage in Pu Zhelong's career, and between 1972 and 1978 the area under biological control in China rose by a factor of ten, giving China arguably the largest area under biological control in the world.[91] Thus, the common understanding of the Cultural Revolution as a setback for scientific progress that Deng Xiaoping's program of Four Modernizations reversed in 1978 fails to make sense of what happened in the realm of biological control.

As Chiang and Metcalf both later understood, entomologists certainly suffered their share of difficulties and trauma during the Cultural Revolution. For example, Huai C. Chiang's old mentor Liu Chongle is said to have suffered "ruthless persecution" before he died of serious illness in 1969.[92] But the difficulties Pu faced were relatively light, and by 1969 he was deeply immersed in scientific work consistent with his own research interests and with the political commitments of the day.

Pu's work won attention from the *People's Daily* on several occasions. In 1970, an article described his efforts to protect lychee orchards where stink bugs had developed resistance to insecticides while pollinating bees had taken the hit. Pu and his students were celebrated not only for their success in employing the ovoparasitic wasp *Anastatus*, but also for their ability to broaden their own worldview beyond the confines of the university. The department established practical classes on insect control, and in the process created a

"new entomology."[93] A 1972 *People's Daily* article elaborated still further on Pu's accomplishments, emphasizing the large scale of his field operations, his grit in transforming a "crude shack" into a workable wasp station, his commitment to training local technical workers to run the pest control operation, and more than anything else his willingness to spend months in the countryside sharing the peasants' life and labor, learning many things, and becoming "tempered." From this time on, Pu Zhelong "regularly entered the front lines of the production struggle and assimilated the rich experience of the masses in his research." Consequently, Pu's teaching and research underwent a profound shift to pay closer attention to the relationship between theory and practice.[94]

As revolutionary as the *People's Daily* saw Pu's work to be, the political authorities at his university decided he was still lacking in one key area: he had failed to "take grain as the key link"—a crucial Cultural Revolution priority in agriculture. Pu needed to find a project that focused on rice.[95] The solution to his problem lay in Big Sand, a commune separated from Guangzhou by seven hours of dirt road. There Pu succeeded in bringing the many priorities of Cultural Revolution science together with his own environmentalist commitment to integrated pest control.

Pu Zhelong at Big Sand, Big Sand on the International Stage

In the summer of 1972, all conversation at Big Sand seemed to revolve around the problem of eliminating rice paddy pests, but the more they fought the insects, the more they seemed to be spinning their wheels, and they still endured heavy losses.[96] When local cadre Mai Baoxiang heard from a provincial-level official about the newspaper coverage of Pu's work, Mai decided to travel the seven-hour road to Guangzhou to beg for Pu's help.[97] Thus began Pu's long relationship with Big Sand. Over the next three years, he visited

thirty-four times, and he continued to conduct research and extension work there until his death in 1997.[98] Mai has shared with Sun Yat-sen University portions of his diary from the 1970s dealing with Pu Zhelong's activities. More than anything else, the entries testify to the tremendous good will and courtesy shared between Pu and local people. But they also paint a picture of the political commitments that helped shape the context for science in 1970s rural China, and here and there we may also detect evidence of Pu's continued connections to the main currents of transnational entomology.

In April 1973, when Pu first came to inspect the land designated for his experiments, he was quickly surrounded by a number of young women workers excited to tell him everything they had done to plant the field and prepare it for the experiment.[99] Also prominent in Pu's work at Big Sand were students from his department at Sun Yat-sen University. One of the U.S. delegates heard one of Pu's students testify to her commitment to the peasants. He wrote in his journal, "After graduation they plan to go to the countryside and serve the lower and middle peasants all their lives and try to improve their lot and the general welfare of their country."[100] The deep participation of both university students and young people from the commune was consistent with the Cultural Revolution's emphasis on involving young people in science and using youthful energy to overturn the old ideas that inhibited scientific progress (Figure 2).

In August, Pu gave a lecture at Big Sand to more than 70 people, including leaders of all the production brigades. He highlighted three important points, highly reminiscent of the arguments being pursued by his counterparts in the U.S. First, pesticides should not be considered silver bullets. When chemical pesticides were introduced in nineteenth-century Europe and the United States, some thought that insects would be eradicated. They even set about collecting specimens against that eventuality! But over the next century

pesticides just became more and more poisonous: for example, one drop of some of the ones used at Big Sand could kill a person, while insects not only survive but actually thrive. Second, it is not easy or necessary to eradicate insect pests. Instead the commune should strive to control insect populations in order to prevent economic harm. Third, no single method of control is perfect. For this reason, the commune should follow an integrated control strategy that combines different methods.[101]

In January, 1974 Pu and his colleague Gu Dexiang visited Big Sand to determine whether the commune leaders were interested in continuing the work. Amid many courtesies and toasts—Pu ended with a toast to Mao—the leaders elected to continue for a second year. In Mai's journal entries, Pu often seems to have a politically appropriate comment on his lips, and his commitment to the peasantry and the revolution appears strong. However, he could also be lighthearted about the political campaign *du jour*. Once he arrived in the midst of a meeting to criticize Confucianism, but instead of joining it, he requested that Mai accompany him on his inspection of the fields, saying, "They're talking about struggles among human relationships; we'll go struggle with nature." Still, their tour provided an opportunity to talk about some of the more enduring priorities of Chinese socialism, and Mai recorded Pu's concerns about hardship in the countryside and his belief that the government should do everything possible to help the peasants.[102]

Chinese scientists met in 1974 at a National Academic Conference on Integrated Control of Agricultural Disease and Pests; there they determined to adopt the slogan "integrated control with prevention foremost" (*yufang weizhu, zonghe fangzhi*).[103] American scientists' presumption that biological methods should play a key role in integrated control held true also for some Chinese scientists, especially for Pu and others who were pioneers in the area. Throughout most of the country, however, labor-intensive

cultural and manual methods continued to form the foundation for pest control, and "integrated control" typically meant maximizing the effectiveness of these methods in order to minimize applications of chemical insecticides. This is clearly evident in the 1974 edition of the *Plant Protector's Handbook*. For example, the entry for rice stem borer: "You must be on guard, fully mobilize the masses, and implement a plan of integrated control with prevention first, adopting a full set of integrated control measures with cultural control as the foundation combined with manual controls and chemical controls."[104] Following discussion of each major pest, the handbook provided a recommended battery of controls, typically including several types of cultural control and a schedule for applying a specific dose of a particular insecticide. Rarely did the protocol include biological control. Although the area under biological control in China increased rapidly over the next few years, by 1978 it still reached only about 8% of the total land under cultivation.[105] Pu's work at Big Sand was thus the exception rather than the rule; his emphasis on biological control tied him more to the world of transnational entomology than to national trends in Chinese agriculture.

In December 1974, Pu and Gu attended a follow-up conference on integrated control of paddy pests where they presented their accomplishments at Big Sand. This representation at the national level seems to have inspired commune members; upon Pu and Gu's return, they resolved to place the entire commune under integrated control. They further specifically pledged to forbid the catching of frogs (beneficial in killing insects), to build a factory for microbial control and a station for rearing wasps, to propagandize peasants and train a technical team, and to expand their program of raising ducks for biological control.

The ducks, so popular among visitors and celebrated in foreign accounts, deserve a bit more mention here. This was by no means the first time ducks had been used for biological control in China.[106] Still, their massive employment—34,000 the first year and 300,000 the next—required careful planning and technical assistance. Their efforts paid off: in one test site in 1975, 9,000 ducklings earned 18,000 yuan at the market, while expenditure on insecticide dropped from 2,560 yuan to just 32.80 yuan.[107]

The ducks helped in other ways too: much cuter and more delicious than wasps or bacteria, the ducks captured the attention of visitors to the commune (Figure 3). Pu's university team and Big Sand commune leaders consciously highlighted the duck program in presentations to international scientific delegations, visitors from other Chinese communes, communist party officials, university leaders, and newspaper reporters. The common criticism that visitors to socialist China saw only "Potemkin villages"—that the communes and other sites they toured were carefully selected and prettied up, and did not represent the typical Chinese experience—miss the point a bit, since the sites were well understood to be "models" in China, that is particularly advanced places from which others could learn. In fact, Big Sand was not only a model, but also explicitly an experimental site.

As both experimental site and model, Big Sand was highly successful. And Pu Zhelong was an effective spokesperson for the vision of insect control—and science more generally—championed in Cultural Revolution China. Pu had developed a project that involved both urban and rural youth, integrated theory and practice, transplanted laboratory research from the ivory tower to a "crude shack" in the countryside, and increased the self-sufficiency of Big Sand Commune, all for the sake of serving the peasants. When he traveled with a Chinese delegation to a conference in Sweden in May, 1975 (just three

months before he hosted Metcalf, Chiang, and the other U.S. entomologists), he placed his work firmly within Cultural Revolution science. Confucianism and feudalism had retarded scientific progress in China, but the "Great Proletarian Culture [sic] Revolution" brought a "step forward," and now scientific personnel cooperated with peasants to conduct research based on practical problems and raise parasitic wasps and insect pathogens in the people's communes.[108] But the specific content of Pu's work at Big Sand also owed much to his connection to international science: the commitment to biological control had been a shared focus of the transnational scientific community since the early twentieth century. Given the interwoven histories of U.S. and Chinese entomology, the 1975 delegation perhaps should not have been surprised to find that their former colleagues shared their perspectives and also some of their values.

Conclusion and Epilogue

Robert van den Bosch came away from the opening session of the 1975 Entomological Society of America meeting convinced that China was ahead of the United States in adopting integrated pest management. But what truly excited him was the way contemplating China's experience offered "considerable insight into what is going on with the American way of doing things."[109] For him, as for many others, the act of comparison itself was of primary significance in the exploration of insect control in socialist China. This act of comparison was made possible by the assumption of difference that accompanied the experience of renewed state-sanctioned cultural exchange after twenty-five years of relative distance. U.S. delegates went to China expecting that insect control in a socialist country would look different from what they knew at home, and their Chinese hosts proudly delivered a vision of self-sufficient, mass-participatory, integrated control

driven not by the profit motives of chemical corporations, but by a nationwide commitment to serve the people.

Much did separate the agricultural experiences of 1975 China and the U.S.—political, scientific, and material differences were thoroughly and inescapably intertwined. The economic structure of the United States—with chemical corporations profiting from the sale of insecticides—added greatly to the pressure on farmers to rely exclusively on chemical forms of control. China, on the other hand, lacked such corporate pressures; instead, limited resources for producing insecticides worked to balance the tendency to depend wholly on the quick chemical fix.[110] When Pu pursued research on biological control, his efforts were framed as helping China become self-sufficient in a world where imperialist countries could not be counted upon to share valuable insecticides. Similarly, in the 1970s plant protection handbooks encouraged forging a balance between use of "foreign" (*yang*) and "indigenous" (*tu*) insecticides.

In addition to self-sufficiency, mass mobilization was a key emphasis in Mao-era scientific writings and universally noticed by foreign scientific delegations. This was both a political value and also a response to the material conditions where labor was abundant and other resources scarcer. From the forecasting of pest populations to the removal of insect eggs from plants, insect control in socialist China was highly labor intensive. The continued importance of cultural control through the 1970s arose from these factors.

The differences the U.S. visitors set out to find, and which the Chinese hosts for their part sought to display, were real enough as far as they went. Nonetheless, they were built on a foundation of commonalities. In both countries farmers faced challenges from insect pests and found chemical insecticides (at least at first) to provide effective and easy control; both countries then discovered that insect resistance made the chemical controls

increasingly ineffective, while health and environmental concerns loomed.[111] Insect scientists in China and the U.S. were also interconnected through their historical participation in transnational science: during the early twentieth century, U.S. influence on Chinese entomology and agricultural science had been particularly strong, and after 1949 the return of scientists educated in the U.S. continued to shape Chinese research agendas.

Moreover, the scientists' core political and scientific values were often closely aligned. The United States agricultural colleges were founded with the understanding that the needs of farmers would drive research agendas and that agricultural scientists would share their knowledge with farmers through extension programs. Although a different set of material forces and a different political context produced "mass science" in China, there was much in it that American scientists could appreciate. Part of the reason the socialist Chinese vision of integrated pest control so inspired U.S. scientists was its *similarity* to the vision the U.S. scientists themselves possessed. But the transformation of these shared values into perceived differences was not simply the result of misconception: even as it distorted history, the act of comparison, together with the tendency to forget, allowed the U.S. scientists to use the Chinese example to reflect critically on the state of U.S. insect control science and to argue for changes that might bring reality into line with their ideals.

In 1979, Huai C. Chiang returned to China as the leader of a delegation of biological control experts; that same year Pu Zhelong and Li Cuiying spent three months touring U.S. universities—including three weeks at their alma mater, the University of Minnesota.[112] Chiang also helped host a group of Chinese plant protection scientists. He tried to ensure that each place the Chinese delegates visited offered them a "local flavor of hospitality." In Minnesota, "they visited a family farm raising 2000 hogs a year, a sweet

corn processing plant, and a branch agricultural experiment station." At a dinner hosted by the university president, they interacted with both agricultural science faculty and "agrobusiness people interested in China."[113] In 1975, these might have been opportunities to highlight the differences between capitalist and socialist visions for agriculture. In 1979, they were planting seeds for China's new direction in agriculture, in which the U.S. would play increasingly significant roles in both the scientific and economic spheres. Indeed, over the course of the 1980s, Chiang would return to China many times: his activities included lecturing on the U.S. land grant agricultural college system, organizing an exhibit on U.S. approaches to insect control, and arranging educational partnerships between the two nations.[114]

The biological and integrated control work that Pu and others spearheaded in the Mao era continued and even expanded in later decades, but the larger picture of socialist science in which this work had been presented at Dasha and elsewhere dissolved in the tide of political, social, and economic changes. With the thrill of visiting a newly opened land wearing off, the growing uncertainty in China of how to present recent scientific achievements in the wake of the "Gang of Four's" fall, and the belated recognition of how scientists had suffered during the Cultural Revolution, U.S. scientists no longer went to China excited to see a model of science outside a capitalist context. The enthusiasm with which U.S. and other Western scientists in 1975 celebrated China's success in moving away from a reliance on chemical pesticides feels ironic—even poignant—today, as international newspapers fill with stories of infants dying from poisoned formula and exports tainted with toxic chemicals. Whether China in state-socialist 1975 in fact showed promise of a better future for insect control (and there is not, I think, an obvious answer to this question), China in state-capitalist 2011 has become the largest producer, consumer,

and exporter of chemical pesticides in a world where pesticide use has continued to climb across the board.

A few years ago, the popular U.S. magazine *Newsweek* began a story on the global honeybee crisis with a vignette from China. "When China rapidly expanded its pear orchards in the 1980s, it stepped up its use of pesticides... Today, during the spring, the snow-white pear blossoms blanket the hills, but there are no bees to carry the pollen. Instead, thousands of villagers climb through the trees, hand-pollinating them by dipping 'pollination sticks'—brushes made of chicken feathers and cigarette filters—into plastic bottles of pollen and then touching them to each of the billions of blossoms."[115] A labor-intensive approach no longer represents as it did in 1975 China's forward-looking ecological responsibility; today it symbolizes just how close China has come to the edge of ecological disaster. There is still no doubt a valuable role for the construction of difference to play in offering alternative possibilities and inspiring change, but the danger in over-emphasizing the contrast between China and the U.S. is just as potent. Now more than ever we must resist the tendency to forget our shared history: the challenges of our common future will require stronger solidarity than we have yet achieved.

Figures

Figure 1. Duck herders in Big Sand Commune. From Robert L. Metcalf Papers, 15/8/23, box 38, University of Illinois archives. Courtesy of the University of Illinois Archives. Reprinted in his article, "China Unleashes Its Ducks," Environment, 1976, 18.9:14-17.

Figure 2. Pu Zhelong at the Big Sand Commune wasp station providing guidance on rearing *Trichogramma* (1975). The emphasis on engaging youth in rural scientific research

is a major theme of Cultural Revolution-era science. Pictured here are both local youth and youth "sent down" to the countryside from the city. Gu Dexiang et al, ed., *Pu Zhelong jinian yingji* [Pu Zhelong Memorial Album] (n.p., 2002), p. 23.

Figure 3. Chart showing biological control at Big Sand, flanked by two stuffed ducks. From Robert L. Metcalf Papers, 15/8/23, box 38, University of Illinois archives. Courtesy of the University of Illinois Archives.

DRAFT

1 For their support and assistance, I thank Joshua Buhs, Katherine Chiang, Gu Dexiang, Bernard Lightman, Mai Baoxiang, Kenneth Pomeranz, Wang Zuoyue, Zhang Guren, Zhang Li, and two anonymous reviewers.

2 The vast literature on historical memory and forgetting has tended to emphasize the effects of trauma on collective memory. While the Mao era offered its share of trauma, the types of forgetting I discuss arose more from changes in the political landscape that rendered some memories inconvenient, irrelevant, or incongruous. My own interest in historical amnesia stems from the work of Vera Schwarcz, who was in turn inspired by Middle East historian Bernard Lewis. See, for example, Vera Schwarcz, "Out of Historical Amnesia: An Eclectic and Nearly Forgotten Chinese Communist in Europe," *Modern China*, 1987, 13.2: 177-225. See also Sigrid Schmalzer, "The Appropriate Use of Rose-Colored Glasses: Reflections on Science in Socialist China," *Isis*, 2007, 98.3: 571-583.

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4 The contributors to the special Focus Section on Modern China in *Isis*, 2007, 98.3 all spoke to this need in one form or another.

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8 van der Vleuten, "Toward a Transnational History of Technology," 983.

9 American Insect Control Delegation, *Insect Control in the People's Republic of China: A Trip Report of the American Insect Control Delegation, Submitted to the Committee on Scholarly Communication with the People's Republic of China* (Washington, D.C.: National Academy of Sciences, 1977); China Trip Notebook, Box 20, Robert L. Metcalf Papers, University of Illinois at Urbana-Champaign Archives (hereafter Metcalf notebook); Mai Baoxiang, "Pu Zhelong jiaoshou zai Dasha de rizi," posted to the Sun Yat-sen University website *Zhongshan chunqiu*, http://www.sysu.edu.cn/zdcq/ji.htm, viewed 15 Jan. 2009; P. L. Adkisson, "China Trip Notes Taken on the U.S. Insect Control Delegation Trip to the People's Republic of China, August 1-September 2, 1975," CSCPRC archives, Global Resource Center, George Washington University.

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