For China, and For Science:
The Institute of Agriculture at Tsinghua University and Scientists in Republican China, 1930s-1940s

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Dedication

This thesis is dedicated to Bo, my husband.

Abstract

In 1934, the National Tsinghua University established an institute of agriculture. It was expanded and strengthened during the Second Sino-Japanese War. Although it only existed for twelve years, this institute played a significant role in the history of science in modern China. Fifty-nine agricultural scientists worked at this institute. Four of them were selected as academicians of the Academia Sinica in 1948, and fourteen became academicians of the China's Academy of Sciences after 1949. This essay will examine the history of the Institute of Agriculture in Tsinghua University and explore the reason for its success. I argue that the Tsinghua researchers' dual-identity of being both Chinese people and scientists enabled this institute to survive and thrive in an extremely turbulent era. Motivated by the Chinese-scientist dual-identity, these scientists at Tsinghua IOA were able to be flexible and to relieve tensions between the Chinese and the foreign, between the central and local political forces, and between different local environments, and therefore contributed to the development of both their country and the scientific knowledge they worked on.

Table of Contents

List of Figures

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I. Introduction

In this thesis, I will take agricultural scientists at Tsinghua University as a case study to explore a group of scientists who had received training in the United States and conducted scientific work in China during the 1930s and 1940s. These scientists articulated their goals in the terms of a "dual-identity" of being both "scientist" and "Chinese". I would like to define the identity of "Chinese" as the love for China, the feeling of belonging to China, and the desire to serve China and its people. This definition is mainly based on cultural belief and feeling rather than politics, although political context played an important role in the history I am exploring. On the other hand, the identity of "scientist" implies the social and professional responsibility of scientists in a broader global sense. The Chinese scientists in this work faced issues similar to their American colleagues such as scientists' struggle to maintain their intellectual autonomy and the appeal to social duty. However, because of critical differences in their historical context, the Chinese scientists reacted to these issues differently from the western scientists. They identified themselves in this dual way: as scientists and as deeply Chinese. The fact that these scientists were trained in the West, along with their American and British counterparts, highlights the tension between the global circulation of scientific knowledge and the need to apply it in particular local contexts. My argument is: motivated by the Chinese-scientist dual-identity, these agricultural scientists were able to adapt to the chaotic context of Republican China. They acquired the dual-identity through their distinctive experiences. By stressing their dual-identity, these scientists were able to be flexible—to relieve tensions between the Chinese and the foreign, between the central and local political forces, and between different local environments. They not only survived and adapted to the chaos, but believed that they had improved both their country and the sciences they worked on. In addition, they were able to send their achievements back to the West, and thus contributed the transnational circulation of scientific knowledge.

My study is situated primarily in the scholarly literature about Chinese scientists who pursued education and training in Western universities. Historians such as James Reardon-Anderson, Wang Zuoyue, and Sigrid Schmalzer have explored some themes related to my argument.[1] For example, in his 2002 article "Saving China Through Science: The Science Society of China, Scientific Nationalism, and the Civil Society in Republican China," Wang studied a group of scientists who received college and graduate education in the United States in the 1910s and went back to China after their American education. According to Wang, these scientists were motivated by "scientific nationalism," which Wang defined as "Chinese scientists' desire to create a strong, unified, and prosperous Chinese nation." Wang pointed out that the scientific nationalism is different from the nationalism of Japanese scientists and German scientists in that the Chinese scientists were emphasizing their country rather than science.[2]

Overall, I agree with Wang that Chinese scientists were enthusiastic to save their country with their scientific knowledge. Wang's work focused on the development of scientific societies and institutions because very few of these institutions existed for scientists in China in the 1910s and early 1920s. Wang uses "professionalism" to describe how the first generation of American-trained Chinese scientists returned to a vacuum of scientific institutions and established a system based on the western model but maintained intimate and complex connections with successive political regimes in Republican China.[3] My project supports some of Wang's conclusions, but focuses on a later time period. During the 1930s and 1940s, American-trained Chinese scientists returned to better developed professional institutions than their predecessors, and therefore were able to be more concentrated on scientific research and education. They still had a strong desire to serve China; meanwhile, different from the first generation,

[1] See Wang, Zuoyue, "Saving China through Science: the Science Society of China, Scientific Nationalism, and Civil Society in Republican China", *Osiris*, Vol. 17, (2002), pp. 291-322; James Reardon-Anderson, *The Study of Change: Chemistry in China, 1840-1949*, Cambridge: Cambridge University Press, 1991, Part III and Part IV; and Sigrid Schmalzer, "Popular Science, A Useful and Productive Category after All," *Isis*, Vol. 98, (2007), pp. 571-583, and "Knowledge in Transit across *Yang / Tu* Boundaries: The Transnational and the Popular in Mao-era Chinese Science," HSS 2012 Annual Meeting at San Diego, California.
[2] Wang, p. 299.
[3] Wang, pp. 299-309.

these younger scientists had a strong desire to contribute to international science as well. The identity of being “Chinese” played significant roles in the lives of both the older and younger scientists in Republican China, although in different ways, as I have described. The importance of the identity as a contributor to international science became remarkable only for the younger generation, after the scientific institutions had been built up in China.

I prefer to use the “Chinese-scientist dual-identity” rather than “scientific nationalism” in my study for three reasons. Firstly, there is no satisfactory equivalent in Chinese language for the English term “nationalism.” “Nationalism” is usually translated into two Chinese terms: “爱国主义” or “民族主义”. The first translation, “爱国主义”, means simple “love for country” and does not necessarily involve ethnical or political implications. “民族主义”, the second translation, reflects ethnics and nation-state concepts, but is actually seldom used in Chinese even today. Scientists in my project were more likely to use the term “爱国” (love the country). The English phrase “scientific nationalism” is not enough to accurately express the ideas and feelings of these scientists. Secondly, for the time period I am working on, there was not a strong consistent national identity in China as there was in Japan. Although China used to be a “Central Empire”, the central government had gradually lost its power to local forces since the late Qing Dynasty. In Republican China (1911-1949), the so-called central government—first the Beiyang government in Beijing, then the Nationalist government—could effectively control only certain provinces, while warlords were controlling other parts of China. Chinese scientists in this project might prefer diverse political forces and did not have a strong feeling of loyalty to China as a “political” entity, but their love for China as a country and the desire to serve the Chinese people might even become stronger because of pressures from both inside and outside of the country. Thirdly, although part of the definition of “Chinese identity” coincides with Wang Zuoyue’s definition of “scientific nationalism,” the exact implication and realization of “the desire to serve China” was changing through the 1930s and 1940s, when the Chinese scientists were enthusiastically serving both China and their sciences.

Therefore, I would like to avoid the term "scientific nationalism" which involves too much political meaning; instead my thesis uses the "dual-identity" to characterize the motivations of Chinese scientists trained in the West from the late 1920s through the 1940s.

Reardon-Anderson has analyzed difference between the first and second generations of Chinese scientists in Part III of his book *The Study of Change: Chemistry in China, 1840-1949*. He explored works of the Chinese chemists and argued that during the "Nanking decade" (1927-1937) and wartime, political authority and scientific autonomy were able to reach a balance. Although there were always conflicts between the state's demand for practical knowledge from the scientists and the scientists' demand to conduct pure research, they were able to maintain a compromise to benefit each other. [4]

Reardon-Anderson's work is very valuable for studies of the history of agricultural sciences as well. However, although he included science in Yan'an (center of the areas controlled by the Chinese Communist Party) in his book, for Nationalist China (1928-1949) Reardon-Anderson concentrated more on scientists near the state political center. A remarkable characteristic of republican China was its decentralized status, and this is reflected in my study. In regions formally controlled by the Nationalist government, social, economic, and political situations were highly diverse and unbalanced. Although it is undeniable that scientists near Nanjing (or Chongqing during the wartime) seem representative for the history of science in modern China, we should notice that scientists far away from the political center were very contributive for both China and international science as well, while the environments in which they were working were quite different. We should also notice that the undeveloped regions had demands for scientific knowledge as well. Therefore, my contribution is to introduce an institute—the Institute of Agriculture at Tsinghua University (Qinghua Daxue Nongye Yanjiusuo, I will use Tsinghua IOA for short)—that was far away from the political center during the 1930s and 1940s (Nanjing or Chongqing). This institute was first established in Peiping (Beijing), the former national capital and one of the cultural centers in Republican China. During the war, it was forced to move to Hunan and Yunan, some undeveloped

[4] Reardon-Anderson, p. 255-257.

southwestern provinces. The development and reform of Tsinghua IOA is a valuable case study to explore my argument of how the Chinese-scientist dual-identity had motivated American-trained Chinese scientists to deal with diverse political forces and to adapt to continually changing social and natural environments.

In her recent works, Schmalzer has also focused on agricultural sciences in modern China and has investigated roles of the Chinese-foreign identity in the career of Chinese agricultural scientists.[5] My project supplements the ideas of Schmalzer because, actually, for sciences in most post-colonial countries, the native-foreign relation is an important topic, but this is especially complex in post-colonial China. The semi-colonial situation determined that Republican China had to develop in ways different from western countries, while the huge territory and imbalanced natural and social diversity with the country itself made it distinctive from other post-colonial countries. Western science was something imported from foreign countries and was supposed to be universal. Its foreign origin along with its so-called universal spirit might cause controversy among post-colonial people eager to emphasize the identity of their own country. However, Republican China was in a state of decentralization. The country itself was in fact separated and governed by different warlords and Chinese people had to live under different political forces. Few post-colonial countries have experienced such separation. The Chinese-scientist dual-identity helped Chinese scientists overcome this difficult situation. Motivated by the identity of being "Chinese" in a cultural sense, the scientists were able to conquer political barriers caused by warlordism. Motivated by the identity of being a "scientist", they were also able to apply their knowledge to diverse natural regions and social fields. Schmalzer's recent work on the Chinese-foreign identities of Chinese agricultural scientists mainly focused on the Maoist period—generally from 1950s to 1970s—which was later than my focus. During the Maoist period, the authority of the central government and state power was greatly strengthened compared to the 1930s and 1940s. Decentralization and internal diversity were not so critical as in the Republican era. However, as China has reopened and reformed since the 1980s, the issue of localism and internal imbalance has become important again. Therefore, some of the

[5] Schmalzer, "Knowledge in Transit across *Yang / Tu* Boundaries", 2012 HSS annual meeting.

conclusions in this article might be applied to the history of science in post-reform China as well.

In the following pages, I will first outline a general picture of the historical context of Republican China. Then I will examine the development of Tsinghua IOA and the lives and careers of the IOA scientists. My thesis on the roles of Chinese-scientist dual-identity will be supported through answering questions such as: (1) how these scientists had pursued studies and careers in America and Republican China; (2) how they had not only survived but also thrived in times of extreme political chaos and at locations of diverse natural and social conditions; and (3) how they had contributed to global circulations of scientific knowledge.

II. The Chinese-Foreign Tension

A General Picture of Republican China and Foreign Influence

The influence of political context should never be neglected in studies of the history of science in modern China. I would like to use “decentralization” to characterize the political condition of China during the first half of the twentieth century. China had been considered as the “central empire” before the nineteenth century. However, the imperial Qing government had been defeated by modernized foreign countries and had not been able to control and strengthen China effectively since the late 19th century. After the loss in the 1895 Sino-Japanese War and the 1900 Boxer Rebellion, local military governors gradually gained dominance of their provinces from the central government, and they later became warlords in the republican era.

The 1911 Revolution ended the Qing Empire with the accession of a republican government. Yuan Shikai (袁世凯), the most powerful military leader, held the country for several years. During the decades after Yuan’s death in 1916, China fell into many parts governed by different warlords, which was usually called the “Warlord Era” (1916-1928). (See Figure 1.) Although the Nationalist Party (KMT) government became the central government authority in 1928 and unified China in form, it was not capable of overcoming the warlords and establishing a strong national identity for all Chinese

people. (See Figure 2.) The KMT government had undertaken reforms—such as the New Life Movement and the Rural Revival Movement—to improve its political authority. However, policies made by the KMT government were largely ignored in regions controlled by other political forces (including the Communist Party, CCP). Even within the provinces directly under the KMT government's influence, these reforms were highly restricted to the urban areas, while most rural areas remained untouched. Therefore, China after 1911 must be considered as quite decentralized,[6] and my project revises previous work by examining the activities of scientists specifically in this context.

During the Second Sino-Japanese War between 1937 and 1945, the Japanese occupied northern and eastern China. The Chinese government and hundreds of thousands of Chinese people had to retreat to the southwestern inland provinces, which were still extremely undeveloped at that time. (See Figure 3.) Although living and working conditions declined horribly for most Chinese people, the decentralized political situation got simplified during the war. After the Sino-Japanese War, only two strong political forces—the KMT and the CCP—remained to compete for political domination. The end of the war marks the end of my analysis.

Despite the political chaos, scientific institutions were established in China during these decades. These early institutions reflected the semi-colonial conditions in China at the turn of the century. In 1909, the Qing government compromised with the United States to set up the Boxer Scholarship to support Chinese students studying practical knowledge in American universities. These students became the first generation of American-trained Chinese scholars. They had contributed to the establishment and development of scientific research and education, publications, civil societies, and policy making. During the turbulent decades of early republican China, foreign activities such as missionary schools and the Boxer Scholarship critically helped

[6] For the general situation of agriculture in Republican China, see Guo, Congjie, and Chen Lei, "Nanjing KMT Government's Policies for Agricultural Popularization before the Sino-Japanese War"; also see Zhang Shijie and Guo Hairu, "Jiang Jieshi's Ideology of Agricultural Economics".

Figure 1, 2, 3 are maps showing the importance of paying attention to the local conditions during the republican period in Chinese history. There was no strong central government in China at that time. Therefore "scientific nationalism" is not a proper phrase to describe this period because there was no clear political "nation". Figure 3 also shows the movements of chief agricultural schools caused by the Japanese invasion in 1937 and 1938.

Figure 1. This picture roughly illustrates the political situation in China in mid-1924, when Beijing government was internationally considered as the legitimate Chinese government (but it only controlled the provinces around Beijing, not including Shanxi province). The blue area was controlled by KMT; the green areas represent different warlord groups.
(The Chinese administrative districts in 1924 were slightly different from those between 1928 and 1949. Here I use the same base map for the convenience of comparing the political situations.)

Figure 2. This picture shows political and military situation in China before the Central Plains War in 1930. The KMT unified China in form in 1928. Beijing was renamed as Peiping; it was no longer the national capital. Most remaining warlords claimed to submit to the KMT government based in Nanjing (therefore I changed them into light blue), but they actually kept independence in politics and military matters. The KMT government could effectively control provinces in East and Southeast China (dark-blue-shadow area). Conflicts between the KMT and other warlords finally resulted in the Central Plains War. The red circles indicate main battlefields of this war. Because of battles in Shandong and Henan, the Nanjing KMT government completely lost its control over Peiping for several months, which results in a series of changes at Tsinghua.

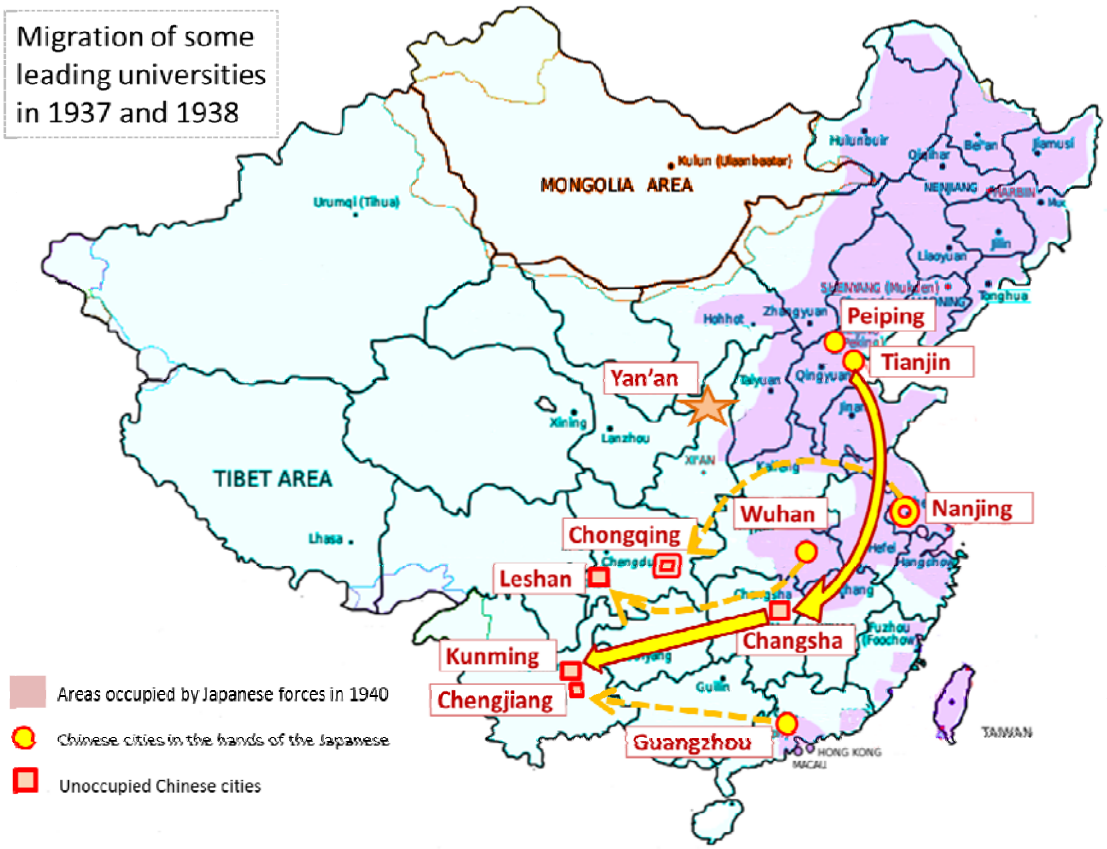

Figure 3. The purple shadow in this picture shows areas occupied by the Japanese troops by 1940. When the Sino-Japanese War comprehensively started in July 1937, most academic institutes had to retreat to safer rear areas because of failures of the Chinese armies. For example, the National Central University moved to Chongqing along with the KMT government, the National Wuhan University moved to Leshan, and the National Sun Yat-Sen University moved to Chengjiang. Three leading universities from North China—Tsinghua, PKU, and the Nankai University—moved to Changsha first, then to Kunming in early 1938, and continued researches and educations as the Southwest Associated University (Lianda for short) during the war. Most Chinese scholars and young students moved to the southwest rear along with their institutes. So did the KMT armies, officials, and some refugees from the Japanese-occupied areas (which means a lot of mouths to feed—a huge pressure for agricultural production!).

The old political pattern in China was significantly changed because of the war. Most warlords gradually lost their forces. However, the Chinese Communist Party (CCP) got a chance to grow (marked as Yan'an in this map). It kept independent during the war and attracted some intellectuals from the Japanese-occupied areas as well. For example, Zhou Jiachi from Tsinghua IOA studied at Yan'an for half a year in 1938. The KMT government was trying to eliminate the CCP all through the war, which disappointed many Chinese people (such as Tang Peisong) because they hoped the central government would concentrate on fighting against the Japanese rather than other Chinese.

the development of science in China as well. Their roles declined after the Anti-Christian Movement in the late 1920s, when most non-Chinese were forced to leave Chinese institutions.[7]

The KMT government (1927-1949) strengthened support as well as control of science. Within regions effectively controlled by the KMT central government, the Ministry of Education reformed scientific education significantly. State and provincial funds were set up to support students to travel to America and European countries to study science, engineering, medicine, and agriculture. Universities receiving foreign funds were reformed into private (mainly the missionary) or national (Tsinghua) universities and were required to take the Ministry of Education's direction. Scientific publication was supervised by the KMT government. Governmental institutes and departments such as the Central Agricultural Experimental Institute (中央农业实验所, *Zhongyang Nongye Shi Yan Suo*, also named as the National Agricultural Bureau; I will use CAEI for short) were established to organize and encourage scientific people to work on knowledge most useful for the country's development. Scientific civil societies such as the Science Society of China worked together with the officials to facilitate and regulate activities of scientists. In addition, Academia Sinica, which also functioned as the ministry of science and technology, cooperated with relevant organizations and helped Chinese scientists to participate in more international scientific communication. As more and more scientists with western training background returned to China and joined these institutions, the Chinese became more active in global science.

Here I would like to borrow Reardon-Anderson's way to categorize the Western-trained Chinese scientists and refer to the scientists returning to China during the Warlord Era (before 1928) as the "first-generation" scientists, and those returning during the KMT era as the "second generation" or "younger generation."[8] Although both generations of Chinese scientists had a strong desire to serve the country, they behaved in significantly

[7] See Zhang Kaiyuan and Arthur Waldron, *Christian Universities and Chinese-Western Cultures*, and Loren William Crabtree, *Christian Colleges and the Chinese Revolution, 1840-1940: A Case Study in the Impact of the West*.
[8] James Reardon-Anderson, pp. 177-185.

different ways because of the changing situations of scientific institutions in China. In the early twentieth century, there were very few scientific institutes in China. For the early generation of American-trained Chinese scientists, the identity of being scientists seemed less important. Their most critical task was to establish an institution for scientific research and education. However, during the decades after 1927, younger Chinese scientists had received better educations than their predecessors, had institutions in China to return home to, and were more committed to research and teaching as their responsibility. Those entering their scientific careers after the late 1920s were usually less interested in the broad political and cultural concerns—partly because they were educated in better-established scientific institutions, and partly because compared with their predecessors, they had to work harder to find a position to work in these institutions. There were more and more debates on the social responsibility and autonomy of scientists gradually during this period, just like in western countries where scientific institutions had grown mature. While for the early-generation scientists, their social responsibility—to serve China—meant to build up more scientific schools, societies, journals, or to participate in political activities beneficial for the development of science in China, while for the younger generation, probably the best way to serve China was to create good sciences.

Although scientific institutional establishments had achieved remarkable results, before the second Sino-Japanese war, most of the achievements were limited in the coastal regions—north, east, and south China, while the inland regions remained underdeveloped. During the war (1937-1945), most Chinese scientists had to leave their well-established homes and workplaces and retreat to the southwestern provinces: Sichuan, Yunnan, Guizhou, and Guangxi. They had to adapt their knowledge and practices to the local circumstances to survive. A general tendency was that the Chinese scientists had to apply their knowledge and skill to more practical and useful topics which might quickly improve agriculture and industry in the parts of China not occupied by Japanese forces. Pure research became something supplementary for most scientific workers, but scientists struggled to maintain their research programs nonetheless. Governmental authority took more control over activities of scientists. When facing

threats from foreign forces, scientists driven by the identity of being Chinese seldom considered this tendency of doing practical applied science as loss of professional autonomy. However, we should notice that, even in such circumstances, the Chinese scientists also continuously worked on less practical research and published their works in western journals. Their achievements were among the most valuable scientific discoveries at that time. I will give specific examples later to illustrate this history, which illuminates the motivations of these scientists and their flexibility in adapting to constantly changing conditions.

Tsinghua University in Early Republican China

Agricultural scientists at Tsinghua University are good case studies of how the dual-identity enabled and facilitated American-trained Chinese scientists to adapt to the chaotic context in Republican China. Firstly, the establishment and early development of Tsinghua University was largely relying on the Boxer Scholarship and the United States; therefore it may represent a tension between the Chinese and the foreigners. Secondly, during the decades when the agricultural scientists were working at Tsinghua University, Tsinghua was far away from the KMT central government and far away from the political center. The University had to find a balance between the central and local governments. Therefore, it is a good example to illustrate the tension between different political forces. Thirdly, agricultural sciences are a type of knowledge that may be applied to both practical use and fundamental research. Therefore, the strategies of these scientists may reflect how the Chinese scientists found a balance between the identity of "Chinese" and the identity of "scientist."

It is necessary to briefly introduce the establishment of Tsinghua University before exploring its agricultural studies. Because of the Boxer Rebellion in 1900, the Qing Empire was fined an indemnity of four hundred and fifty million taels of silver to the Eight-Nation Alliance. This indemnity claim took 39 years to extinguish and, with an annual interest of 4%, required over nine hundred and eighty-two million taels (about US $726 million at that time). The United States shared 7.32% of this indemnity. However,

the Qing government quickly argued that the Boxer Protocol awarded the U.S. more than it should have demanded. After a seven-year negotiation, the U.S. government (under President Theodore Roosevelt) agreed to use the surplus portion to set up a scholarship program for Chinese students to study practical knowledge such as engineering, agriculture, and medicine in the United States. For China, this program was meant to bring in advanced scientific and technical knowledge. For the U.S., it was a chance to export American culture and influence to China. This program started to select and prepare Chinese students to study in the U.S. in 1909, and Tsinghua College began as a preparatory school in April, 1911 with part of the first remission.[9]

At first, this school provided education at the level of secondary school and the first two years of college. Students at Tsinghua College received education to prepare for further studies in the U.S. However, during the late 1910s and the early 1920s, scholars at Tsinghua decided that, if they were contented with the status of a preparatory school, Tsinghua would lose its roots in Chinese culture. Although early graduates from Tsinghua often stressed the humiliation of China, they were also actually trained western-style and relatively weakly in Chinese knowledge, even though the students themselves did not mean to be that way. As a preparatory school, Tsinghua was more like a secondary school or junior college at first. Its students were only prepared to go to an American university rather than to work or study in China directly. Students and scholars from other national universities often laughed at Tsinghua students for their poor knowledge and skill as Chinese people. In addition, the school was completely dependent on the refund of US Boxer indemnity. If this situation continued, whenever the Boxer Scholarship finished, Tsinghua School would be finished.[10]

To avoid such a fate, in 1925 Tsinghua set up its college department to provide full college education. About two thirds of the annual fee from the Boxer Scholarship was used to support the college. The newly-established college was able to get the best faculty in China because its alumni who had received graduate degrees from the U.S.

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[9] Ye, Weili, *Seeking Modernity in China's Name: Chinese students in the United States, 1900-1927,* Stanford: Stanford University Press, 2001, p. 10.
[10] *Historical Materials of Tsinghua University*, Vol. 1, pp. 276-277.

were likely to come back and work at Tsinghua. In addition, Tsinghua's financial support was much more stable than other famous universities supported by Chinese governments, which made it very attractive for students. By 1928, when the KMT government took over Tsinghua, this school had become one of the best universities in China. Many of its early graduates later became very outstanding scientists in both republican and post-1949 China, and three of them were leading researchers at the Tsinghua IOA, the focus institute of this paper.

III. Dual-Identity of Two Agricultural Scientists at Tsinghua IOA

Actually, the fact that Tsinghua University itself was funded by the Boxer Indemnity was definitely a stimulus to induce the identity of being "Chinese" for Tsinghua scientists, while the advantages of receiving the best education in both China and the U.S. implied their capability in scientific studies. All eight professors from three divisions of the Tsinghua IOA along with their students and assistants may exemplify the dual-identity. Considering the representativeness of examples and the availability of archives, I will focus on the lives of two agricultural scientists at Tsinghua—Dai Fanglan (戴芳瀾) and Tang Peisong (汤佩松) (see Figure 4.)—in this part to illustrate how the dual-identity influenced the career and life of scientists in Republican China.

Dai Fanglan's Early Career and the Uneasy Lives of the First-Generation Chinese Scientists

Dai Fanglan may be considered as a member of the "first-generation" of American-trained Chinese scientists. His life exemplified the dual-identity of the first-generation scientists: they held contradictory attitudes towards foreign countries. On the one hand, they actively accepted resources from foreign sources; on the other hand, they felt deep humiliation for foreigners' superiority over Chinese people because of China's disadvantage in modern social institutions and scientific knowledge.

Dai Fanglan was born in Zhenhai, Zejiang Province on May 3rd, 1893. He was the third son of a scholar-gentry family. His grandfather and father had been chief officials at several counties in Zhejiang Province. Sponsored by their uncle Dai Zhenchuo, Dan

Fanglan and his elder brother were able to take western style elementary and secondary education in Shanghai. They graduated from high school in 1910, the year when the Qing Government started the Boxer Indemnity Scholarship Program. After a one-year preparation, Dai Fanglan passed the exam and was admitted to Tsinghua College at the age of eighteen. He studied at this college for two years to prepare for college education in the United States.[11]

According to the original agreement between the Qing Empire and the U.S. government, over 80% of the selected Boxer students had to major in applied knowledge such as engineering, agriculture, medicine, business and law. The Republican governments followed this rule. In actual practice, the Boxer students had the freedom to change their universities and majors. For example, Hu Shi (胡适), one of the first generation Boxer students, transferred from agriculture to philosophy at Cornell University. However, Hu Shi was only an exceptional case. Most Boxer students stayed in sciences and engineering. In his autobiography, Dai Fanglan explained the reason of his choosing agriculture as a major, which apparently suggested a motivation of patriotism and scientific nationalism:

> "…foreigners were continuously insulting our country. Youths at that era were all filled with righteous patriotism and wished our country to become stronger very soon. Most young people prefer to study practical knowledge rather than humanities in order to make China stronger. Therefore I chose agriculture as my major. I thought that the United States had advanced agricultural sciences. In addition, it was a democratic and advanced country and might be a model for our development."[12]

Nevertheless, just like most first-generation American-trained Chinese scientists, while acknowledging the democracy and advancement of the United States, Dai Fanglan did not forget the humiliations for China brought by this country.

In 1914 Dai Fanglan entered the College of Agriculture in University of Wisconsin-Madison. It was the era when H. L. Russell and J. L. Ralph were building up the studies

[11] Cheng Guangsheng, *Biography of Dai Fanglan*, pp. 5-10.
[12] Cheng Guangsheng, pp. 10-11

of microbiology and plant pathology in the United States. Dai Fanglan was the first Chinese student to study plant pathology in America. For two years, Dai Fanglan had focused on mycology and agronomy at the University of Wisconsin. It was during this period that he joined the Science Society of China (SSC), the first Chinese scientific association established by his Tsinghua seniors in the Cornell University in 1915. The SSC was organized by a group of Chinese students at Cornell University in 1914. The first issue of its monthly journal, *Kexue* (Science), was published in January 1915, which signified the formal establishment of the Science Society. Among the nine founders of the SSC, seven were sponsored by the Boxer scholarship and were therefore Tsinghua alumni.[13] Dai Fanglan's Cornell colleagues encouraged him to introduce other Chinese students in Wisconsin into this society. Two years later, in fall 1916, Dai Fanglan transferred to the School of Agriculture in Cornell University, considered by some to be the best agricultural school in the United States.[14] He took mycology and plant pathology courses of George Francis Atkinson, Herbert Hice Whetzel[15], Harry Morton Fitzpatrick, Joseph Charles Arthur, and Charles David Chupp. Under the direction of Whetzel, Dai Fanglan got more field practice as an undergraduate student. He developed a strong interest in plant pathology and mycology during the two years in Cornell.

In 1918, Dai Fanglan entered the graduate school in Columbia University. His advisor was Professor Robert Almer Harper. Dai Fanglan's studies during the Columbia period were on cellular biology and taxonomy of fungi. He also developed a good relationship with Bernard Ogilvie Dodge, an American scientist from University of

[13] Wang Zuoyue, "Saving China through Science: the Science Society of China, Scientific Nationalism, and Civil Society in Republican China", *Osiris*, 2nd Series, Vol. 17, Science and Civil Society (2002), pp. 291-322.

[14] Several Tsinghua students had already studied at Cornell before Dai Fanglan. For example, Bing Zhi (秉志, 1886-1965) studied there between 1909 and 1913 and later received a PhD degree from the department of biology; Guo Tanxian (过探先, 1886-1926) received a master's degree in 1915; Zou Bingwen (邹秉文, 1893-1985) received a bachelor degree in 1915 and then studied plant pathology for one year before going back to China in 1916.

[15] Herbert H. Whetzel directed two other prominent Chinese agricultural scientists to finish their doctorate dissertations: Deng Shuqun in 1928 and Lin Chuanguang (林传光) in 1940.

Wisconsin. After returning to China, Dai Fanglan kept in communication with Harper and Dodge for many years.[16]

Dai Fanglan's studies in Columbia proceeded smoothly. However, his father was unemployed in 1919, and the whole family was falling into a difficult situation. Dai Fanglan had to give up his study in America to go back home and to earn a living for the family.[17] From 1919 to 1925, he worked at several organizations. Dai Fanglan's early career in China demonstrates the political instability of the times. As mentioned before, the decade from the late 1910s to 1928 was a period of high warlordism. China was actually controlled by more than ten warlords competing with each other. Some of these warlords were receiving funding and support from foreign countries such as the US, Japan, and USSR. Therefore, it was very hard for American-trained Chinese scientists and educationists in China to fully concentrate on scientific works without interference from politics. They had to deal with such complicated political situations and to balance so many political forces—local and foreign—just to survive and maintain their lives, while their overseas experience sometimes made it impossible for them to stay away from political and interpersonal collisions.

Dai Fanglan's first position in China was to teach botany related courses at the Jiangsu Provincial First Agricultural School (江苏省立第一农校). This appointment was encouraged by Guo Tanxian, who was chairing the secondary school at that time. Most of Dai Fanglan's colleagues were American-trained Chinese scientists such as Qian Chongshu (钱崇澍), Sun Yushu (孙玉书), and Chen Zongyi (陈宗一, also named Chen Rong, 陈嵘). Lin Chuanguang (林传光) was a student at this school at that time. He was also Dai Fanglan's student later at Jinda and then a PhD student at Cornell University. However, Guo Tanxian resigned in 1920 because of interpersonal conflicts and all of the American-trained teachers left this school. Qian Chongshu was employed by Tsinghua

[16] Cheng Guangsheng, p. 14 and p. 32.
[17] I would like to make a comparison between Dai Fanglan and Shen Zonghan, another great Chinese agricultural scientist and Cornell University alumnus. Shen Zonghan insisted on finishing his education despite the fact that his father strongly opposed this decision and that his family had been in heavy debt for decades. In this sense, Dai Fanglan was still following traditional Chinese ethics to fulfill his filial duty.

and many others later joined the University of Nanking. Dai Fanglan had no interest in factional conflicts, but he was forced to leave this school as well. His eldest brother Dai Lianjiang was working in Tianjin at that time and introduced Dai Fanglan to work at a private farm in Tianjin (1920-1921). Dai Fanglan felt deeply depressed at this job because he could neither use the scientific knowledge he had learned nor do anything contributive to the country.[18]

One year later, he transferred to the Guangdong Agricultural Specialized School (广东省农业专门学校) and taught there from 1921 to 1923. This school was chaired by Deng Zhiyi (邓植仪, 1888-1957),[19] Dai Fanglan's friend at the University of Wisconsin. However, this school had no guaranteed financial support because of warfare among warlords and the nationalist party in the early 1920s. Dai Fanglan was not paid and had to move to the Southeast University in Nanjing in 1923. The position at Southeast University allowed him to conduct serious scientific research. Nevertheless, this good situation was soon interrupted by interpersonal conflicts. Guo Bingwen, the chair and founder of the agricultural school in Southeast University, was dismissed in 1926 because of strife among warlords. As an American-trained scientist and a friend of Guo Bingwen, Dai Fanglan encountered hostility from some colleagues with different political concepts and was dismissed as well. During the following summer, Dai Fanglan got in touch with Guo Tanxian, the chair of agricultural school in University of Nanking, who hired him in the fall of 1927.[20]

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[18] Cheng Guangsheng, pp. 19-20.

[19] Deng Zhiyi was a soil scientist and agricultural educationalist from Guangdong province. Different from Tsinghua alumni such as Dai Fanglan and Tang Peisong who had been sponsored by the Boxer scholarship, Deng Zhiyi studied in the United States at his own expense. He traveled to America in 1909, studied at the California State University for half a year, and then transferred to University of Wisconsin and majored in soil science. Deng Zhiyi returned China in 1915 after receiving a M.S. degree. He chaired the Guangdong Agricultural Specialized School since 1920 and the agricultural school in the National Sun Yat-sen University from 1932 to 1940. Deng Zhiyi was also the first Chinese soil scientist to attend an international conference—from July to August 1935, he attended at the Third International Conference on Soil Science at the University of Oxford , where he made presentation and introduced the surveys and research of soil in Guangdong province. See the online archives of the Sun Yat-Sen University, http://gjs.sysu.edu.cn/zsdxxs/ms/9627.htm.

[20] Cheng Guangsheng, pp. 22-26.

After occupational uncertainty for almost eight years, Dai Fanglan settled down at the University of Nanking (金陵大学, the Chinese name reads as *Jinling Daxue*, and I will use "Jinda" for short). This was a missionary university supported by American funding, so it was able to protect its faculty and students from the chaotic warlordism. Compared with the earlier farm and schools, Jinda provided Dai much more stable and superior conditions for both his life and research. He was appointed as professor and director of the program of plant pathology. However, he had never felt fully comfortable at this university because of its missionary background and had been looking forward to somewhere more comfortable for him.

His attitude towards Jinda (from 1927 to 1934) exemplified the complex feelings of "first generation" Chinese scientists trained abroad, who returned to work at American-sponsored institutions. Dai Fanglan commented on his experience at Jinda that:

> "Jinda was a missionary university, which I did not like to join in. However, I was unemployed at that time and not able to find anywhere else to settle down. … I often conflicted with foreigners because of their offending Chinese people. … Our living condition in Jinda was very comfortable and the research condition was also very satisfactory. However, I sincerely wished to move to some other place because of a sense of national pride. Therefore, when received the invitation from Tsinghua, I accepted this opportunity at once."[21]

Dai Fanglan's displeasure at Jinda was mainly toward ideas of imperialism and colonialism behind these missionary schools instead of his American colleagues.[22] He had always felt humiliated by the fact that foreign scientists enjoyed more privileges than Chinese scientists on the land of China. Dai Fanglan acknowledged that western researchers' works had significantly contributed to the development of science in China. He also had to admit that Chinese scientists had not been capable of conducting systematic scientific research in many fields. However, he felt ashamed of the fact that western scientists were unrestricted in using research resources in China while Chinese

[21] Cheng Guangsheng, pp. 26-30.
[22] For Chinese people's paradoxical attitude towards Christian schools, see Daniel H. Bays, *China's Christian Colleges: Cross-Cultural Connections, 1900-1950,* Stanford: Stanford University Press, 2009.

scientists were so non-competitive. Dai's strong feelings of the dual-identity of being both Chinese and a scientist, especially "Chinese pride" significantly influenced his choice of research topics, which I will explore later.

During his eight years in Jinda, Dai Fanglan made significant advances in research about plant pathology and mycology. From 1929 to 1934, he published twelve research articles in academic journals in China (with two coauthored with Wei Jingchao, and one coauthored with Zhou Jiachi). By 1933, his monthly salary had reached 270 CND, among three of the highest paid professors at the school of agriculture in Jinda (the two others were Chen Zongyi and Shen Zonghan)[23]. But these achievements did not relieve his feeling of humiliation. In 1934, Dai was planning to leave Jinda and had arranged a two-year research trip to New York Botanical Garden and Cornell University. At this time, he received an invitation from Tsinghua to direct a group of plant pathology at the newly established institute of agriculture—the group where he spent the rest of his career.[24]

Dai Fanglan is a good example of the first-generation Chinese scientists who got their education in the West and returned to China. They were more constrained by complex political situations than the second generation and faced a dearth of developed scientific institutions. They felt the humiliation of being semi-colonial while working at universities sponsored by foreign money, and watching Chinese colleagues suffer for lack of resources. Meanwhile, the number of this generation was relatively small, which meant that they did not need to worry too much about competing for academic positions. Therefore they paid more attention to building the infrastructure in China that would enable them to practice science as they had seen in the West, but in a distinctly Chinese way which allowed them to adapt to the chaotic environment in Republican China.

[23] Shen Zonghan, *Memoirs of the Middle Age*, p. 28.
[24] Cheng Guangsheng, pp. 27-32 and p. 37.

Tang Peisong and the Younger-Generation Chinese Scientists' Enthusiasm in Scientific Research

Compared with Dai Fanglan, Tang Peisong belonged to a younger generation of scientists who shared more common professional characteristics with their western colleagues, such as being more devoted to academic research rather than focusing on establishing new institution or on political activities. This shift of western-trained Chinese scientists was largely because of changes in their professional environment. During the decades after 1928, when more and more high-level universities and research institutes had been established in China, the second-generation scientists were able to work in more established professional environment than that of the first generation—but as the number of scientists increased significantly, they also needed to demonstrate much higher scientific research ability to compete for a chance to work in this better environment. They were more capable of creating more advanced scientific knowledge to help China, of becoming important in international science, and sometimes (but not always) of applying their achievements to agricultural and industrial production to improve China's strength. The younger-generation of scientists' self-identity of being Chinese and the love for their country were as strong as their precursors. They just expressed this love in some different ways.

Tang Peisong (1903-2001) is a good example. He was born into a revolutionist family. His father Tang Hualong (汤化龙, 1874-1918) was a jurist, journalist, and politician and had taken important positions in the republican government, such as congress chairman and minister of education. Because of his political dissent, Tang Hualong was murdered by the KMT (the Chinese Nationalist Party) in 1918. Possibly due to the suffering of his father, Tang Peisong never had any positive opinion of the KMT government, even though he had been a passionate patriot all through his life.[25]

Tang Peisong took secondary education at Tsinghua College from 1917 to 1925. He described the Tsinghua fund in his memoirs with strong emotion:

> "The Tsinghua fund was from the returned part of the Boxer Indemnity.

[25] Tang Peisong, *Wei Jie Zhao Xia Gu Xi Yang*, p. 1 and p. 40.

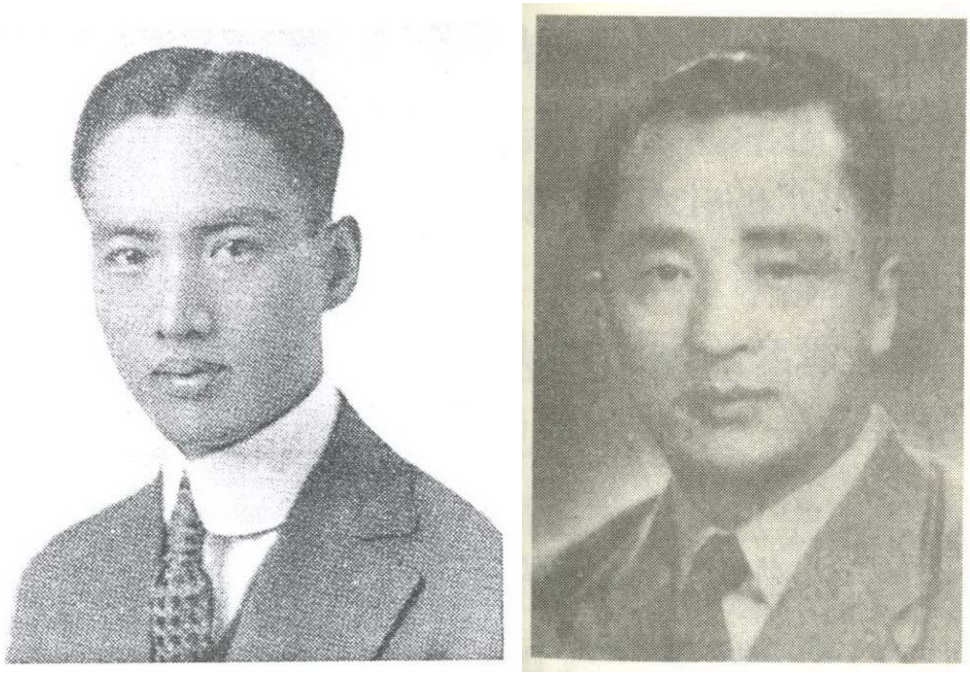

Figure 4. Dai Fanglan in 1918 (left) and Tang Peisong in the 1940s (right)

Figure 5. Yin Hongzhang, Tang Peisong, and Lou Chenghou in the 1980s

> This indemnity was extorted by an Eight-Nation Alliance whose troops traveled overseas to invade and plunder our country land and to insult the Qing government. My schoolmates and I were educated with the four hundred and fifty million taels of fine silver from four hundred and fifty million Chinese people (over ninety percent of whom were poor people); that is, each Chinese person donated one tael of blood to cultivate us. I still feel profoundly guilty and grateful up to the present… I encouraged myself with the country's humiliation and swore to study hard in order to reciprocate favours bestowed by the country."[26]

This quotation suggests one component of "love of China" for both the first and the second-generation American-trained Chinese scientists: they felt guilt and a passion to help China become strong and important in international science, because they owed their education to their countrymen. In addition, this strong feeling was not a love for the political nation, but love for the social and cultural countrymen. All the three leading scientists in Tsinghua IOA including Tang Peisong were alumni of Tsinghua College, and the younger Tsinghua IOA researchers who later studied in the United States were all sponsored by the Boxer scholarship. As Tang articulated, this sponsorship had stimulated them to respond to the reality that their country was still in dire suffering and the best way for them to save the country and to repay their debt was their knowledge and its application.

Under the suggestion of Tu Zhi (涂治), his friend at Tsinghua, Tang Peisong came to the agricultural school in University of Minnesota in 1925.[27] But he quickly transferred to the school of liberal arts because of a strong interest in pure research to explore the foundations of biology. He studied botany under William Cooper. During this period, Tang Peisong was exposed to the general physiology of Jacques Loeb and this raised his

[26] Tang Peisong, pp. 1-2.

[27] Along with Tang Peisong, there were at least three other Chinese students at the UMN agricultural school—Tu Zhi, Zhang Kewei (张克威), and Sun Qingbo (孙清波). All of them returned to China and became leaders in the agricultural sciences. Zhang Kewei (1901-1974) was an animal husbandry scientist. He was the founder and first president of the Shenyang Agricultural College. Sun Qingbo had chaired the department of agricultural mechanics in the National Central University (Nanjing University) after 1948.

strong interest in exploring the fundamental nature of living creatures with physical and chemical principles. In summer 1927, Tang Peisong received his B.A. degree and won the first prize. He then was admitted by the plant physiology laboratory of Burton E. Livingston in the Johns Hopkins University and was deeply impressed by its graduate school. Ten years later, after becoming a professor in Tsinghua, he modeled his own research group after JHU's advanced education. Tang Peisong received his Ph.D. degree in the summer of 1930. Then he spent the summers in 1930 and 1931 working as a research assistant at Woods Hole Marine Biological Laboratory, where he published two articles about the respiration intensity of sea urchins and asters, and tested the level of phosphagen in the lobster's nerve conduction. During these summers, Tang Peisong got a chance to participate in the lectures and discussions of Otto H. Warburg, Leonor Michaelis, Frank and Ralph Lillie, Archibald Vivian Hill, and Otto Meyerhof. Influenced by these scientists, Tang Peisong decided to choose thermodynamics of plant respiration and photosynthesis as his lifelong career.[28]

From September 1930 to August 1933, Tang Peisong worked as a fellowship researcher and instructor at William John Crozier's laboratory of general physiology at Harvard University. However, Tang Peisong's understanding of *in situ* activation energy was quite different from the hypothesis of Crozier and they two did not get along with each other very well (later scientific discoveries have demonstrated that Tang was right).[29] Tang Peisong started to contact universities in China for a faculty position. In spring 1933, he received an invitation from the National Wuhan University with an offer of $2,000 to launch a laboratory.[30]

When considering the Tsinghua IOA scientists' returning to China after their training in the US, we should remember that their affection for the country was not directly applicable to specific governments. For these scientists maturing in the early twentieth century, the country had been torn by warlordism for decades and the KMT central government was not necessarily representative of China for them. Most of these

[28] Tang Peisong, pp. 30-32.
[29] Tang Peisong, chapter 5.
[30] This opportunity was arranged by Ren Hongjun (任鸿隽), Tang Hualong's close friend and one of the founders of the Science Society of China. Tang Peisong, chapter 6.

scientists were merely indifferent in politics, while a few of them were radical democrats and some were socialists. However, because of a sense of belonging, their self-identities as Chinese people were quite similar, and this encouraged them to return to build a stronger China. Tang Peisong explained this in his memoir:

> "The fund from [Robert] Marshall[31] may guarantee my career and life in the U.S. Then why did I insist on giving up this fund and returning to chaotic China—China under the government of a party murdering my father in 1918? … Now I have got the answer: although my life in the U.S. has been very comfortable, there has always been a sense reminding me that I don't belong here."[32]

Tang returned to China because he loved the country, but not the nation governed by the KMT party (the so-called Chinese Nationalist Party). It was the sense of "belonging to China" as a cultural and social entity, not a political one, that motivated Chinese scientists such as Tang to study in the U.S. and to return China to apply their knowledge to the social problems of their homeland. They wanted to use the advanced knowledge in science and engineering they had learned abroad to improve and rebuild their country despite the turbulent political situation.

Tang Peisong went back to China, where he started working at the National Wuhan University in fall 1933. He was the first scientist to teach and research general physiology in Chinese universities. From 1933 to 1937, he organized other physiologists to compile textbooks and to teach physiology courses in Chinese, established a laboratory of cellular physiology and general physiology, and invited several other western-trained scientists to join his research, including Lin Chunyou (林春猷), Gao Shangmeng (高尚萌), Wu Maoyi (吴懋仪), Yin Hongzhang (殷宏章), Zhang Xincheng (张信诚), and Shen Qiyi (沈其益). (See Figure 5.) From 1936 to 1938, Tang Peisong, Lin Chunyou, and Wu

[31] Robert Marshall was Tang Peisong's labmate and close friend in the Johns Hopkins University. When hearing that Tang Peisong was planning to go back to China, Marshall strongly suggested Tang to stay in the U.S. and promised to set up a fund in a university in New York City to support the career and life of Tang and his family. Tang Peisong declined this generous offer and went back to China in August 1933.

[32] Tang Peisong, pp. 40-41.

Maoyi published seven articles on the thermodynamics of cellular respiration in *Journal of Cellular and Comparative Physiology*. This group was at a very promising stage when the July 7 Incident[33] broke out. This incident refers to the battle between Japanese and Chinese armies near Peiping on July 7th, 1937. It marks Japanese troops' comprehensive invasion of China and the start of the Second Sino-Japanese War. The war completely disrupted the physiology group, forcing them to move and adapt to new circumstances.

By the end of 1937, Tang Peisong was faced with three choices—he could stay with Wuhan University, which would retreat to Leshan (乐山) in Sichuan Province; he could obey the Ministry of Education, which had instructed him along with several medical scientists from Peiping and Nanjing to establish a medical college in Guiyang, Guizhou province; or he could accept the offer of Mei Yiqi, the Tsinghua president, who sent him a letter inviting him to join the Tsinghua IOA to organize a plant physiology research group. Tang Peisong was most interested in plant physiology and its economic applications, so his preference was to join Tsinghua IOA in Yunnan province. However, he also felt obligated to help the medical scientists. As a result, he first spent half a year establishing the Guiyang Medical College (March to August 1938), and then traveled to Kunming to start his research at Tsinghua IOA in August 1938.[34]

While Dai Fanglan's patriotic activities were located mainly in universities and academic circles, Tang Peisong's love for China and desire to serve his country seemed to be much more radical and showed in many ways. When the July 7 Incident broke out, Tang Peisong was extremely lost at the beginning and wondered what he could do for the nation. He quickly took two actions—first, recording BBC's reports about the Anti-Japanese War and spreading this international perspective with leaflets among faculty and students at the National Wuhan University; and, he applied to join the KMT army to fight against the Japanese. The first action lasted for about one month and was very popular. Obviously, Tang could not have done this without his western experience and language skills. However, Wang Xinggong (王星拱), president of the Wuhan University, told him that some secret service members in the KMT government were investigating

[34] Tsinghua University Archives, file 1-3:3-40.

and punishing any activity that spread news different from official reports of the KMT central government. So Tang Peisong had to give up his leaflets. As for joining the army, only one military official treated Tang Peisong's application seriously: General Hu Zongnan (胡宗南) invited Tang Peisong to join his troops in Shaanxi (Northwest China) to suppress CCP in Yan'an, which was unacceptable for Tang Peisong. Disappointed by the KMT government and army, Tang Peisong reassessed the situation and realized that the best and only reasonable way for him to serve his country during this crisis was scientific research and its applications to increase agricultural and industrial production.[35]

Tang's life is an excellent example of how "love for China" and being a scientist created this dual-identity. At Tsinghua IOA, even the younger passionate patriots found that practicing science was the best way to serve their country. It is understandable that in the chaotic atmosphere of wartime China, researchers at the Tsinghua IOA presented their identity of being Chinese in many aspects other than science. Some patriotic activities involved political issues. However, usually these scientists would return to scientific studies. One example is Zhou Jiachi's travels to Northwest China. Zhou Jiachi (1911-) took his college education at the School of Agriculture in Jinda from 1928 to 1932. He first entered the department of agronomy but then transferred to pathology in order to study under Dai Fanglan. He was highly devoted in scientific studies but also enthusiastic in patriotic activities. After the September 18 Incident[36], Zhou Jiachi participated in a series of public activities to appeal to the KMT government to resist Japanese invasion and to encourage Chinese compatriots in anti-Japanese activities. He even missed some courses and experiments required for his education—fortunately professor Dai Fanglan never blamed him for the absence but helped him to catch up and finish the B.S. thesis.[37] After working as a research assistant in Lingnan University for one year, Zhou Jiachi joined the Tsinghua IOA at Dai Fanglan's invitation. He had substantial achievements in plant pathology research and published four articles during

[35] Tang Peisong, pp. 60-65.
[36] The Japanese troops occupied Northeast China after September 18, 1931.
[37] Cheng Guangsheng, p. 27.

the three years in Peiping.[38] However, Zhou Jiachi had felt extremely depressed after the July 7 Incident. When hearing the Tsinghua university committee's decision to suspend the IOA in January 1938, he decided almost at once to leave the university and travel to Northwest China in order to do something for the country more directly.[39] From January to June 1938, Zhou Jiachi traveled to Yanan and received training at Shanbei Public School, a political school training revolutionaries for the CCP. However, when Dai Fanglan asked him to return the Tsinghua IOA in June 1938, he returned to his mycological and plant pathological studies at once. In Yan'an and returning to Tsinghua IOA, Zhou Jiachi was realizing his wish to contribute to the country in practice, by using his scientific knowledge and skills. [40]

The life stories and words of these Tsinghua IOA scientists help us to understand their motivations and how they defined "love for China" in social and cultural ways. If we merely concentrate on "love for China", it seems that the concept of "scientific nationalism" discussed by earlier historians is enough to describe these scientists' feeling and emotion towards their country and their science. However, it is also important to understand the domestic political context of the 1920s and 1930s. During this period, China was in a very chaotic and tricky situation when localism coexisted with (and in many areas was stronger than) nationalism. Such a situation marked a significant difference between the lives and careers of Chinese scientists of this period and those after 1949, when the CCP government was much more capable of controlling the entire country. The Tsinghua IOA was established and developed at a time when Chinese scientists had to sometimes cooperate with and sometimes fight with both the central nationalist government (KMT government) and local political forces. The Tsinghua IOA scientists had different feelings and attitudes towards these political forces, which would remarkably influence their choices and decisions in scientific research and education. In

[38] Tsinghua University Archives, file 1-3:3-88, pp. 10-21, Dai Fanglan's report on the Division of Plant Pathology.
[39] Tsinghua University Archives, file 1-3:3-40.
[40] Qiu Weifan, "Professor Dai Fanglan", in *Yi En Shi* (*Recollection on Our Mentors*), edited by Wu Ruzhuo, Wang Buzheng, and Xu Zenghua, Beijing: Chine's Agricultural University Press, 2010. (裘维蕃，"戴芳澜教授"，《忆恩师》，吴汝焯，王步峥，许增华主编，中国农业大学出版社，2010)

the next section, I will describe some of their strategies of negotiating the tensions between local needs and central political forces, from the late 1920s through the Sino-Japanese War (1937-1945).

IV. Tensions between the Central and Local Political Forces

Early development of the National Tsinghua University

As a school with a strong foreign background, Tsinghua experienced a remarkable shift of "sinicization" in its institution and administration after 1928. From 1912 to 1928, the "Beiyang Government" was internationally recognized as the legitimate government of the Republic of China, even though it usually could only effectively control several provinces in North China. It refers to a series of military regimes ruled by warlords from the Beiyang Army of the Qing Government. In June 1928, the National Revolutionary Army of the Nanjing KMT government occupied Beijing and unified China (only formally). The KMT government became the new legitimate Chinese government with international recognition, while local military forces remained powerful in regions far away from the reach of the KMT central government. As already described for Tsinghua, during the Warlord Era (from 1916 to February 1928), it was always at the national capital, ranked as the best school in China, and because of its relations with the US, it was under the administration of the Ministry of Foreign Affairs. In contrast, from 1928 to 1948 (the KMT era and the Sino-Japanese War), Tsinghua was always at a place outside of the political center—first in Beiping, later in Kunming during the wartime. This means that local support was important for the development of this school. Tsinghua suffered another big change: it was transferred from the Ministry of Foreign Affairs to the Ministry of Education of the KMT central government. This meant increased scrutiny by the KMT. Tsinghua scholars and students had to deal with new situations and to find a proper balance between the central and local political forces for its further development.

Because of a regime change, from February to August 1928, there was no official president of the Tsinghua University. When the KMT government believed that they had

controlled Beijing and changed the name of this city into Peiping,[41] the KMT government changed Tsinghua's name into the "National Tsinghua University" in August 1928 and put it under the joint-administration of the ministries of foreign affairs and education. In September 1928, Luo Jialun (罗家伦) assumed the presidency of Tsinghua with the appointment of the Nanjing government. From 1928 to 1930, Luo Jialun made a series of reforms aimed at rebuilding Tsinghua into a university to serve the Chinese people and setting up a foundation to develop Tsinghua into a comprehensive research university. One of Luo's most unpopular reforms was to apply military regulations to the students, which aimed to improve the students' discipline and patriotism. Luo's reforms were based on his decisive personality and the support of the KMT central government, while the Tsinghua scholars and students, no matter how patriotic they were, had got used to the autonomy and freedom brought by its unique background (under the looser control of the Ministry of Foreign Affairs, not Education). Therefore, although the Tsinghua students admitted that Luo was capable and had done a lot of good things for Tsinghua, they disliked Luo's reforms. Moreover, many Tsinghua people preferred other political forces to the KMT government. As a result, Luo was expelled by the Tsinghua student

[41] In Chinese, "京" (Jing) means the capital of a country. Beijing (or Peking, 北京) means the north capital, while Nanjing (or Nanking, 南京) means the south capital. Beiping (or Peiping, 北平) was an old name of this city and was only used for several decades during the 14th and 15th centuries. Local residents had considered this city as a capital for over thousand years. Therefore, when the KMT government prohibited the name "Beijing", it irritated many local people, especially university students and scholars. The KMT central government tried to integrate eight national universities with "Beijing" in their names into a new "Peiping University", which further angered students and scholars of these universities. Students launched movements such as strikes and protest marches to protect their schools. From 1928 to 1929, Peking University was almost closed because of students' strike, and students from the normal universities received violent suppression from the government. Finally the Nanjing government gave up and publically abolished the decision to integrate these universities in summer 1929. Peking University remained its independence with a name as the "National Peking (Beijing) University", while the Peking Normal University united with the Peking Women's Normal University and received a new name of the "National Peiping Normal University" in 1931. Tsinghua was not directly involved in these conflicts because of its relations with the US and its unique status among Chinese universities, but it also had its own struggles during this shifting period.

union in 1930.[42] In the following paragraphs, I will briefly introduce Luo's reforms and how the thoughts and careers of Tsinghua scientists would be influenced by these events.

The purpose of Luo's reform was to make Tsinghua a university to improve China's own academics ("我去办理清华，除谋中国的学术独立外，他无目的"). He proposed three principal concerns for Tsinghua's future development: first, the sciences China needed; second, Tsinghua's existing basis; and third, local conditions of Peiping.[43] Luo's reforms were carried out mainly in four aspects. Firstly, Luo moved the administration of Tsinghua to the Ministry of Education of the Nanjing KMT government completely. From then on, Tsinghua was to be under the management of the Chinese government—at least in form.[44] Secondly, Luo moved the administration of the "Tsinghua fund" from the minister of foreign affairs to directors of the "China Foundation for the Promotion of Education and Culture" ("China Foundation" for short). These directors were non-governmental famous people from both China and the US. This move was in part calculated to reduce corruption and mismanagement of funds. Thirdly and fourthly, he re-organized the departments and re-allocated funds. Luo Jialun increased inputs in purchasing academic books and scientific research equipment and materials, expanded the library, set up more buildings for research and education, and, correspondingly, cut off some programs he believed to be redundant—including the program of agriculture. This program had an important history in the early development of Tsinghua School, and scholars have not paid much attention to it (indeed no published history exists).

At the very beginning of its establishment in the early 1910s, Tsinghua had a mandate to build up an agriculture program. Its college students organized an association of agriculture to prepare for further study in agricultural sciences in the United States. In

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[42] Li Jingqing, "Storms at Tsinghua", September 1930, *Historical Materials of Tsinghua University*, Vol. 2(1), pp. 82-86. (李景清，"清华学潮的前后"，1930 年 9 月，《清华大学史料选编》，二（上），82-86 页).

[43] Luo Jialun, "Reports and Plans for Reforming University Affairs" ("整理校务之经过及计划"), November 23, 1928, *Historical Materials of Tsinghua University*, Vol. 2 (1), p. 5.

[44] In practice, part of the Tsinghua scholars and students did not accept this fact heartily. In addition, some times the leaders of Tsinghua also stressed their American background in order to claim more benefit.

1921, Yu Zhenyong (虞振镛), a Tsinghua College graduate with an M.S. degree in animal husbandry from Cornell University, organized a program of agriculture and provided optional courses such as crop science, horticultural science and animal husbandry for college students at the Tsinghua College. This program was changed into a department in 1926, with Yu Zhenyong as the director. Yu Zhenyong continued teaching optional courses for college students and did not enroll students for the agricultural program. In 1928, when Tsinghua was reformed into the National Tsinghua University, this department had only one faculty member (Yu Zhenyong) and no full-time students. Tsinghua President Luo Jialun believed that this program was not running well and therefore closed it. Yu Zhenyong continued agricultural activities by collaborating with other organizations, such as the National Association of Mass Education Movements led by Yan Yangchu (晏阳初, Y. C. James Yen) and the Yenching University.[45] Together they established an experimental farm to conduct research on livestock breeding. At the same time, in 1928, they started an agricultural school to provide training for practical farming technicians and literate peasants. The experimental farm and the school did not run well either and was finally suspended in 1930 when Yenching University decided to give up. At the request of Yenching University, the University of Nanking (Jinda) took over the experimental farm. Researchers from the School of Agriculture in the University of Nanking kept this farm for their studies in plant breeding. Yu Zhenyong left and joined the School of Agriculture in the National Peiping University.[46]

Meanwhile, Luo's reorganizations received both positive and negative comments, while his militarization program irritated both students and faculty at Tsinghua. Because of its background, Tsinghua had high autonomy and a strong democratic atmosphere before 1928. It also had a unique tradition of "professors managing the school" ("教授治

[45] Yenching University was the best missionary university in north China and its campus neighbored Tsinghua's campus. The University of Nanking (Jinda) was the best missionary university in Nanjing and had the best agricultural school in China at that time.

[46] "The Agriculture Department's Effort in China's Agricultural Improvement and Education", by Zhu Junpeng from the Tsinghua University Archives ("注重中国农业改良的农业学系", 朱俊鹏, 清华大学档案馆)
http://xs.tsinghua.edu.cn/docinfo/board/boarddetail.jsp?columnId=00401&parentColumnId=004&itemSeq=5352.

校”)—when facing important events, the professors would get together and vote to make important decisions. Luo’s strong and arbitrary personality enabled him to make the reforms quickly and efficiently, but also challenged Tsinghua’s democratic tradition significantly. He was tolerated by Tsinghua people for almost two years mainly because of two reasons: firstly, his reforms really benefited Tsinghua; and secondly, he was supported by the KMT central government. But this situation did not last long.

In spring 1930, the “Central Plains War” broke out. It was a civil war between the forces of the KMT government and a coalition of three warlords: Feng Yuxiang (冯玉祥) controlling Shaanxi, Gansu, Henan, and part of the Inner Mongolia; Yan Xishan (阎锡山) controlling Shanxi province; and Li Zongren (李宗仁) controlling Guangxi province in south China. This war involved more than ten provinces and lasted for about six months. The KMT government lost its control over Peiping during the summer. As a result, Luo Jialun lost his political support.

On May 20, 1930, some radical students took advantage of the situation and launched an “Expelling Luo Movement” (“倒罗运动”), supported by the student union. Luo Jialun was forced to resign and went back to Nanjing. But the student union and the faculty soon noticed that the radical students starting the movement were not thinking about Tsinghua’s benefit and development at all but were followers of Yan Xishan, the warlord controlling Peiping at that time. In June 1930, Yan Xishan appointed Qiao Wanxuan (乔万选) to be Tsinghua’s president. The Tsinghua student union and faculty committee believed that Qiao was not qualified to be their president and firmly rejected this appointment. After winning the Central Plains War and gaining Peiping back, the KMT government tried to send Luo Jialun back to Tsinghua—but both Luo and the Tsinghua side refused this proposal. In April 1931, the KMT government appointed Wu Nanxuan (吴南轩) as the Tsinghua president. Just one month later, the Tsinghua students and scholars claimed that Wu Nanxuan was even worse than Luo Jialun in both personality and capability and started another “Expelling Wu Movement” (“驱吴运动”). Wu was forced to resign on June 5, 1931.

The conflict between Tsinghua and the governments lasted for over a year and finally got resolved in October 1931, when Mei Yiqi (梅贻琦) became the new president. Mei was the one acceptable for both Tsinghua and the KMT government. He was an early graduate from the Tsinghua School and had worked as the university dean from 1928 to 1930. Therefore he was very familiar with Tsinghua's traditions and knew how to handle the strong feeling of the Tsinghua faculty and students. In addition, he had worked in the KMT government and knew how to deal with the politicians. From 1931, Mei Yiqi was Tsinghua president for over 17 years and he was considered as the most successful president (although many of his actions were following the ways designed by Luo Jialun). After struggling between the desire to maintain democratic autonomy and the desire to be the school of Chinese people for several years, Tsinghua people finally found a balance and compromise under Mei, and the Tsinghua scientists were able to settle down and apply their knowledge to serve China. During this productive and stable period (1931 to the outbreak of the Sino-Japanese War in 1937), the Tsinghua Institute of Agriculture (清华大学农业研究所, Tsinghua IOA) was established. The interesting story of Tsinghua IOA's founding and wartime survival unites the political tensions I have just discussed with the life histories of the two scientists, Dai Fanglan and Tang Peisong. Despite the difficulties of having to endure political regime changes and war, the dual-identity felt by Dai, Tang, and other foreign-educated Chinese scientists enabled them to keep research programs going, continue to educate students, and develop practical solutions to China's agricultural problems.

Establishment of the Tsinghua IOA

In the early 1930s, after the political situation stabilized in North China, the KMT government (located in Nanjing) launched a "Rural Revival Movement" in order to promote agricultural production and the living standard of Chinese peasants. Considering its limited control over the country, the Nanjing government had to enlist support from people outside the KMT party. Patriotic intellectuals were the people most likely to support the KMT's reforms, and therefore, agricultural education became an important

part of this movement. In May 1933, the KMT government set up a special "Rural Revival Committee" to administrate the "Rural Revival Movement". As a response to this movement, in June 1933, The Ministry of Education in Nanjing issued Instruction Number 5825, which required Tsinghua to establish a school of agriculture in order to investigate important issues of agricultural production in North China and to train agricultural researchers.[47]

Because of the unsuccessful experience of the earlier agricultural department and schools, the Tsinghua University was not very enthusiastic about establishing this new school. The University committee believed that Tsinghua should focus on developing liberal arts, sciences, and engineering, rather than including too many programs. In addition, the Shandong University had already set up a school of agriculture in Qingdao with departments of agronomy, forestry, and sericulture, which seemed able to conduct investigation and research of agriculture in North and East China. Therefore Tsinghua was inclined to decline the instruction from Ministry of Education with this reason.[48]

Another problem (not as openly discussed) was about funding. The Tsinghua University committee was short of income at that time. Tsinghua's financing came from the China Foundation for the Promotion of Education and Culture (the China Foundation) which relied on the returning fund of the Boxer Indemnity. However, payment stopped in 1932 and was in arrears in 1933. Tsinghua had just established a new engineering school with three departments at the beginning of 1932 and was not prepared for this suspension. Although Tsinghua finally went through this crisis with one million Chinese dollars (CND) in interim funds from Ministry of Finance in the nationalist government and three hundred thousand CND in bank loans, construction of the engineering school had been largely delayed and the university could hardly afford a new school. In March 1932, the university committee had publicly announced that faculty and students should not apply to establish new programs or departments.[49]

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[47] Tsinghua University Archives, file 1-2-1-162, p. 1.
[48] Tsinghua University Archives, file 1-2-1-162, pp. 2-6, and Cheng Guangsheng, p. 37.
[49] Since its establishment in 1924, the China Foundation started to manage funds returned by the US from the Boxer Indemnity. The Chinese central government paid the Boxer Indemnity to the United States government, which then allocated the surplus portion to the China Foundation.

However, Wang Shijie (王世杰), the Minister of Education, implied that the Ministry of Education would require the China Foundation to move part of the Tsinghua fund to support the National Wuhan University to establish an agricultural school in Central China if Tsinghua refused to create a school of agriculture.[50] Considering the possibility of a major funding reduction, the Tsinghua university committee finally decided to establish an agricultural research institute as a compromise so that they could still keep all their funds from the China Foundation. This institute was to focus on the most necessary and beneficial research topics for a future expanded agricultural school.

From December 1933 to September 1934, Mei Yiqi, president of the Tsinghua University, appointed three professors from the department of biology—Chen Zhen (陈桢), Li Jidong (李继侗), and Dai Lisheng (戴立生)[51]—to organize the new Institute of

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Then the China Foundation earmarked the fund to programs related to culture and education in China. Because of Luo Jialun's efforts, the running of Tsinghua funds was moved to the China Foundation in 1928. Due to the worldwide economic crisis, in 1932 the Nationalist government could hardly pay the Boxer Indemnity to its creditor nations and had to ask for extension of the payment. The United States therefore diminished support to the China Foundation. As a result, the Tsinghua University could not receive funds from the China Foundation that year. See *Journal of the National Tsinghua University*, No. 379, March 9th, 1932 (《国立清华大学校刊》第 379 期). Also see Yang Tsui-hua, *Patronage of Sciences: The China Foundation for the Promotion of Education and Culture*, Taipei, Institute of Modern History, Academia Sinica, 1991, pp. 61-68 (杨翠华，《中基会对科学的赞助》，台北，中央研究院近代史研究所专刊 65，1991 年, 第 61-68 页) and Qiu Huafei, "China and the United States' negotiation on extending payment of the Boxer Indemnity in 1933", *Archives of the Republic of China*, 2005 Issue 2, pp. 75-79 (仇华飞，"1933 年中美延期偿还庚款问题之交涉"，《民国档案》2005 年第 2 期，第 75-79 页).

[50] Cheng Guangsheng, *Biography of Dai Fanglan*, the Institute of Microbiology, Chinese Academy of Sciences, 2008, p. 37. (程光胜，《戴芳澜传》，中国科学院微生物所，第 37 页。) The minister Wang Shijie (1891-1981) was a British-and-French-trained jurist and educationist. He had been founder and the first president of the National Wuhan University. As a successful politician and lawyer, he asked to inscribe on his gravestone only one title—"the former president of the National Wuhan University".

[51] All the three biology professors were American-trained agricultural scientists. Chen Zhen (1894-1957) received a bachelor's degree from the School of Agriculture in the University of Nanking before he got sponsorship from the Tsinghua College in 1919. He studied at the department of agronomy in Cornell University for two years; he then transferred to Columbia University in 1920 and studied in the group of T. H. Morgan. After returning China, Chen Zhen had worked at the Department of Biology in Tsinghua University for twenty-six years (1926-1952). Li Jidong (1897-1961) majored in forestry in the University of Nanking and entered the school of forestry in Yale University with Tsinghua sponsorship in 1921. He was the first Chinese

Agriculture. The university committee set several operating principles. Firstly, considering the tight budget, this institute should be as frugal as possible; the university would only allocate an annual income of twenty thousand Chinese dollars for three years. Secondly, the institute should have no more than two disciplines. Thirdly, the new institute should take full advantage of existing researchers and equipment. And fourthly, leading researchers of the new institute should be Chinese scientists with substantial experience in independent research and with good scientific reputations internationally.[52]

At this time, Tsinghua had competition in the agricultural research and education areas. The University of Nanking was definitely the most outstanding in agriculture science. It was the first university in China to set up a school of agriculture.[53] By the 1930s, the University of Nanking (Jinda) School of Agriculture and Forestry had established nine departments: agronomy (chaired by Shen Zonghan, 沈宗瀚), forestry (chaired by Chen Rong, 陈嵘, also named Chen Zongyi, 陈宗一), botany (chaired by Albert Newton Steward, 史德蔚), sericulture (chaired by Qian Tianhe, 钱天鹤), agricultural economics (chaired by Lossing Buck, 卜凯), horticulture (chaired by Hu Changchi, 胡昌炽), plant pathology (chaired by Dai Fanglan, 戴芳澜), agricultural

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scientist to receive a doctoral degree in forestry in the United States. Dai Lisheng (1898-1968) received a doctoral degree from the Stanford University and had been the founder of vertebrate zoology in China.

[52] For preparation and establishment of this institute, see Tsinghua University Archives, file 1-2-1-200.

[53] In 1913 and 1914, Joseph Bailie, a mathematics professor in University of Nanking, started the departments of agriculture and forestry. In fall 1914, John H. Reisner joined the department of agriculture after receiving his master's degree from Cornell University (Reisner was the only person in China who had a master's degree in agriculture at that time). In 1916, the university committee decided to expand the department of agriculture and forestry into a school. Randall E. Stross explores the history of the agricultural school in University of Nanking. See Stross, *The Stubborn Earth: American Agriculturalists on Chinese Soil, 1898-1937*, Berkeley: University of California Press, 1988. Shen Zonghan (沈宗瀚) also recalls the cooperative Nanking-Cornell cooperative project in his memoirs. See Shen Zonghan, *Autobiography of Shen Zonghan: Memoirs of the Middle Age*, Taipei: Zhuan Ji Wen Xue Chu Ban She, 1975 (沈宗瀚，《沈宗瀚自述：中年自述》，台北：传记文学出版社，1975). In some cases, Peking University also claims to be the first Chinese university setting agriculture department. However, although it had started a department of agriculture in 1905, President Cai Yuanpei separated it into an independent college in 1917 so that Peking University could concentrate on liberal arts and sciences.

education (chaired by Zhang Zhiwen, 章之汶), and a group engaged in agricultural science popularization.[54] All the leading agricultural scientists in Jinda were American specialists or American-trained Chinese scientists. In addition, Jinda and Cornell University had developed a fraternal relationship since 1923. Several Cornell professors spent sabbaticals at Nanking. Two experts in plant breeding, Harry H. Love and Clyder Myers, arranged long-term cooperation with the University of Nanking and conducted their research in China for over five years.[55] Strong research teams and sufficient funding from American missionary organizations made the School of Agriculture in Jinda unrivalled in contemporary China.

Also, in Nanjing, Guo Bingwen (郭秉文, 1880-1969),[56] an American-trained Chinese educator, started a school of agriculture in the Southeast University, which was later reformed into the National Central University in 1928. Because of Gou Bingwen, this school gained sponsorship from the local government, the Rockefeller Foundation, and the China Foundation. It had six programs: agronomy, horticulture, husbandry, sericulture, biology, and plant pathology.[57] However, except for Shen Zonghan's plant breeding studies in Jinda, most agricultural research in Nanjing was based on the natural conditions in East China, which were quite different from those in North China (where Tsinghua was located).

In South China, the School of Agriculture in Lingnan University, another famous missionary university in Guangzhou, had four departments: agronomy, horticulture, husbandry, and sericulture. This school put particular emphasis on sericulture because

[54] *The Centennial Records of Nanking University:Historical Materials of the University of Nanking*, pp. 253-256.
[55] See *The Stubborn Earth* and *Autobiography of Shen Zonghan*.
[56] Guo Bingwen was an American-trained Chinese educationalist. He received an Ed. D. degree from Columbia University in 1914 and then returned to China. In 1921, Guo Bingwen reformed the Nanjing Advanced Normal College into the National Southeast University, and managing this university by reference to the model of Harvard University and Columbia University.
[57] "Statistics of the Programs in Each School, 1933", *The Centennial Records of Nanking University: Historical Materials of the National Central University*, p. 313.

silk production was a mainstay of industry in Guangdong Province.[58] National Sun Yat-Sen University's agriculture school emphasized rice breeding as well as economic plants research in south China.[59] Since the cooperative agricultural program of Tsinghua and Yenching University terminated in 1930, by 1933 the only comprehensive university in North China with agricultural school was the National Shandong University, which concentrated on forestry and sericulture.

Considering the specialties of other universities and the principles suggested by the Tsinghua university committee (as mentioned above), the three organizers decided to set plant pathology and entomology as major disciplines for the new agricultural institute. T hese foci might avoid redundant scientific construction in North China and set up Tsinghua's own advantage in competition with other agricultural programs, especially the ones in the National Shandong University. Meanwhile, it was possible for Tsinghua to invite agricultural experts from other universities to join the new agricultural institute.

In March 1934, Dai Lisheng, Chen Zhen, and Li Jidong reported to President Mei Yiqi their suggestions on the new institute. This institute would be named as the Institute of Agriculture in Tsinghua University (清华大学农业研究所, Tsinghua IOA) and would include two independent research groups: the Division of Pathology, and the Division of Entomology. Each group would engage one professor, one or two research assistants, and several staff members. Tsinghua University provided 10, 000 Chinese dollars (CND) as starting funds to purchase equipment. In the following three years, the institute could receive 20, 000 CND every year,[60] with 11, 600 CND as salary, 6, 400 CND for academic publications, and 2, 000 for research trips. The three biology professors also listed five scientists as professor candidates: Dai Fanglan (戴芳澜, one of the two

[58] Chen Guojin and Yuan Zheng, *Momentary Splendor: Sixty-four years of Lingnan University*, Guangdong Renmin Press, 2008, pp. 50-51 & 83-84 (陈国钦，袁征，《瞬逝的辉煌：岭南大学六十四年》，广东人民出版社，2008，页 50-51,83-84). Also see Yang Tsuihua, p. 155.
[59] Yang Tsuihua, pp. 153-156.
[60] Tsinghua's annual expenditure for the entire university in the early 1930s was 1,200,000 CND. See Mei Yiqi, "General Report of Tsinghua's University Affairs during the Past Year", in *Historical Materials of Tsinghua University*, volume 2, Beijing: Tsinghua University Press, 1990, pp. 21-39. Originally published in *Qinghua Fu Kan*, volume 39, No. 7, April 29, 1933.

scientists featured above), Deng Shuqun (邓叔群),[61] and Tu Zhi (涂治)[62] for pathology; Yang Weiyi (杨惟义)[63] and Liu Chongle (刘崇乐) for entomology. Four of the five candidates—Dai Fanglan, Deng Shuqun, Tu Zhi, and Liu Chongle—were Tsinghua College alumni and had received postgraduate degrees in American Universities with the aid of Tsinghua (Boxer) scholarships. Finally, Tsinghua decided to invite Dai Fanglan and Liu Chongle to join this institute.[64]

When receiving invitations from Tsinghua, both Dai Fanglan and Liu Chongle were willing to join the institute in their Alma Mater. However, both of them had already planned research trips to the United States. Bernard O. Dodge[65] had already arranged a two-year visiting research trip to the New York Botanical Garden for Dai Fanglan and the China Foundation had awarded a grant of 7, 500 CND per year to support this research trip. Liu Chongle also applied for support from the China Foundation in 1934 and

[61] Deng Shuqun (1902-1970), was a scientist of mycology, plant pathology, and forestry. He started the studies of forests in Northwest China and higher fungi in China. Deng Shuqun graduated from the Tsinghua College in 1923 and finished his studies at the agricultural school at Cornell University in 1928 (double majoring in forestry and plant pathology). After returning China, he had worked at Lingnan University, Jinda, the National Central University, and the Academia Sinica. He was elected as the Academia Sinica academician in 1948 and CAS academician in 1955. His younger brother Deng Tuo (邓拓) was a famous CCP journalist and one of the first intellectuals sacrificed in the Cultural Revolution. Deng Shuqun was persecuted to death in 1970.

[62] Tu Zhi (1901-1976) graduated from Tsinghua in 1924 and received his doctoral degree in plant pathology from the University of Minnesota in 1929. From 1929 to 1938, Tu Zhi worked at Lingnan Unviersity, Sun Yat-sen University, Wuhan University and Henan University as professor. He supported Marxism and the CCP and had been imprisoned by the nationalist government for this reason. During the war, Tu Zhi took the position of president of the Northwestern Agricultural School and explored agriculture, forestry and graziery in Xinjiang. After 1950, he took charge of translating foreign agricultural publications from English, French, German, and Russian into Chinese. Tu Zhi was selected as CAS academician in 1955.

[63] Yang Weiyi (1897-1972) was a European-trained entomologist. He had been the first scientist to work on Hemiptera in China and the first to provide a systematic way to describe the regional distribution of insects in China.

[64] Tsinghua University Archives, file 1-2:1-200, pp. 6-10.

[65] It seems that Dai Fanglan had been deeply influenced by Dodge in his fungi studies. According to the memoirs of Shen Shanjiong, a younger scientist at Tsinghua IOA, Dai Fanglan had recommended his students interested in microbial genetics to read Dodge and Carl C. Lindegren's works on *Neurospora*. See Shen Shanjiong, "Opportunities: Memoirs of Shen Shanjion", in *Memoirs of Prominent Academicians*, edited by Han Cunzhi, volume 1, Shanghai: Shanghai Science Technology and Education Press, 2003, p. 388. (沈善炯，"机遇"，《资深院士回忆录》，韩存志主编，第一卷，上海：上海科技教育出版社，2003 年，第 388 页).

planned research travel through the United States and Europe between October 1934 and April 1936.

In July 1934, Tsinghua reached an agreement with the two professors: Dai Fanglan and Liu Chongle accepted their appointments and abbreviated their research trips to one year. Tsinghua would count their absences as sabbatical. During the 1934-1935 academic year, research assistants in the two groups would undertake some surveys and make preparation for research under the two professors. Li Jidong from the department of biology would provide advice for the assistants when necessary. After returning to Tsinghua, Dai Fanglan and Liu Chongle were expected to focus on research and popularization of agricultural sciences rather than teaching. Tsinghua attempted to appoint Dai Fanglan as the chair of the Tsinghua IOA. However, Dai Fanglan had little interest in taking administrative positions all through his life[66] and declined determinedly. Liu Chongle was even more indifferent to this position. Therefore, the Tsinghua IOA at this time had two independent divisions but no chief leader.[67] Despite this peculiar formation, Dai Fanlan and Liu Chongle maintained their two research groups through the

[66] I would like to say: Dai Fanglan's indifferent attitude triggered some troubles later. In 1949, the CCP government required agricultural schools in Tsinghua and Peking University to integrate with the agricultural division from the North China University to establish the Beijing Agricultural University (BAU). Again, Dai Fanglan firmly refused to be president of the BAU. However, he was the only person acceptable for scientists from both Tsinghua and Peking University. As a result, no scientist could take this position, and Le Tianyu (乐天宇, 1901-1984), a USSR-trained communist agriculturalist, actually started to take charge of the BAU. Le Tianyu insisted on replacing American sciences with Lysenkoism, which resulted in severe conflicts among faculty members and finally caused reorganization of the BAU and some American-trained scientists' leaving. Conflicts at the BAU remind me of another institute: Shanghai Institute of Biochemistry in Chinese Academy of Sciences. In the 1950s and 1960s, CCP also attempted to reform western-trained scientists in this institute. Fortunately, Wang Yinglai (王应睐, 1907-2001), chair of the institute and a British-trained biochemist, negotiated and compromised with the CCP and pacified the western-trained scientists. The Institute of Biochemistry survived plenty of political movements without severe destruction. It even won fame as the "Little Cambridge" during the Cultural Revolution. For scientists and scientific organization in a turbulent era, sometimes it was very significant to be tactful. However, to deal with administrative and interpersonal affairs, scientists usually had to sacrifice their research.

[67] Cheng Guangsheng, pp. 37-38.

remaining of their careers, even when these groups moved among many different research institutes.[68]

After meeting with President Mei Yiqi and other professors in July 1934, Dai Fanglan invited his student, Zhou Jiachi (周家炽), to be a research assistant in the division of plant pathology. Zhou Jiachi was Dai Fanglan's student at the School of Agriculture in Jinda and had been working as a research assistant at Lingnan University for one year. The division of entomology invited Mao Yingdou (毛应斗), a new graduate from the department of biology in Yenching University, to be a lecturer. Due to the limited research resources, by the summer of 1935, the lecturer and research assistant mainly conducted surveys and collections near Peiping.

Besides engaging researchers, President Mei Yiqi continued negotiating with the Ministry of Education and the local government in Peiping for some suitable places as experimental fields for the Institute of Agriculture. Mei Yiqi's original objective was the ruins of Yuan Ming Yuan (圆明园, the Old Summer Palace destroyed by French and British troops in 1860 during the Second Opium War). The Yuan Ming Yuan ruins covered an area of 3.5 square kilometers and it was next to the northwest corner of the Tsinghua campus, which was very convenient for Tsinghua IOA researchers to conduct field experiments. Mei Yiqi proposed his application to Minister Wang Shijie in a letter on July 8, 1933. However, Mei underestimated an important factor: since the destruction of the palace buildings in the 1860s, local peasants had gradually moved into this site for farming and residence, and local officials could not control them.

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[68] At the beginning of the Anti-Japanese War, Tsinghua had to suspend the Institute of Agriculture and these two divisions had to merge with the department of biology in the National Changsha Temporary University. In summer 1938 Tsinghua restored the Institute of Agriculture, so Dai Fanglan and Liu Chongle returned to their original positions. In 1947 this institute was formed into a school of agriculture and the research groups became departments in the new school. In September 1949, the agricultural schools in Tsinghua and Peking University (along with the North China Agricultural University from communist area) integrated into the Beijing Agricultural University (BAU); therefore Dai and Liu's groups joined the departments of pathology and entomology in BAU. In 1952 and 1953, after series of political and interpersonal conflicts, the Chinese Academy of Sciences (CAS) got agreements with the BAU to reorganize several research groups in BAU—including Dai and Liu's groups—into CAS. Dai Fanlan and Liu Chongle spent the rest of their lives in CAS. Their research groups finally become the Institute of Microbiology and the Institute of Zoology in CAS.

Chaotic political circumstances since the late Qing Dynasty had created entangled property claims related to the Yuan Ming Yuan ruins. In the early 1930s, the Peiping local government was managing the property. Concerned about income, the Peiping government did not want to give this site to Tsinghua. It was only a few years after the nationalist government's unifying China, and the Peiping government was not fully subordinate to the central government. As mentioned before, the central government was still powerless in many parts of China and was unwilling to displease the local government for Tsinghua's sake. Therefore, the Ministry of Education suggested that Tsinghua negotiate with the Peiping local government directly. Tsinghua spent more than half a year and took some tactful means to solve this difficulty. For example, President Mei Yiqi had written several times to Shen Pengfei (沈鹏飞), an early Tsinghua School graduate who was working as director of the Department of Higher Education at the Nanjing government, to ask for help. However, the local officials were not the root of the problem. Peasants living on this site over decades believed that Tsinghua was looting their land and resolutely resisted Tsinghua's taking over. They wrote to President Mei with angry questions,[69] and accused Tsinghua of bullying and oppressing poor peasants at

[69] Tsinghua University Archives, file 1-2-1-162, pp.66-70. This might be an interesting case. The original letter (as below) was written in very literary classical Chinese, with very beautiful hand script (the poor peasants must have some old-school intellectual to write this letter~). The general idea of this letter was: the noble elite Tsinghua scholars were lying to the Nanjing government; Tsinghua was not promoting agriculture at all, but just wanted to rob the poor peasants to take profits for themselves; the poor peasants could only make their lives by farming and would die if losing their lands, so, if they had to die, they might kill someone who had caused the misfortune for revenge. –It seems that the peasants were really upset and threatening President Mei and the Tsinghua IOA with their lives!

"贻琦校长执事

农民 等僻处西郊，与贵校为比邻，唯以车笠悬殊，自惭衣冠不整，故每相逢道左，未敢为礼。然而道貌则瞻仰有素矣。执事得英才而教育之， 农 等唯以牧我牛羊，其道不同。至于仰事俯畜之资，均赖终岁勤动其揆一也。自维择邻于学府之侧，庶几可免豪右欺凌，耕食鑿饮，谓余生当可苟全矣。

乃日前披阅报章，得读执事上南京教育部之洋洋大文，竟欲攫夺圆明园而据为己有。年来振兴农村、救济农村之声调不绝于耳，虽则于屡遭欺骗之余，未敢遽信，但私衷窃祷，未尝不希邀上天之眷怜，变理想而为实现也。岂图振兴者未遑，救济者有待，而新式破坏农村之方法竟出自我芳邻之学府，泛此兵匪不得视为专业矣，蚩氓何辜遭此荼毒！

执事所云："该地久沦荒墟"，其真内情不知耶，则出入于斯者有年，乃并田腾之禾麦蒙茸而不见，未免蹣跚可笑，其知之而故作此语，以欺蒙政府耶则其心实可诛矣！

Yuan Ming Yuan to the peasants' union of Peiping KMT party headquarters. Tsinghua's higher intellectuals with an American-training background could hardly expect to be trusted by the poor Chinese peasants. As a result, Tsinghua IOA thus never used this convenient land during its entire existence from 1934 to 1947. Moreover, the Tsinghua officials learned to carefully consider the desires of the local people.[70]

The episode of the Yuan Ming Yuan land, along with some later conflicts between the Tsinghua IOA and local peasants in Peiping or southwest China, suggested an unpleasant fact of most American-trained Chinese agricultural scientists: no matter how "Chinese" they considered themselves and how enthusiastic they were to serve China, their identity as "American-trained scientists" determined that poor Chinese peasants would consider them as outsiders and were inclined to keep distance from them. Although these scientists were able to fluently communicate with high politicians and famous international scientists, most (not all) of them lacked the skill to closely communicate with and gain the trust from low-class peasants, who were directly working on agricultural production in China. This character implied that these scientists often were not able to directly apply their knowledge and had to cooperate with the governments or other agricultural activists.

When Dai Fanglan returned from his sabbatical in August 1935, Tsinghua IOA still had no experimental fields. Researchers borrowed three rooms from the department of biology as laboratory—one bigger room for the division of entomology and two smaller

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今以一语告执事：耕者藉地以为活，失地则无以自存，牛衣对泣，冻馁而死。死也自杀死也，杀人而自偿之亦死也，冤各有头债各有主，若相煎迫而至山穷水尽时，则吾侪亦知所以自处矣嗟乎！

执事庚款期限尚能得几年？贵校所积之基金，果真有余力以经营此万数千亩之农场乎？其谁欺？若自以为奥援可恃，不惜先破坏一大好农村，以留待后日之试验，自非丧心病狂当不出此是！则执事此举，其非为公也明矣。既非为公，自当别有所为，勿以为一手竟可掩尽天下目也！

且近顷贵校以兴办农场为由，已向实业部索得香山迤南松堂之地千余亩，未见经营之迹，而又汲汲欲攫夺圆明园。试问执事之学校究竟须要若干农场而后可？天下事不平则鸣，激且生变，解铃系铃莫能相代，唯执事实图之。

情急陈词，不知所择，肃此上达即颂台祺

圆明园全体佃户谨启 通讯处

圆明园前湖三十二号于珠轩"

[70] Tsinghua University Archives, file 1-2:1-162-1.

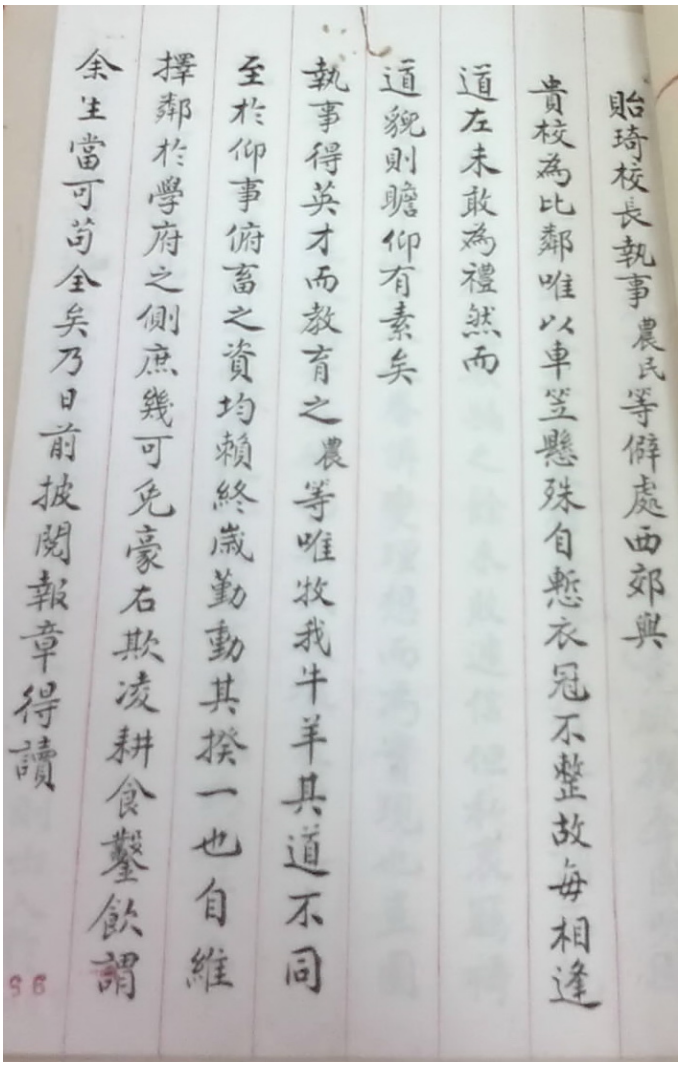
貽琦校長執事 農民等僻處西郊與
貴校為比鄰唯以車笠懸殊自慙衣冠不整故每相逢
道左未敢為禮然而
道貌則瞻仰有素矣
執事得英才而教育之 農等唯牧我牛羊其道不同
至於仰事俯畜之資均賴終歲勤動其揆一也自維
擇鄰於學府之側庶幾可免豪右欺凌耕食鑿飲謂
余生當可苟全矣乃日前披閱報章得讀

Figure 6. In 1934, Tsinghua scientists attempted to rent former government lands for research station. Unfortunately, peasants already lived there under rental agreements with the previous governments. This photo shows the first page of a letter from some Yuan Ming Yuan peasants to President Mei Yiqi in 1934. The original letter was written in very literary classical Chinese, with very beautiful hand script (the poor peasants must have had some old-school intellectual to write this letter!). The general idea of this letter was: the noble elite Tsinghua scholars were lying to the Nanjing government; Tsinghua was not promoting agriculture at all, but just wanted to rob the poor peasants to take profits for themselves; the poor peasants could only make their living by farming and would die if losing their lands, so, if they had to die, they might kill someone who had caused the misfortune for revenge. This is an example of how difficult it was for the scientists to find research facilities in such chaotic times (and this was the so-called "golden age"!). (Tsinghua University Archives, file 1-2-1-162, p. 66)

rooms for the division of plant pathology. At the request of Dai Fanglan, Tsinghua gave the IOA 0.06 square kilometers of land on campus for research. As for equipment, Tsinghua IOA managed to borrow books and laboratory supplies from other biological institutes such as the department of biology in Tsinghua and the Fan Memorial Institute of Biology. But they had to subscribe to agricultural journals themselves, and 6400 CND per year was far away from enough. Generally speaking, Tsinghua IOA started its research program under very limited conditions.[71]

From 1934 to the summer of 1937, research by the Tsinghua IOA staff was generally based on the North China area and its particular agricultural problems. The Division of Entomology conducted surveys on insect pests, beneficial insect breeding, and life history of insects. It also collaborated with the department of chemistry for insecticide research. In addition to Mao Yingdou, this division engaged Zhu Bao (朱宝, later changed his name into Zhu Hongfu 朱弘复 in December 1939) and Fan Xinrun (范新润) as research assistants in 1935 and Guo Haifeng (郭海峰) in 1936. All the three research assistants were Tsinghua graduates—Zhu Hongfu (1910-2002) and Guo Haifeng from the department of biology while Fan Xinrun was from the department of chemistry. The division of entomology published thirteen academic articles and some scientific popular pamphlets (such as *An Elementary Introduction to Insects*, 《昆虫浅说》, see Figure 7.) during the prewar period. Scientists at the division of plant pathology conducted surveys on plant diseases and fungi in North China. Zhou Jiachi cooperated with Professor Li Jidong at the department of biology and kept contact with Qiu Weifan and Wei Jingchao at Jinda for his survey research when Dai Fanglan was in the U.S. After Dai Fanglan returned, this division increased with two research assistants—Shi Lei (石磊) and Wang Qinghe (王清和). Dai Fanglan led and instructed these younger

[71] Yan Wanying, "The Institute of Agriculture in Tsinghua University during Wartime", in *Tsinghua University and Science and Technology in modern China*, edited by Yang Jian and Dai Wusan, Beijing: Tsinghua University Press, 2006, pp. 211-222. Originally published on *Historical Materials of Chinese Science and Technology*, No. 4, 1987. (闫万英，"抗战时期的清华大学农业研究所"，《清华大学与中国近现代科学技术》，杨舰，戴吾三编著，北京：清华大学出版社，2006 年，页 211-222。原载《中国科技史料》1987 年第四期).

Figure 7. This is the cover page of the first volume of *Brief Introduction of Insects* (*Kunchong Qian Shuo*, 《昆虫浅说》), a four-volume serial popular science booklet published by the Division of Entomology at Tsinghua IOA in 1935, aiming to introduce important pests and beneficial insects in North China to local peasants. These publications included the basic biology of the insects, including life cycles, and were intended to be educational. (Tsinghua University archives, file 1-2-1-200, p. 29)

Figure 8. Scientists of the Tsinghua IOA. Taken in 1937, Peiping. (*Tsinghua Annual Journal, 1937*)

(The original photo was marked as "the Division of Plant Pathology at Tsinghua IOA". However, I can recognize Liu Chongle and Mao Yingdou from the division of entomology. It should be a photo of the entire institute at that time.)

scientists to identify pathogens of diseases of millets, white pear, sorghum, wheat, and barley, which were crops and fruits widely planted in North China at that time. Meanwhile, they continued a fungi taxonomy project that Dai Fanglan had started at Jinda by collecting and identifying fungi in North China.[72]

In this way, Tsinghua IOA started its works with American-trained scientists who had to negotiate between the central government and local conditions. (See Figure 8.) They quickly adapted their research projects to the local fungi, insects, crops, and fruits. They were good at working with limited research resources. Compared with its rivals in Nanjing (such as the agricultural programs at the University of Nanking or the National Central University), the Tsinghua IOA received less governmental interference and the faculty had a fair amount of autonomy in designing their research and education. Although this was a new agricultural institute in the mid-1930s, it was positioned to succeed over the next twenty years because of the strong academic background support from Tsinghua and its politically marginal location among Chinese universities, which

[72] Tsinghua University Archives, file 1-2:1-200, pp. 17-26.

allowed it to be flexible and able to thrive in chaotic circumstances and adapt to local conditions.

Moving to the Southwest

The ability to be flexible and adaptive proved very important when the Second Sino-Japanese War broke out in July 1937. It seemed that the Institute of Agriculture in Tsinghua University faced an unfortunate fate to be terminated. The Japanese Army quickly occupied the campuses of several leading universities in North China, such as the National Peking University (PKU) and Tsinghua University, as well as Nankai University. On August 28, 1937, the Ministry of Education instructed the three presidents—Mei Yiqi of Tsinghua, Jiang Menglin of Peking University, and Zhang Boling of Nankai University—to arrange a retreat to Changsha, Hunan province, in order to unite together and to continue education and research in exile during the war. On September 10, the Ministry of Education's No. 16696 Instruction joined the three universities and established the National Changsha Temporary University. The university officially opened on November 1, 1937. However, the war went much worse than Chinese people's expectations. Shanghai and Nanjing fell into the hands of the Japanese army in November and December. Wuhan and Changsha in Central China quickly became the front. From February to April 1938, the Changsha Temporary University had to move once again to Kuming and was renamed as the National Southwest Associated University (国立西南联合大学，abbreviated as "Lianda").[73] (See Figure 3, the map of Tsinghua's movements.)

Tsinghua IOA was not totally unready for the retreat. Already when Japan plotted to create a separate puppet regime in North China in autumn 1935, the Tsinghua University had realized the danger and started to purchase land and buildings in Changsha to prepare for the retreat. In summer 1936, the Tsinghua IOA started a cooperative program with the Hunan Provincial Advanced Agricultural Professional School in Changsha in order to transfer its research focus to Central China.[74] Nevertheless, no one had expected that the

[73] See John Israel, *Lianda: A Chinese University in War and Revolution*.
[74] Tsinghua University Archives, file 1-2:1-201.

war would come so rapidly or that the nationalist army would be overpowered. Tsinghua IOA had to leave Peiping so hastily that they could neither harvest their plants nor rescue their research materials. Although a German company later helped the scientists move some equipment to Kunming, they had lost all the books and journals, research data, specimens, and seeds. On January 19, 1938, the Tsinghua university committee felt that it had no choice but to eliminate the Tsinghua IOA and to amalgamate it with the department of biology in Lianda.[75]

The retreat and unification of the three universities from North China is a good example to show the ongoing tension between the central and provincial governments. The KMT central government was more willing to support universities from Nanjing and east China, the base area of its government. Although it continued supporting the three universities from North China, annual appropriations for these universities were reduced to 75% of that before the war. In addition, when the central government allocated extra money to universities, Lianda only counted as one unit even though it was composed of three universities, while the National Central University from Nanjing maintained its independence and counted as one unit as well. The actual result was that Tsinghua, PKU, and Nankai could receive less support from the KMT central government compared with their rivals from the base area of the KMT government.

On the other hand, some provincial governments were very passionate in inviting these northern universities to relocate to their area. Before the war, the Hunan provincial government started cooperation with Tsinghua in agricultural experiments and education, and assigned lands and constructions for Tsinghua in 1935. When the Changsha Temporary University planned to move to the southwest, it received enthusiastic invitations from both Yunnan and Guangxi provincial presidents. The university leaders finally decided to move to Yunnan because it seemed farther from the battlefront and safer at that time, but the Guangxi government was so zealous that the universities had to send several very famous professors there to express their denial gracefully. All these provinces were still influenced by political and military forces that disagreed with the KMT government. They were all underdeveloped and poorly civilized before the war and

[75] Tsinghua University Archives, file 1-3:3-40, p. 2.

their governors believed that the top universities from north China could help them to develop both education and economics. Tsinghua found a balance between these political forces and got the chance to survive and thrive in the chaotic environment.

Growth in Marginal Regions

After arriving in Kunming, the southwest provincial capital city, the situation changed. During the war, all major agricultural and industrial producing areas fell into the hands of Japan. The nationalist government had to depend on its unoccupied regions including southwest China to support the country and to fight against the Japanese. During the war, the areas formally controlled by the KMT government included Sichuan, Yunan, Guizhou, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, and parts of Guangdong, Guangxi, Fujian, Jiangxi, Hunan, Hubei, Henan, Shanxi, and Zhejiang provinces. The southeast provinces were front lines to fight with the Japanese, and Shaanxi and Shanxi were interspersed by base areas of the Chinese Communist Party (CCP). Therefore, the nationalist central government could only effectively practice reforms in the Southwest to improve agricultural production. At a temporary national party congress in March 1938, the Chinese Nationalist Party (KMT) passed the *Wartime Principles for State Establishing* (《战时建国纲领》), which stressed that agriculture should have precedence over other industry and transportation. In April 1939, the KMT launched its first national production conference to make a comprehensive plan for agricultural improvement. This conference outlined several essential points for wartime agricultural development, including improving food production to support people's life, providing raw materials for industrial production, and increasing exportation of economic agricultural products.[76]

The Southwest had been an extremely backward region in China until that time. Even the most productive province, Sichuan, needed to import rice every year in the

[76] Wu Weirong, "Agricultural Development in rear area during the Anti-Japanese War", *Studies of Modern History*, 1991 No. 01, Beijing: Institute of Modern History in Chinese Academy of Social Sciences, pp. 221-243. (吴伟荣，"论抗战期间后方农业的发展"，《近代史研究》，1991 年第 01 期，北京：中国社会科学院近代史研究所，页 221-243).

1930s. Before the war, cotton production in the Southwest only counted for 4% of the national production. Thus the challenge to advancing science and technology to elevate agricultural production in this region was significant. The Central Agricultural Experimental Institute (中央农业实验所, CAEI) took charge of agricultural research in academic organizations and popularization of advanced agricultural knowledge and techniques. On one hand, the CAEI operated financial and scientific aids to research institutes in the Academia Sinica (the National Central Academy) and chief universities for research in improving agricultural production. On the other hand, the CAEI functioned as a governmental branch to help each county establish a department of agricultural popularization and more agricultural clubs in villages in order to pass agricultural knowledge and techniques to local peasants directly.[77] Shen Zonghan, chair of the CAEI, therefore decided to sponsor research at the Tsinghua IOA, where his old Jinda colleagues and Cornell alumni Dai Fanglan and Liu Chongle were engaged.

Given this situation, Tsinghua University was willing to restore and expand the IOA as well, for the sake of both the country and the university itself. According to Tang Peisong's memoirs, all the three universities—Tsinghua, Peking University, and Nankai—believed that the association of Lianda was merely an expedient measure and that they would definitely separate after the war. Therefore, all the three were willing to conserve forces for postwar development.[78] After Shanghai, where the main office of China Foundation was located, fell into the hands of Japan, Tsinghua could not get its monthly funds any more. The central government's fund for Lianda was 75% of the total of the three universities' prewar funds, which, considering skyrocketing prices during the war, was clearly not enough for further development. Therefore, Tsinghua decided to request a loan from banks with its temporarily unavailable China Foundation fund as

[77] Li Zidian, "The Brief History of the Central Agricultural Experimental Institute", *Historical Archives*, 2006.4, pp.113-120 (李自典，"中央农业实验所论述"，《历史档案》，2006.4，113-120 页).

[78] Tang Peisong, "Wei Jie Zhao Xia Gu Xi Yang", in *Memoirs of Prominent Academicians*, edited by Han Cunzhi, Shanghai: Shanghai Science Technology and Education Press, volume 1, 2003, p. 76. (汤佩松，"为接朝霞顾夕阳"，《资深院士回忆录》，韩存志主编，上海：上海科技教育出版社，第一卷，2003 年，第 76 页)

guarantee. The loan allowed Tsinghua to establish and expand several research institutes independent from Lianda. In June 1938, the Institute of Agriculture was restored and expanded in Kunming. Meanwhile, Tsinghua established the Institute of Radio Science, the Institute of Metallurgy, the Institute of Aeronautics, and the Institute of National Condition Survey. Ye Qisun (叶企孙) was appointed as chairman of these special institutes.[79]

The two prewar divisions got the opportunity to recruit new researchers with American postgraduate training backgrounds. Yu Dafu (俞大绂) and Lu Jinren (陆近仁) joined the divisions of pathology and entomology as associate professors respectively in July and October 1938. In addition, the Tsinghua IOA established a new division, Laboratory of Physiology, which later became the most active one. The new division was chaired by Tang Peisong (汤佩松), whom we met earlier. Yin Hongzhang, who had already been engaged with the department of biology in Lianda, also started to work at Tang Peisong's group as an honorary fellow. Zhang Xincheng, Tang Peisong's student and colleague at Wuhan University, joined the physiology group as an associate professor in May 1939. In summer 1939, Lou Chenghou (娄成后, 1911-2009), Tang Peisong's Tsinghua junior and University of Minnesota alumnus, returned from Minnesota after receiving his Ph.D. degree and joined Tang's group with latest instruments for electrophysiology purchased from the United States. Therefore, Tang Peisong's group became the best equipped plant physiology laboratory in southwest China.[80]

Although Tsinghua IOA had three groups, its formation and operation became a problem again. Again, both Dai Fanglan and Liu Chongle were totally indifferent to being head of this institute. Tang Peisong was very interested in such managerial job, but as a newcomer and the youngest professor, it was inappropriate for him to take this position. Therefore the Tsinghua IOA stayed in three independent groups without an institute head.

[79] *Historical Materials of Tsinghua University*, volume 3, 1990, pp. 116-118.
[80] Tang Peisong, p. 83.

Through early 1939, the Tsinghua IOA stayed together with Lianda at some temporary campus buildings in Kunming. However, after September 1939, the Japanese air force started to bomb Kunming. Air attacks became more and more frequent once Japanese troops occupied Hanoi, Vietnam in 1940. Many temporary classrooms and laboratories were ruined in the air attacks. The city was not a safe place any more. The Tsinghua university committee decided to rent lands in rural areas near Kunming and move the special institutes out of town to avoid air attacks. From January to September, 1939, Mei Yiqi and Ye Qisun contacted the Department of Construction of Yunnan Province and signed a ten-year lease to rent a land of 165.87 *mu* (0.11 square kilometers) at Dapuji (大普吉), northwestern suburb of Kunming. From the end of 1939 to the summer 1946, Dapuji was the base for the divisions of pathology and physiology of Tsinghua IOA, as well as the base for the Institute of Radio Science and the Institute of Metallurgy. The division of entomology set an office in Kunming and rented a land of ten *mu* at Poxi (婆兮), a small town 170 kilometers south of Kunming, as their experimental farm to plant fruit-trees and sugarcane (important crops of the southwest).[81]

Living conditions at these villages were extremely tough. These prominent scientists had to build up houses as well as establish basic water and power systems for their lives and research. They also needed to deal with harassment from brigands, local peasants, and the soldiers protecting them.[82] By 1939, the annual fund from Tsinghua for each research group had increased to 30,000 CND. In addition, the divisions of plant pathology and entomology received 8,000 CND annual stipend from CAEI; the group of general physiology had a grant of US $2,500 from the Rockefeller Foundation.[83] Although the funding had increased, the scientists had to repurchase apparatus and

[81] Tsinghua University Archives, file 1-3:3-92, “Documents and Contracts about How the Tsinghua IOA’s Rented Lands at Dapuji”.

[82] Before Tsinghua, some scholars from the National Sun Yat-Sen University had moved to a farm near Dapuji, and they suffered robbery in February 1940 (see Tsinghua University Archives, file 1-3:3-92, p. 31). At the request of President Mei Yiqi, Long Yun (龙云), chairman of Yunnan province, sent some soldiers to Dapuji for a security guard. From then on the Tsinghua researchers had to tolerate noise from the soldiers. In addition, local peasants along with the soldiers usually came to the experimental farm and garden of Tsinghua IOA to steal fruits. The elegant Tsinghua intellectuals could hardly stop such rude harassment.

[83] Tsinghua University Archives, file 1-3:3-88, draft reports of the Institute of Agriculture in 1940.

journals, and, different from in Peiping, there were few other research organizations in Kunming to share research equipment with Tsinghua IOA. The financial situation for the Tsinghua IOA became even tougher after 1940, when severe inflation happened in Southwest China.

However, in the villages the scientists were finally able to stay far away from air attacks and to settle down for their research and education. Since the summer of 1939, when Lianda restarted to recruit graduate students, Tsinghua IOA had accepted many graduate students from the departments of biology and chemistry as research assistants. It provided a relatively peaceful environment for graduate students to conduct experimental research and finish their studies at the master's level. Also after 1939, Lianda restarted the exams to select talented Chinese students to study in the U.S. The Tsinghua IOA functioned as a preparatory training institute and allowed the selected biology and agriculture students to undertake short-term research before going to the U.S.[84]

Because all professors at Tsinghua IOA were American-trained scientists and familiar with English and American culture, they played an important role in receiving western scientists. After 1941, when the United States joined the Allies of WWII, China restored its diplomatic communication with the U.S. and Britain. Academic communications became active as well.[85] Tsinghua IOA scientists' contribution to the local-global circulation of scientific knowledge lasted till the 1970s and 1980s, which I will explore in the following parts.

Reforms and Finality

After the Sino-Japanese War, the Tsinghua IOA returned to Peiping in 1946. It was reorganized into the School of Agriculture in 1947, with Tang Peisong as the director. Several professors (such as Yin Hongzhang and Yu Dafu) left for foreign organizations or Peking University, but the three leading scientists stayed in the new agricultural

[84] From 1942 to 1945, some lecturers in Tsinghua IOA went to study in the U.S. as well, for example, Mao Yingdou, Jiang Huaizhang, and Zhu Hongfu.
[85] For example, Joseph and Dorothy Needham had visited Dapuji and built up close friendship with Tang Peisong and other scientists in the physiology group.

school. The divisions of plant pathology and entomology were reformed into the departments of plant pathology and entomology. The Laboratory of General Physiology was changed into the department of agricultural chemistry. Tang Peisong borrowed the institutional model of Johns Hopkins University and aimed to establish the agricultural school at Tsinghua as an institute training elite scientists. For instance, there were in total 12 professors, all of whom were western-trained scientists with teaching experience, in the three departments. And in 1947 this school enrolled only 12 students. Tang Peisong wished to maintain the faculty/students ratio around 1:5 after five years. He got permission to use an area[86] near the Summer Palace as site for the agricultural school. In addition, he purchased and installed most advanced apparatus for field works and laboratory research.[87]

However, the turbulent political environment broke Tang Peisong's dream of building a Johns Hopkins University in China. In the middle of December 1948, the PLA troops (People's Liberation Army, the army of the CCP) besieged Peiping. President Mei Yiqi fled to Nanjing. All Tsinghua professors gathered together to discuss the future of their university. Tang Peisong was the first one to stand up and appeal that "Tsinghua was built up with the blood of Chinese people. Now it is time to give it back to the people!"[88] His appeal received a thunder of applause. Most Tsinghua faculty and students had no affection for the nationalist government. They took a university-wide vote and decided to accept liberation of the CCP. The discussion and voting exemplified Tsinghua scientists' identity of "being Chinese" and their "love for China" which motivated them to make this important decision. Their primary allegiance was not to the central government, but to the Chinese people.

Nine months later, under an instruction from the CCP central government, the Tsinghua agricultural school was integrated into the new Beijing Agricultural University (BAU) along with the Peking University agricultural school and an agricultural division

[86] Sheng Ping Shu (昇平署), an old but beautiful governmental office next to the east gate of the Summer Palace (颐和园). The Japanese occupying army had started a farm near this office and Tsinghua had taken both the office and the farm in 1946.
[87] Tang Peisong, Chapter 12.
[88] Tang Peisong, pp. 125-126.

from the North China University. Scientists from the Tsinghua IOA reunited at the BAU, and the Tsinghua IOA itself had finally ended up in this new specialized agricultural university.

V. From the Local to the Global—Case Studies of the Tsinghua Scientists Negotiating the Basic Science – Applied Science Boundary

During its early development, Tsinghua was established as a preparatory school for the Boxer students. It had been highly inclined to prepare students for practical studies because according to the agreement between the US and the Chinese government, more than 80% of the Boxer students must major in practical knowledge such as science, engineer, medicine, and agriculture. The primary goal for training western-style intellectuals was to introduce practical knowledge directly beneficial for China. In addition, China was so underdeveloped in both economics and scientific institution, and therefore not able to support pure scientific research without obvious use. It was very hard for Chinese scientists to have equal academic communication with their foreign colleagues. Since the late 1920s, however, scientific research and education institutions had greatly improved in many areas of China, as mentioned above. It was no longer an extravagant hope for the Chinese people to create international-level scientific knowledge at their home country. At this time, Tsinghua had evolved to a leading university in China, which meant that it needed to maintain both its teaching and research at a high level. On one hand, Yu Zhenyong's unsuccessful agricultural department suggested that simply applying agricultural knowledge and directly teaching the peasants was not enough for the development of agricultural department in a leading Chinese university. On the other hand, pure research without application was definitely unsuitable for the actual conditions of the Republican China, because most parts of the country was still very poor and the country could not afford huge investment in scientific research without noticeable reward. Therefore, it was the time for Chinese scientists to re-evaluate the importance of pure and applied sciences in order to make a long-term development plan.

I argue here that the Tsinghua IOA scientists found a way to emphasize both pure research and application, which allowed them to be able to adapt to local conditions and to communicate with their international scientific colleagues. Dai Fanglan had pointed out at the very beginning of Tsinghua IOA's establishment that:

> "[O]ur institute will devote our research to resolving practical problems in agricultural production. We are not focusing on profound research. This is why we name us as the Institute of Agriculture (农业研究所) rather than institute of agricultural sciences (农学研究所)."[89]

And that:

> "All applied sciences are built up on the base of pure research."[90]

These paradoxical expressions do not imply an inconsistency among the Tsinghua IOA scientists. Actually, historians of science in modern China have already noticed that pure and applied sciences in China have not been in a tension as they had in the United States.[91] Although debates around the relationship between pure and applied sciences had lasted through the republican period in mainland China, generally speaking, Chinese scholars in the 1920s and the 1930s believed that the two were inseparable and deserved equal attention and investment. For example, in 1936, Cai Yuanpei (蔡元培) proposed that:

> "Scientific research should not set application as the only purpose. Many applicable scientific results were achieved as the byproduct of pure scientific research. … It is undeniable that achievements of pure sciences may become foundations of applied sciences, while concerns of applied sciences can provide new topics and methodologies for pure sciences. We should place

[89] Tsinghua University Archives, file 1-2:1-200, p. 30.
[90] Tsinghua University Archives, file 1-3:3-94, pp. 2-4.
[91] For example, in his book *The Study of Change: Chemistry in China, 1840-1949* (Cambridge: Cambridge University Press, 1991), James Reardon-Anderson analyzes how the KMT government compromised with scientific activists and researchers to balance both pure and applied scientific research during the republican period. Sigrid Schmalzer also explores how the basic/applied science dichotomy in China differed from in the United States through cases of agricultural science in socialist China in her "Self-Reliant Science: The Impact of the Cold War on Science in Socialist China". [full citation]

equal emphasis on both of them and therefore receive double-wins. Ignoring one of the two would result in failure for both of them."[92]

Scientists such as Ding Wenjiang and Tao Menghe also declared that the so-called "pure" or "applied" sciences were just simple and convenient categories to distinguish some new disciplines, while science itself should be a cohesive entirety rather than separate fragments. "It should be called the application of sciences, rather than applied sciences."[93]

Therefore, although Chinese scientists motivated by their identity of being Chinese were inclined to conduct the scientific research most useful and practical for China's prosperity and strength, they were able to stress the identity of being scientists and therefore were able to balance pure research and applications in their results. The reason for the successful balance was that, although the government and people in China—just as in the U.S.—were demanding that scientists produce most beneficial outcomes, Chinese scientists felt that it was critical to contribute to international scientific research, because science in China had been dominated by foreigners. With pride in being Chinese scientists, they wanted to create and circulate new scientific knowledge around the world in order to promote China's status in the global scientific community as well as to promote the development of science. As examples of this strategy, I will briefly discuss Tsinghua scientists' work in three areas: the biological control of insects, water potential in plant respiration, and fungal classification.

Biological Control of Pest Insects

Compared with Dai Fanglan and Tang Peisong, Liu Chongle, director of the Division of Entomology at Tsinghua IOA, seemed to be quieter and less public. However, his experience in Republican China might be the best example of how scientific knowledge circulated between China and the West.

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[92] Cai Yuanpei, "Process Outline of the National Central Academy" (April 16th, 1936), *The First Draft of the History of the Academia Sinica*, Taipei: the Academia Sinica, 1988, pp. 23-28. (蔡元培，"国立中央研究院进行工作大纲"（1936 年 4 月 16 日），《中央研究院史初稿》，台北，中央研究院，1988 年，第 25-26 页)

[93] Yang Tsui-Hua, p. 149.

Liu was born in Shanghai on September 20, 1901. His grandfather Liu Qixian (刘齐衔, 1815-1877), the son-in-law of Lin Zexu (林则徐), had taken positions such as provincial governor or judge (e.g., 陕西布政使, and 浙江按察使). Liu Chongle majored in chemistry and biology at Tsinghua College from 1916 to 1920. He received B.S. degree from Cornell University in 1922 and entered the department of entomology at the agricultural school in this university. After receiving a doctoral degree, Liu Chongle returned to China in September 1926 and served as a professor at the Northeastern University in Shenyang. After the September 18 Incident,[94] when most faculty and students of the Northeastern University were exiled to Peiping, Liu Chongle was engaged by the department of biology in the National Peiping Normal University (Beijing Normal University). By 1933, Liu Chongle had become the chair of this department. However, compared with universities with foreign supports such as Jinda and Tsinghua, the Peiping Normal University (funded by the Ministry of Education in Nanjing) did not have enough funding to effectively support scientific survey and research. Liu Chongle had not gotten the chance to put what he had learned from the Cornell agricultural school to good use until he joined Tsinghua IOA in 1934.[95]

Biological control of insect pests had been Liu Chongle's research focus all through his life. During his research trip in 1934 and 1935, Liu Chongle visited six western institutes for this topic—the agricultural experiment station of the Hawaiian Sugar Planters' Association, Honolulu, Hawaii; the Cities Experiment Station, Riverside, California; the Gipsy Moth Laboratory, Melrose Highlands, Massachusetts; European Corn Borer laboratory, Arlington, Massachusetts; Japanese Beetle Laboratory, Moorestown, New Jersey; and the parasite laboratory of the Imperial Bureau of

[94] Japanese troops invaded Northeast China on September 18, 1931.

[95] It is not easy to figure out details of Liu Chongle's life. He was persecuted to death at the beginning of the Cultural Revolution without leaving any memoir or biography. Almost all archival materials of the Institute of Zoology in CAS (where Liu Chongle had been working since 1953) were ruined during the Cultural Revolution and all personal records of the scientists were lost. This brief introduction is based on Tsinghua University Archives file 1-2:1-200 and *The Brief History of the Institute of Zoology in Chinese Academy of Sciences*, Beijing: Science Press, 2008.

Entomology, Farnham Royal, England. He was deeply impressed by the use of parasitic wasps in controlling orange pests in California.[96]

We see Liu's strategy to link his basic science research program to local applications very clearly when he and his Tsinghua colleagues fled to Yunnan Province to escape the Japanese Army during the war. From 1936 to 1937, Liu designed and headed a research program in which his assistants and students identified natural enemies of pests of plants important to the economy in North China, including cotton, sorghum, and oak. After moving to Yunnan, Liu and the Tsinghua entomologists shifted their emphasis to pest insects of peaches, sugarcane, and some other plants that were economically important to this south-western province. In the southwest, they had to start over to figure out the life histories of local pest insects and identify some of the natural predatory insects of these pests through experiments. Meanwhile, the entomology group cooperated with the physiology group to give weekly lectures to researchers from Lianda, Tsinghua, and local schools and institutes. Liu Chongle was the first presenter of this lecture series and his topic was on a parasitic wasp of a beetle larva. Lacking the personnel, Tsinghua IOA by itself was not able to popularize this scientific method. However, Liu and his Tsinghua colleagues gave their research results to the agricultural departments of the provincial government for further popularization and education (a topic I would like to explore further in my dissertation). Because of Tsinghua IOA's collaboration with these governmental organizations, the idea of biological control of pests was disseminated to peasants in South China and became a popular method to treat pests after the 1950s. Interestingly, although the idea of bio-control originated in western countries, it declined in the US and Europe after the wide application of chemical fertilizer and pesticides. As a result, when mainland China restarted diplomatic communications with the US, scientists from America were deeply impressed by bio-

[96] Tsinghua University Archives, file 1-2-1-200, "Liu Chongle's Research Travel Plan of studying agricultural entomology in America and Europe", pp. 57-59.

control of insect pest in China, and this method was re-introduced to American people as an example of mass science from communist China.[97]

According to the extant documents of Liu Chongle, unlike Dai Fanglan and Tang Peisong, Liu did not talk too much about love for his country. He was always quiet towards issues beyond the scope of his scientific research. Compared with the identity of being Chinese, the identity of being a scientist seemed to be a stronger motivation through Liu's life and career. For example, Liu Chongle described the goals of Tsinghua IOA as:

> "This program was established under the request of government and belongs to a university. … The working emphasis must be research and cultivating scientists. … The general steps for insect research were surveying, experimenting, and popularizing…"[98]

And when talking about the biological control of pests, he believed that the duty of Tsinghua scientists was research rather than popularization and education:

> "Our research outcomes may be applied to the control and utilization of insects. However, our labors were too limited to popularize the outcomes among peasants. We need to cooperate with governmental departments for the popularization."[99]

Compared with Dai Fanglan's description of the goals of the IOA, his words reveal that Liu was not as interested in institution building and especially publicity. He preferred to focus narrowly on his research and let the government popularize and apply his findings.

During the wartime, CAEI (the Central Agricultural Experimental Institute) provided about half of the research funding for Liu Chongle's group, which implied that the central government was expecting some practical results from Liu's research. From the case of Liu's bio-control research, we can see that this scientist did not especially alter his research interest to fit the requirements of the government. However, one the other hand, we should also notice that even without the motivation of governmental

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[97] See Sigrid Schmalzer, "Insect Control in Socialist China and Corporate United States.: The Act of Comparison, The Tendency to Forget, and The Construction of Difference in 1970s U.S.-Chinese Scientific Exchange," *Isis*, 2013, 104:303-329.
[98] Tsinghua University Archives, file 1-3:3-94, pp. 2-4.
[99] Tsinghua University Archives, file 1-3:3-88, pp. 38-42.

funding, Liu was choosing—maybe unconsciously—some research topic potentially beneficial for his country. During his 1934-1935 research trip, Liu wrote to president Mei Yiqi to introduce the bio-control method he saw in California, and expressed an enthusiasm to apply this method in rural China. While the idea of biological control of insect pests can only be applied based on specific local conditions, Liu Chongle's research exemplified how a general scientific idea from western countries adapted to and developed in local environments, and how Chinese scientists fed the developed ideas back to their western colleagues. Liu also exemplified a way of Chinese scientists to realize their dual-identity—they claimed to be focusing on pure scientific research of their interest, and claimed to be indifferent in politics and practical application of knowledge. However, motivated by the identity of being Chinese (maybe unconsciously), their research interests were entangled with the actual needs of Chinese society. Therefore, when conducting and creating scientific knowledge, they were also contributing to their country and particularly to the welfare of its people.

Pure Research of Plant Metabolism

Among the three leading Tsinghua IOA scientists, Tang Peisong had especially emphasized pure research while he was also a major contributor to the application of science. His practical research included producing lubricant oil with castor-oil plants as raw materials; cultivating fast-growing crops and seedless fruits by applying auxin, colchicine, and low-temperature treatments; researching fermentation processes and producing acetone and calcium lactate; and surveying nutritional details of Chinese diets and planning a balanced diet for Chinese soldiers. These contributions made Tang's group very attractive for both young students and governmental and industrial financial support during the war. Tang created a very good balance between practical studies of applied science and the pure research of sciences with less obvious direct benefits. These practical studies, on one hand, realized Tang's identity of "being for the Chinese people"—the desire to serve China; on the other hand, this work also enabled him to

realize his identity of being a scientist—to conduct the pure research in which he was interested.

Tang Peisong had developed a strong interest in exploring the fundamental nature of physical and chemical principles of living things since his years at the University of Minnesota. During his studies at the Johns Hopkins University, Woods Hole, and Harvard University, he decided to choose the physiology of plant respiration and photosynthesis as the focus of his scientific career—and he did insist on this focus all through his life, even during wartime. Research condition was extremely poor at Kunming during the war. Tang's Laboratory of General Physiology was considered as the best-equipped laboratory in Southwest China because Lou Chenghou, an associate professor at this group, had brought back some specialized electrophysiology equipment from the US. However, Lou's research was separated from the works of other scientists. For Tang and most of his colleagues and students, even the incubator and the refrigerators would break down very frequently. However, these scientists were still able to overcome these difficulties and generate top-ranking scientific knowledge. For instance, in March 1940, Tang Peisong and Luo Shiwei (罗士苇) published their research on polyploidy induced by colchicine treatment in *Science* (No. 2357).[100] In December 1943, Luo Shiwei and Wang Fuxiong (王伏雄) published their works on conifer physiology in *Science* (No. 2555).[101] In 1945, because of Joseph Needham's introduction, three young scientists at Tang's group, Zheng Bolin (郑柏林), Chen Shaoling (陈绍龄), and Zheng Weiguang (郑伟光), published their research of puchiin in *Nature* (Vol. 156),[102] which was the first time anyone had purified an antibiotic from higher plants.[103] Among all the achievements of this group, I believe that the most interesting and

[100] P.S. Tang, and W.S. Loo, "Polyploidy in Soybean, Pea, Wheat and Rice, Induced by Colchicine Treatment", *Science*, Vol. 91, No. 2357, 1 March 1940, p. 222.
[101] S.W. Loo, and F.H. Wang, "The Culture of Young Conifer Embryos *in vitro*", *Science*, Vol. 98, No. 2555. 17 December 1943, p. 544.
[102] S.L. Chen, B.L. Cheng, W.K. Cheng, and P.S. Tang, "An Antibiotic Substance in the Chinese Water-chestnut, Eleocharis tuberosa", *Nature*, Vol. 156, 25 August 1945, p. 234.
[103] *The Brief History of the Institute of Botany at CAS*, p. 622.

remarkable one should be Tang Peisong's 1941 article on the "water relations" (now called "water potential" in plant physiology) during plant metabolism.

In 1940, Tang Peisong collaborated with Wang Zhuxi (王竹溪), a physics professor at Lianda, working on water relations in plant cells. They submitted their discoveries to the *Journal of Physical Chemistry* in U.S. in August 1940, in a study entitled "A Thermodynamic Formulation of the Water Relation in an Isolated Living Cell." This article was published in the 3rd issue of *Journal of Physical Chemistry* in 1941. It proposed the thermodynamic methods to explain and calculate the water movement of plant cells with the concept of intra- and extra-cellular chemical potentials (although they did not use the term "potential" directly). Tang Peisong and Wang Zhuxi's results were an important breakthrough in understanding the physical chemistry of water metabolism in plants at that time. This article demonstrated that scientists in wartime China were still active and enthusiastic in fundamental research and in participating actively in international scientific communication. However, their discoveries were too ahead of their time and were ignored for decades.[104] In the 1960s, western scientists such as R. O. Slatyer, S. A. Taylor, and P. J. Kramer developed a systematic way to describe water metabolism in plant cells using the concept of "water potential". They were considered as pioneers in unifying studies in this field, while Tang and Wang's 1941 article had actually covered all essential points in the works of Slatyer, Taylor, and Kramer. In 1984, Kramer expressed a deep regret for neglecting Tang and Wang's results.[105]

After 1949, Tang Peisong continued his research in the physiology of plant respiration and photosynthesis. For example, when taking the position of vice director of the Institute of Botany at CAS, Tang led his group in elucidating multiple pathways of

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[104] According to Google scholar (searched on August 3, 2012), Tang Peisong and Wang Zhuxi's 1941 article has only been cited by 14, while P. J. Kramer's 1984 book *Water Relations of Plants and Soils* has been cited by 2514.

[105] Liu Jixing, "Collaboration between Tang Peisong and Wang Zhuxi on Water Relation in Plant Cells", in *Tsinghua University and Science and Technology in Modern China*, edited by Yang Jian and Dai Wusan, Beijing: Tsinghua University Press, 2006, pp. 97-118. Originally published in *Physics*, 2003, No. 6 & No. 7. (刘寄星，"汤佩松和王竹溪关于植物细胞水分关系的合作研究及其启示"，《清华大学与中国近现代科学技术》，杨舰，戴吾三编著，北京：清华大学出版社，2006，页 211-222。原载《物理》2003 年第 6、7 期)

Figure 9. The global circulation of knowledge established by Tsinghua scientists in the 1940s continued to thrive after that period. The Chinese photosynthesis scientists delegation visited the laboratory of Melvin Calvin (discover of the Calvin cycle and winner of the 1961 Nobel Prize in chemistry) at Berkeley, California, in 1974. Four of these Chinese scientists were students and assistants of Tang Peisong and Yin Hongzhang—Shen Yungang (沈允钢),Kuang Tingyun (匡廷云), Li Liangbi (李良壁), and Zhang Qide (张其德) . (Gu Dinghai, "Exclusive Interviews with Shen Yungang", http://shszx.eastday.com/node2/node22/lhsb/node4487/node4495/u1a23239.html)

respiration in rice. He collaborated with scholars from Peking University, Nankai University, and the Beijing Agricultural University to apply these achievements to scientific research, higher education, and agricultural production. During the Cultural Revolution, Tang's research was extensively interrupted by political movements, but he still paid close attention to trends in international academic circles. When hearing that the

U.S. Plant Studies Delegation visited China during August and September 1974,[106] Tang proposed to leaders at CAS that China might also send a scientist delegation to the U.S. He suggested that photosynthesis was a hot topic at that time, and Chinese scientists had strong background in this field, so this delegation might be composed scientists focusing on plant metabolism and photosynthesis. The CAS leaders accepted Tang's proposal and organized a "Plant Photosynthesis Delegation". This delegation consisted of eight plant scientists and visited the US from November 15 to December 15, 1974. (See Figure 9.) Tang Peisong was excluded from this group because of his suspicious political background. But he was still very proud that this delegation of Chinese scientists was traveling to meet their western counterparts and to describe their research. The crucial impact of such an international delegation during the Cold War was not lost by Tang. In his memoirs, he bantered that this delegation functioned as "photosynthesis diplomacy".[107]

Fungi Classification

When newly settled down at the program of plant pathology at Jinda, Dai Fanglan focused his research on fungi related to crop and fruit diseases rather than the basic research of fungi classification and systematics. However, when continuing writing scientific popularization articles for the *Kexue* journal, he noticed that from the 1870s to the early twentieth century, all publications on fungi in China were published by foreigners.[108] China only provided raw materials for the research of natural history, but could not really contribute to the generation of scientific knowledge. Dai Fanglan's pride

[106] This delegation visited China from August 27 to September 23, 1974. Its members included world-renowned scientists, such as Richard L. Bernard, Norman E. Borlaug, Nyle C. Brady, Glenn W. Burton, John L. Creech, Jack R. Harlan, Arthur Kelman, Henry M. Munger, George F. Sprague, and Sterling Wortman. They visited many botany and agriculture institutes in China. Tang was suffering political persecution and not able to meet these American scientists, but some of his old colleagues (such as Yin Hongzhang) got chance to meet and talk with the delegation. See Sun Qiliang, "中国与美国古植物学交流与合作的大门是如何被打开的？", http://blog.sciencenet.cn/home.php?mod=space&uid=225931&do=blog&id=378602

[107] Tang Peisong, p. 52.

[108] Dai Fanglan, "Collections of Fungi in China by Foreign Explorers", *Nanking Journal*, 1(2), 1932, pp. 537-548.

and the feeling of dual-identity of being both Chinese and a scientist made it hard for him to accept China's disadvantage in scientific research.

One of Dai's conflicts with Albert N. Steward, director of the program of plant pathology at Jinda finally motivated him to work on fungi classification. Steward promised to assist Professor Roland Thaxter (an American from Harvard University) to collect fungi specimens in Southwest China. Dai Fanglan insisted that Jinda should keep one copy of the fungus specimen and send another copy to Harvard. Steward was uncertain whether Chinese people were competent to carry out serious research on these fungi specimens, but he finally gave in to Dai Fanglan's persistence. The problem was that there had never been Chinese scientists working on fungi taxonomy before. Dai Fanglan's focus had been plant pathology research and anti-disease crop selecting. However, to break westerners' monopoly on mycological research in China, he undertook the task of working on fungi specimens collected from Southwest China.[109]

Dai Fanglan's 1930 article, "A new species of *Uncinula* on Acer Trifidum Hook and Arn",[110] marked the establishment of Chinese mycology. After that, Dai Fanglan shifted his research emphasis from practical pathology partly to identifying and classifying fungi in China, which became the research focus all through his life and has made him the founder of mycology in China. He also organized and instructed Chinese scientists and students in his program such as Zhou Jiachi, Yu Dafu, Chen Hongkui, Qiu Weifan,[111] Wei Jingchao, and Huang Liang to conduct research and surveys on fungi in East China. Dai Fanglan encouraged these younger researchers, stating that Chinese people should investigate and control national resources of their own and publish their findings as soon as possible to claim the achievements of Chinese scientists to the world.[112]

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[109] Cheng Guangsheng, pp. 29-30. This was important work. Even today, only about 8% of fungal species have been named, classified, and related to other fungi (the majority coming from Europe, China and the USA). Bryn Dentinger, personal communication, 29 April 2013.

[110] This article was published in English in Volume 6, Issue 1 of *Contributions from the Biological Laboratory of the Science Society of China: Botanical series*, Nanjing: the Science Society of China, 1930.

[111] These four scientists later joined the Tsinghua IOA and worked closely with Dai Fanglan in their later careers.

[112] Cheng Guangsheng, p. 31.

From then on, Dai Fanglan moved part of his research emphasis to fundamental research of mycology and published plenty of research articles at the international level. His series of articles, "Notes on Chinese Fungi", was started during the years at Jinda, and lasted through his years at Peiping and Yunnan. Although the war caused a lot of troubles for Dai's research, the forced migration from north China to Hunan in middle China, then to Yunnan in Southwest China, also enabled him to survey and study fungi at different sites of China. Yunnan province has very diverse and complex geological landscapes and biological species. Western researchers such as J.W. Delavary and Narcisse Theophile Patouillard had discovered and described hundreds of fungi from Yunnan. Knowing these facts, Dai Fanglan would definitely grasp the opportunity to research on fungi in this region. During the eight years in Yunnan, the primary tasks for Dai and his research group was to work on disease related to economic plants in southwest China and to teach students at Lianda. However, Dai Fanglan took every chance to conduct surveys of fungi in Yunnan. He and the young scientists in the division of plant pathology had explored and collected more than two hundred species of fungi, and named over sixty of them. Some of these discoveries were published in the No. IX of Dai's "Notes on Chinese Fungi" in 1939; some were published in western journals such as *Lloydia* and *Farlowia* between 1944 and 1948.[113]

If Tang Peisong exemplified how a second-generation Chinese scientist succeeded in balancing pure and practical research and was therefore able to contribute to both China and science, for Dai Fanglan, there was no need to balance—he combined the desire to serve his country and scientific knowledge. As a first-generation American-trained Chinese scientist, Dai believed that contributing to science meant much more than pure scientific research. It also involved institution building such as establishing journals, academic societies, and training younger researchers. From 1930 to 1948, Dai Fanglan played active roles in all these activities. For example, in May 1929, he collaborated with his Cornell alumni friends, such as Zou Bingwen and Deng Shuqun, to establish the Chinese Society for Plant Pathology. Also in this year, they applied a grant from the

[113] For example, see Tai F.L., "Studies in the Geoglossaceae of Yunnan", *Lloydia*, 7(2), 1944, pp. 146-162; and "Cercosporae of China II", *Lloydia*, 11(1), 1948, pp. 36-56.

China foundation to support Herbert H. Whetzel, their professor and advisor from Cornell University, to come to China and give lectures. In August 1933, he participated in establishing the Chinese Society of Botany. In 1934, he took the position of editor for the *Chinese Journal of Botany*.[114] Dai Fanglan believed that these scientific journals, societies and lectures could help Chinese scientists communicate with international scientific communities equally.[115]

Dai Fanglan's early experience suggested different strategies from those of Liu Chongle and Tang Peisong. Liu Chongle was claiming the academic duty and autonomy of university scientists and tried to get rid of interference from non-scientific issues, although his "pure" scientific research actually involved plenty of practical benefits for China. Tang Peisong was enthusiastic in many events such as applying practical scientific knowledge, conducting pure scientific research, communicating with foreign scientists, training young students and establishing scientific institution. Tang was able to arrange all these issues on different tracks and made excellent balance among them. Dai Fanglan did not consider the desire to conduct pure scientific research as an issue separated from his "love for China" at all. In Dai's career, pure scientific research, as well as practical research and institutional establishment, were closely connected to each other because they were all ways to create good science and to serve China—for Dai Fanglan, "being a scientist" meant a good way to "being a Chinese person". Each of the three leading scientists at Tsinghua IOA is an example of the different ways of managing the interaction between "being Chinese" and "being a scientist", between local and global, and between pure and applied research.

[114] The chief editor of this journal was Hu Xiansu (胡先骕, 1894-1968), a Harvard University botany Ph.D. and the first Chinese scientist working on taxonomy of plants in China. This journal stopped publication in 1937 because of the war.
[115] Cheng Guangsheng, pp. 29-31.

Figure 10. In 1948, the Academia Sinica—the National Central Academy—selected its academicians for the first time. About ten of the first eighty-one academicians had conducted agriculture-related research, and the former Tsinghua IOA scientists counted four of them. This photo shows Yu Dafu, Tang Peisong, and Dai Fanglan. (Yin Hongzhang was travelling abroad at that time).

The ten agricultural scientists were Qian Chongshu (钱崇澍), Hu Xiansu (胡先骕), Li Xianwen (李先闻), Chen Zhen (陈桢), Luo Zongluo (罗宗洛), Deng Shuqun (邓叔群), Dai Fanglan, Tang Peisong, Yu Dafu, and Yin Hongzhang. Except for Qian, Hu, and Luo, all the rest of these scientists had been supported by the Tsinghua scholarships or worked at Tsinghua IOA.

VI. Conclusions

Although the Tsinghua IOA scientists conducted their works in a turbulent era that seemed very unsuitable for the development of scientific knowledge, they were able to adapt to the chaotic environment of Republican China because of their motivation of the dual-identity of being both Chinese and scientists. Their dual-identity developed in the

distinctive historical context of semi-colonial and decentralized China. The republican era of China (1910s-1949) was characterized by cultural, social, and political tensions such as the tensions between the Chinese and the foreign, between the central government and local situations, and between local and global circumstances. By stressing the dual-identity through their lives and careers, the Tsinghua IOA scientists were able to take proper strategies to relieve these tensions. They not only survived and adapted to the chaotic environment, but also had made remarkable contributions to both their country and the sciences they worked on. Moreover, they developed more advanced scientific knowledge in the local environments and fed the achievements back to their foreign colleagues, and therefore contributed to the global circulation of scientific knowledge.

The history of Tsinghua IOA is an important case study illustrating how the dual-identity of being both Chinese and scientist had enabled Chinese scientists to pursue education in foreign countries, and how these scientists had managed to deal with diverse local conditions and develop in chaotic environment after returning China. The lives and careers of Dai Fanglan and Tang Peisong, two leading Tsinghua IOA scientists in this project, exemplified the dual-identity's influence on the first and the second generations of American-trained Chinese scientists in Republican China. Both of them possessed strong desire to serve their country and people as well as to contribute to the development of science. However, they were facing different circumstances. The identity of being Chinese and scientist played significant roles in the lives and careers of both the older and younger scientists, but in different ways.

The first-generation scientists such as Dai Fanglan usually kept contradictory feelings towards foreign countries. They were active in pursuing useful knowledge and resources from foreign countries in order to serve China. Meanwhile, compared with the younger generation, they were more sensitive to foreigner's superiority and felt humiliated more deeply and frequently, because for the first-generation Chinese scientists, scientific institution in China was extremely underdeveloped, which made it almost impossible for Chinese scientists to have equal academic communication with their western colleagues. Therefore, for the first-generation scientists, serving China and

contributing to science meant similar activities—creating a scientific institution to enable Chinese scientists conducting high-level scientific research and education. These scientists were highly devoted to establishing scientific schools, societies, publications, or building up the foundation of research in certain disciplines, as Dai Fanglan did. Because of these early efforts, the second generation returned to better developed professional institutions during the 1930s and 1940s. They were able to be more concentrated on research and education. In addition to the desire to serve China and Chinese people, these younger scientists were enthusiastic to contribute to international science as well, and their research had covered more diverse topics, both pure and practical.

Tsinghua IOA's establishment and development illustrated the tensions between foreign and Chinese and between central and local. Despite difficulties caused by political changes, these scientists motivated by the dual-identity were able to adopt flexible and proper strategies to adapt to different local conditions and to keep communicating with their international scientific colleagues. They succeeded in keeping their research programs running, training young students, and resolving practical agricultural problems. Although political and social situations required scientists to focus on most useful and practical researches to save China, these scientists kept long-term perspective and balanced pure research and applications in their works, because they believed that pure research with less direct beneficial outcomes would contribute to international scientific research as well as promote China's status in the global scientific community. It was the dual-identity of being both Chinese and scientists that motivated the Tsinghua IOA scientists to take these strategies. The idea "dual-identity" might be applied to the history of other agriculture institutes and schools in Republican China. Moreover, scientists and their sciences can never thrive without connecting and adapting to their historical and local contexts. Therefore, the motivations and strategies of these Tsinghua IOA scientists can help us to understand how scientists acquired, developed, and circulated knowledge in the history of science.

Archives and Online Databases

Archives at the Institute of Zoology, Chinese Academy of Sciences

China Agricultural University Archives

The First Historical Archives of China

Library at the Institute of Botany at the Chinese Academy of Sciences

National Science Libraries at the Chinese Academy of Sciences

Peking University Archives

Reference Library at the Institute of Microbiology at the Chinese Academy of Sciences

The Second Historical Archives of China

Tsinghua University Archives

University of Minnesota Archives

Academia Historica (國史館, http://www.drnh.gov.tw/Default_Chinese.aspx)

Academia Sinica Digital Resources (中央研究院數位典藏資源網, http://digiarch.sinica.edu.tw/en_index.html)

Atlases at the United States Military Academy, http://www.usma.edu/history/SitePages/Our%20Atlases.aspx

China Agricultural University Archives Online Museum, (中国农业大学档案馆百年校史展览, http://www.cau.edu.cn/dag/hmuseum/index.php

Needham Research Institute, Wartime China Photographs Archives, http://www.nri.org.uk/JN_wartime_photos/home.htm

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