The China Study: Three Decades of Transnational Research

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Introduction

In 2006, the publication of the plant-based diet book, *The China Study*, grew quickly in popularity, from afternoon Oprah viewers[1] to former President Bill Clinton, who cited the book as a deciding factor in switching to a vegan diet after undergoing cardiovascular surgery.[2] *The China Study* was an updated Mediterranean Diet,[3] and a geopolitically relevant addendum to Atkins and South Beach,[4] which reflected China's rise to a position of global economic strength at the start of the new millennium. However, what was largely unknown to the American public was that *The China Study*—as presented by Dr. Colin T. Campbell, professor of Nutritional Biochemistry at Cornell University—was built on decades of international research, shaped by collaboration between Chinese and Western institutions. The American public's introduction to *The China Study* came through Campbell's adaptation of the research as an approachable self-help book, rather than as an epidemiological study. Yet, the transnational research that preceded Campbell's book had a far broader scope than diet recommendations; it was rooted in a systematic study of disease, environmental factors, and mortality over multiple decades.

The history of this research was shaped by significant political and institutional changes in China. The transnational collaboration that culminated in *The China Study* began in the 1970s, facilitated by China's communist labor organization infrastructure, internal Communist Party ideological struggle, and the aging and ailing state of the Chinese politburo. The medical advancements made in China in the decades following the 1949 revolution marked a stark decrease in mortality caused by what Dr. Richard Peto describes as preventable "diseases of poverty" and resulting increase toward mortality from "the chronic diseases of middle age."[5] When researchers at Dr. Campbell's Cornell lab first met Dr. Chen Junshi, a professor on sabbatical from China's National Centre for Food Safety Risk Assessment in 1981, they discovered that both Western and Chinese research institutions had independently shifted their focuses toward the role of environmental factors—rather than genetics—in disease and mortality.

The second half of the twentieth century saw public health researchers around the world pivoted toward investigating the environmental and chemical causes of disease. By 1954, *China Study* collaborator Sir Richard Doll had conclusively uncovered the link between smoking and lung cancer in The British Doctor Study. In the 1970s, as a researcher at MIT, Dr. Colin T. Campbell made his first contribution to this paradigm shift with his discovery of the carcinogenic effects of dioxin and aflatoxin.[6] When Dr. Chen Junshi arrived in the US and toured Dr. Campbell's lab, his prior research had already established a link between Keshan Disease and

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[1] Joe Conason, "Bill Clinton Reveals How He Became a Vegan," *AARP*, August 1, 2013, https://www.aarp.org/health/healthy-living/info-08-2013/bill-clinton-vegan.html.

[2] Kathy Freston "Can a Plant Based Diet Cure Cancer?" Oprah, accessed December 4, 2023. https://www.oprah.com/health/can-a-plant-based-diet-cure-cancer/all.

[3]. The Mediterranean Diet, developed by Margaret and Ancel Keys in 1975, was a plant-based diet modeled on the traditional diets of people living in Greece. It was believed to improve cardiovascular health and promote weight loss.

[4] The Atkins Diet, developed by Dr. Robert Atkins, and the South Beach Diet, developed by Dr. Arthur Agatston, were both popular fad diets first introduced in self-help books in 2003. The Atkins Diet emphasized carbohydrate restriction, while the South Beach Diet aimed to limit both "bad" carbohydrates and "bad" fats.

[5] *Chinese Figures,* 1:26.

[6] Colin T Campbell, *The China Study* (Dallas: BenBella Books, 2006) 5.

selenium. At the time of Dr. Chen's visit, Dr. Campbell's lab was also investigating the link between selenium and disease.[7]

For Deng Xiaoping's China, medical collaboration with researchers from Western universities like Cornell and Oxford served the foreign policy goal of expanding China's international role in global public health.[8] At the same time, Western researchers viewed China as an invaluable research site. China's relative geographic, genetic, and dietary homogeneity—alongside the scale at which data could be collected—made it an appealing location for studying the connections between diet and disease. The epidemiological studies that formed the foundation of *The China Study* were originally designed as centralized national data collection projects aimed at understanding the environmental impacts on health outcomes. These ambitious studies gathered extensive data on nutrition, disease patterns, and mortality across diverse Chinese regions. Beyond identifying correlations between environmental factors and disease, these studies also sought to inform public health policies and nutritional guidelines that could mitigate risk of chronic diseases that were on the rise across China.

While Campbell's publication of *The China Study* brought this research to a mass American audience, it fundamentally reframed the scope of the studies that preceded it. Campbell adapted decades of transnational research into a nutritional argument that emphasized a plant-based diet, presenting findings that resonated with American concerns about food, health, and chronic disease. However, in doing so, the broader historical and political context of this research—along with its significance to global epidemiology—was largely overlooked in the book's popular reception. This paper seeks to restore that history by tracing the development of *The China Study* research from its origins in transnational collaboration to its reinvention as a mainstream dietary guide.

Terminology

Throughout this work there will be the discussion of four unique bodies of work, which Dr. Colin T Campbell referred to it synonymously as *The China Study*. Each work examined here was undertaken at a distinct place, in a distinct time, and as such precision in naming is important. So as not to reduce decades of research, primarily conducted in China by Chinese researchers, into the mode of introduction with which English-speaking readers are most familiar, this work will pry apart the four bodies of work into their discrete components.

To begin at the most broad, and the most recent, *The China Study*, italicized as such refers to the 2006 diet guide published by Ben Bella Books, written by Dr. Colin T Campbell. This work is intended for a general audience, namely the American public, and serves as an accessible critique of animal products and their impact on the health of the average American, supported by Dr. Campbell's academic ethos and his research in China. When Dr. Campbell refers to *The China Study* he does not mean this work alone. In Dr. Campbell's words, *The China* Study also refers to the following three works.

The first of these three works chronologically, referred to here as "The Cancer Atlas," is the Atlas of Cancer and Mortality in the People's Republic of China: An Aid for Cancer Control and Research.[9] This body of research was led by Dr. Li Junyao, of the China Academy of

[7] Junshi Chen and Colin T Campbell et al, *Diet, Life-style, and Mortality in China: A Study of the Characteristics of 65 Chinese Counties* Oxford: Oxford University Press, Ithaca: Cornell University Press, Beijing: People's Medical Publishing House, 1990) 840.

[8] Deng Xiaoping was Mao Zedong's successor and leader of the People's Republic of China from 1978 to 1989.

[9] Li Junyao, Liu Boqi, et al. "Atlas of Cancer and Mortality in the People's Republic of China: An Aid for Cancer Control and Research." *International Journal of Epidemiology* 10, no. 2 (June 1981): 127–33.

Medical Science. Research for this project took place between 1973 and 1975, after Premier Zhou Enlai[10] was diagnosed with cancer in 1972.

The second work chronologically is what will be referred to here as "The 1990 Monograph" represents research undertaken in collaboration with Dr. Chen Junshi, Dr. Campbell's Cornell laboratory, and Dr. Richard Peto and Sir Richard Doll, epidemiologists from Oxford University. The data collection for the 1990 Monograph took place in a broad ecological survey of China in 1983 to 1984. The focus of the 1990 monograph is exclusively on rural Chinese populations. The monograph presents these findings in conjunctions with the disease and mortality data gathered in The Cancer Atlas, introduced above.

The final work to introduce is the 2006 Monograph. This is a resurvey of the 1990 Monograph using many of the same data points and experimental design found in the 1983-1984 ecological survey. The 2006 Monograph still primarily focused on rural Chinese populations but also sought to survey a subset of urban Chinese populations, as well as a number of populations in Taiwan. Though this monograph was published around the same time as Dr. Campbell's book *The China Study,* the resurvey which updated the data collection from the 1983-1984 ecological survey, as well as the 1973-1975 Cancer Atlas, was conducted in 1989. Though Dr. Campbell is listed as a coauthor on this work, this project was led primarily by Dr. Chen Junshi of China National Centre for Food Safety Risk Assessment and Dr. Richard Peto of Oxford University.

Sudden Changes: A Primer on Chinese History of the 1960s - 1980s

Dr. Campbell recounts his impression of China in a 1990 documentary film *Chinese Figures*, saying, "[f]or the Chinese… life does not gradually change over the centuries. Either it stays the same, or it changes very suddenly. History shows us that a peoples' way of life, the nature of their diet, their environment, and ultimately their diseases and deaths, evolves in the same manner as their country's political character."[11] The period in history in which *The China Study* began was host to political and geopolitical change for China. Throughout the late 1960s China was at risk of imminent war with the Soviet Union and embroiled in the internal strife brought by the Cultural Revolution. In 1969, Mao declared the Cultural Revolution a victory. For academics especially, the Cultural Revolution was not a safe time for intellectual freedom. Research that did not align with Party values could be deemed counterrevolutionary and halted, and researchers punished or killed by youth red guards for their participation. Author Dr. Chen Junshi told his colleague, Martin Root in Dr. Campbell's lab at Cornell that he had no interest in reading George Orwell's book *1984* after living through it in the Cultural Revolution.[12]

During this period the relationship between the United States and China was also changing. According to Rebecca Karl, diplomatic opening between China and the US happened on Mao's initiative.[13] In December 1970, almost six months prior to "ping-pong diplomacy,"[14]

[10] Zhou Enlai was a Chinese statesman and a close political ally of Mao Zedong. He served as the premier of the People's Republic of China from its founding in 1949 until his death in 1976.
[11] *Chinese Figures*, (1990; Cornell), video, 1:21.
[12] Martin Root, "China Project History Part 1: A Personal Story," *T. Colin Campbell Center for Nutrition Studies*, originally published July 17, 2015, last updated January 7, 2019, accessed September 25, 2023, https://nutritionstudies.org/china-project-history-part-1-a-personal-story/.
[13] Rebecca Karl, *Mao Zedong and China in the Twentieth-Century World: A Concise History* (Durham, NC: Duke University Press, 2010), 144.
[14] At the 1971 Nagoya Table Tennis World Championships, American player Glenn Cowan exchanged gifts and wishes for peace with Zhuang Zedong, China's three-time world champion. This symbolic gesture led to an official invitation for the U.S. team to visit China in April 1971, marking the first official American delegation to enter the

Mao asked American Journalist and personal friend Edgar Snow, his liaison to the US, to arrange a meeting with President Richard Nixon.[15] The Soviet Union, under Leonid Brezhnev,[16] was also in talks with the Nixon administration, trying to leverage US containment policy against China, by providing intelligence that they hoped would lead to US strikes on nuclear weapons installations within China.[17] The Nixon Administration resisted the Soviets' attempt to strong arm the US into their own foreign policy goals, and in 1971 National Security Advisor Henry Kissinger[18] instead made his, now well known, secret visit to China, followed by a visit from Nixon himself in 1972. Following Kissinger's visit, in late 1971, the Guomindang's Republic of China on the Island of Taiwan was expelled from the United Nations, and the People's Republic of China was given its place on the UN Permanent Council.[19]

Since 1970, Mao had struggled with his health, which continued to worsen. In 1972, as Mao worsened, Premier Zhou Enlai was also diagnosed with cancer. Jiang Qing,[20] Mao's wife opposed Zhou Enlai and Mao's handpicked successor Deng Xiaoping. Jiang's campaign against the "rightist" Deng, ultimately resulted in her and the rest of the Gang of Four's end.[21] Despite the downfall of the Gang of Four, the climate of internal party friction and the political terror of the Cultural Revolution overshadowed these years.[22]

In 1976 both Mao and Zhou succumbed to their ailments alongside many other members of the old guard communists and revolutionaries who did the long march to Yan'an. Despite internal tensions within the party, these years also marked the beginning of a period of more robust diplomatic relations with the United States and with the rest of the rest of the international community. Though by the late 1970s, the legacy of the Cultural Revolution had yet to be forgotten, opportunities for academics were once again opening up. During this time academics enjoyed greater freedom to publish and also to travel, but Dr. Chen recounts to Cornell documentarians in 1990, "Only by this sort of collaboration [with researchers from Cornell and

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country since 1949. The event, later known as Ping-Pong Diplomacy, helped thaw U.S.-China relations and paved the way for President Nixon's 1972 state visit.

[15] Karl, *Mao Zedong and China*, 144.

[16] Leonid Brezhnev, opponent and successor to Nikita Kruschev, served as General Secretary of the Communist Party of the Soviet Union from 1964 until his death in 1982.

[17] Karl, *Mao Zedong and China*, 145.

[18] Henry Kissenger, national security advisor to President Nixon from 1969 to 1975, was later propelled by his successes in China to the role of US Secretary of State from 1973 to 1977, serving both President Nixon and President Ford.

[19] After retreating to Taiwan in 1949 following the Chinese Civil War, the Guomindang (also romanized as Kuomintang/KMT)-led Republic of China (ROC) government, under Generalissimo Chiang Kai-shek, continued to claim sovereignty over all of China, including the mainland. From Taiwan, the ROC asserted itself as the legitimate government of China, maintaining its seat at the United Nations until 1971, when it was replaced by the People's Republic of China.

[20] Jiang Qing, Mao Zedong's wife, wielded significant influence over China's cultural and propaganda policies, particularly during the Cultural Revolution (1966–1976). She led the Central Cultural Revolution Group, overseeing state-sanctioned media, literature, and theater, and played a central role in political purges. As a key figure in the Cultural Revolution, she helped shape the ideological messaging of the Chinese Communist Party and promoted Maoist revolutionary culture before being arrested in 1976 as part of the Gang of Four.

[21] The Gang of Four was a political faction within the Chinese Communist Party (CCP), led by Jiang Qing, Zhang Chunqiao, Yao Wenyuan, and Wang Hongwen. The group wielded significant influence during the Cultural Revolution, controlling propaganda, cultural policy, and political purges. After Mao's death in 1976, the Gang of Four was arrested and blamed for the excesses of the Cultural Revolution, marking the end of the movement. They were later convicted of counter-revolutionary crimes in a 1981 trial, with Jiang Qing receiving a death sentence that was later commuted to life imprisonment.

[22] Karl, *Mao Zedong and China*, 156.

Oxford] can we have the best use of resources in China, for example. That's the field survey, and have the best use of the resources in Cornell for example. They have the assay center of coordination and the center of communication, so we can easily get access to the outside world, which in China, that's too difficult. We cannot say impossible, but it's too difficult."[23]

The Cancer Atlas

In 1972, Premier Zhou Enlai was diagnosed with lung cancer, which took his life in January of 1976 at the age of 78. In 1973, after his initial diagnosis, Zhou's government launched a nationwide survey which took information from 850 million people in 2,400 cities--96 per cent of China's population at the time of the survey.[24] The survey is referred to here as The Cancer Atlas, after its original English Language title in Oxford University's 1981 International Journal of Epidemiology, "Atlas of Cancer and Mortality in the People's Republic of China: An Aid For Cancer Control and Research."[25] China's National Office of Cancer Control and Research supervised the survey on a national level, while smaller supervisory subgroups were assigned to collect information and diagnosis at the regional level.[26] Based on the Cancer Atlas' findings, Dr. Campbell recreated a sample atlas in *The China Study*, in which the darker colors represented higher cancer rates.[27]

Around this period, in the late 1970s to early 1980s, US based researchers were also independently concluding that cancer was largely determined by environmental factors rather than genetics.[28] When compared with countries like the US and UK, China was relatively genetically homogenous, yet cancer rates varied as much as 10,000% between counties.[29] At the time of the survey, cancer was the second leading cause of death for Chinese men, and the third for women.[30] The mapping done by The Cancer Atlas provided a comprehensive snapshot of the majority of China's population via mortality rates and which appealed to western researchers as a control sample against the comparative genetic heterogeneity found in the US and UK. The survey enlisted 650,000 surveyors and researchers conducting biomedical research on a scale previously unseen.[31] This likely proved very exciting for Campbell's team, who prior to Chen's visit had not heard of any research in their field being done by Chinese researchers according to Dr. Root.[32] The study indicated significant variation in cancer types across counties, suggesting that environmental factors played a greater role than genetics.[33] In 1981, after the Cancer Atlas'

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[23] *Chinese Figures,* 3:38.
[24] Junshi Chen and Colin T Campbell et al, *Diet, Life-style, and Mortality in China: A Study of the Characteristics of 65 Chinese Counties* Oxford: Oxford University Press, Ithaca: Cornell University Press, Beijing: People's Medical Publishing House, 1990) 4.
[25] Li Junyao and Liu Boqi et al, "Atlas of Cancer and Mortality in the People's Republic of China: An Aid For Cancer Control and Research." *International Journal of Epidemiology*, 10, no 2. (June 1981). 127-133.
[26] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 4.
[27] Campbell, *The China Study* (Dallas: BenBella Books, 2006) 70.
[28]Campbell, *The China Study* (Dallas: BenBella Books, 2006), p. 70. Campbell references Richard Doll and Richard Peto, "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today," *Journal of the National Cancer Institute* 58, no. 4 (January 1981): 1192–1265; and Ernst L. Wynder and Gio B. Gori, "Contribution of the Environment to Cancer Incidence: An Epidemiologic Exercise," *Journal of the National Cancer Institute* 58, no. 4 (April 1977): 825–832.
[29] Campbell, *The China Study*, 72.
[30] Li, Liu, et al., "Atlas of Cancer and Mortality," 129.
[31] Campbell, *The China Study*, 69-70.
[32] Martin Root, "China Project History Part 1."
[33] Campbell, *The China Study*, 70.

publication internationally, principal investigator, Li Junyao, was invited by the National Institute of Health (NIH) to visit Washington DC.[34]

The Public Health Legacy of the Deng Xiaoping Era

In May of 1973 shortly before Mao's handpicked successor Zhou Enlai was hospitalized, Mao also ailing, politically rehabilitated the once-disgraced revolutionary leader Deng Xiaoping. Deng had spent the prior seven years at a tractor factory in Jiangxi for his associations with Liu Shaoqi, another disgraced revolutionary statesman, and the chosen successor to Mao in the Great Leap Forward era through the Cultural Revolution.[35] Zhou Enlai also gave his endorsement to the transfer of power to Deng Xiaoping at his final public speech in January 1975, outlining the roadmap of China's future as a task of "modernization 'of agriculture, industry, national defense, science and technology'" in a platform that came to be known during the Deng era as "the four modernizations."[36]

In 1978 a fifth modernization was appended to the "four modernizations" by a former red guard who hung a poster outside the Gate of Heavenly Peace in Beijing, exclaiming that Deng would "democratize" society. Many similar posters soon joined the wall.[37] Though the posters were outlawed and Deng's party sought greater centralization of power and political voice as a result of the poster wall movement, the posters illustrated that the period of political normalization post Cultural Revolution was inherently tied to the "four modernizations."

Chinese political participation shifted lenses from internal to international. As the People's Republic of China saw itself admitted to the United Nations, China's participation in global health experienced what Liu and Guo et al fittingly describe as "a shift from economic development serving foreign policy to foreign policy serving economic development."[38]

The World Health Organization, Global Health, and the Promise of Primary Health Care

"Foreign policy serving economic development" was a theme internationally as member states came to appreciate the role of soft power projects in international organizing bodies. The World Health Organization (WHO) especially, through the more politically neutral lens of what at the time was termed "international health" became a geopolitical tool for UN member states.[39] When the Soviet Union left the UN in 1949, the United States took this opportunity to use the WHO as a vehicle for US international projects.[40] Theodore Brown writes, "During the 1960s and 1970s, changes in WHO were significantly influenced by a political context marked by the emergence of decolonized African nations, the spread of nationalist and socialist movements, and new theories of development that emphasized long-term socioeconomic growth rather than short-term technological intervention." By 1956, the Soviet Union had rejoined the UN, and in

[34] Martin Root, "China Project History Part 2: Serendipity of a Study," *T. Colin Campbell Center for Nutrition Studies*, originally published August 14, 2015, last updated January 7, 2019, accessed October 18, 2023, https://nutritionstudies.org/china-project-history-part-2-serendipity-of-a-study/.
[35] Karl, *Mao Zedong and China*, 154.
[36] Karl, *Mao Zedong and China*, 154.
[37] Karl, *Mao Zedong and China*, 163.
[38] Peilong Liu, Yan Guo, Lincoln Chen, et al., "China's Distinctive Engagement in Global Health," *The Lancet* 384 (August 2014): 793–804.
[39] Theodore M. Brown, Marcos Cueto, and Elizabeth Fee, "Public Health Then and Now: The World Health Organization Transition from 'International' to 'Global' Public Health," *American Journal of Public Health* 96, no. 1 (January 2006): 62–72.
[40] Brown, Cueto, and Fee, "Public Health Then and Now," 65.

1968 requested the organization's assistance in conducting a study on the development of their national health services.[41]

When the People's Republic of China unseated the Taiwan's Republic of China Government in the Chinese seat for the UN permanent council in 1971, the Chinese medical "frontier" became a topic of international interest alongside the "barefoot doctors," rural residents trained in basic medicine in locations too remote to attract more skilled medical professionals. [42] While barefoot doctors were in fact transforming rural healthcare, they were one part of a larger public health picture in China. A number of Chinese Medical Universities were established after the founding of the PRC in 1949, and in the decades following the revolution. The three decades after the founding of the People's Republic in 1949 witnessed some of the steepest advances of mortality control in human history.[43]In the case of the 1973 mortality survey and Cancer Atlas, barefoot doctors were able to provide crucial information on the number of deaths in between 1973-1975 to researchers at these newly established medical research institutions.[44] Because of barefoot doctors, despite the high possibility of misdiagnosis of cancer types in the cancer atlas in more rural areas due to lack of specialized medical training, the death counts reported by the cancer atlas are thought to be highly accurate.[45]

The rural primary health care provided by barefoot doctors was a crucial component to larger scale, national public health campaigns. The centralization of the PRC government allowed for these public health campaigns to be conducted on a scale that would have proven difficult for other UN member countries like the US and UK. When China opened itself up to WHO collaboration, during the WHO push toward "primary health care" in the 1970s, "barefoot doctors" were of particular interest at the time because of their role in providing a novel model for primary health care. The move toward a primary healthcare model of global public health, strangely came about as a result of pressure applied by the Soviet Union's delegate to the WHO.

Inception of Collaboration for the 1983-1983 Ecological Survey

Principal Chinese researcher, Chen Junshi, visited Colin Campbell's Laboratory at Cornell University for a period of six months, while on sabbatical from his position at the Chinese Academy of Preventative Medicine. Dr. Chen's visit spanned the winter of 1980-81, during which time both he and Dr. Campbell were studying the role of selenium in nutrition.[46] According to Martin Root, Chen Junshi was on a World Health Organization research fellowship when Campbell's lab received a letter from him indicating that he was looking for a position in their lab because of their shared research interests.[47] Root elaborates that in 1981 Chinese researchers in the United States were very unusual, and that American researchers in their field had little to no contact with Chinese researchers.[48] Chen, who had been an academic in Medical sciences during the Cultural Revolution, spent his time exiled to rural China studying Keshan disease, a heart disease endemic to parts of China that had recently been linked to selenium

[41] Brown, Cueto, and Fee, "Public Health Then and Now," 66.
[42] Brown, Cueto, and Fee, "Public Health Then and Now," 66.
[43] Liu, Guo, et al., "China's Distinctive Engagement in Global Health," 799.
[44] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 4.
[45] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 2.
[46] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 840.
[47] Martin Root, "China Project History Part 1: A Personal Story" Colin T Campbell Center for Nutrition Studies Website. Written July 17, 2015, Updated January 7, 2019. Accessed September 25, 2023.
[48] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.

deficiency.[49] Campbell's lab at Cornell was researching the effects of various nutrients in the development of cancers, one of which was selenium.[50]

The Cancer Atlas, under the Zhou Enlai administration, surveyed 96% of the citizens in more than 2,300 Chinese counties, according to the 1990 monograph,[51] or somewhere 2,400 according to Campbell.[52] Martin Root, from Campbell's team at Cornell, expressed his team's excitement after hearing about Dr. Chen's research. He conveys that prior to Chen's visit the team at Cornell had not had any familiarity with work being done by Chinese researchers.[53] The Cancer Atlas indicated that cancer types varied widely by county and suggested environmental rather than genetic causes for cancer.[54] Chen and Campbell reasoned during Chen's visit to Dr. Colin T Campbell's lab at Cornell, that these discrepancies may have been due to a wide variety in dietary intake of selenium by county.[55] This collaboration between Chen and Campbell on the topic of selenium in cancer formation expanded when, in 1981, Cancer Atlas principal investigator Li Junyao visited the NIH headquarters in Washington, D.C., providing an opportunity for Chen to arrange a visit to Cornell to discuss the findings in greater depth.[56]

During this period Richard Peto, of Oxford University also became associated with the project.[57] In 1982 the NIH received a grant application from the project group formed to continue the survey work begun by Dr. Li's Cancer Atlas project; in June 1982 a site visit was conducted, and in May 1983 the grant was awarded.[58] The survey on cancer causation and selenium took place in the fall of 1983; this survey included a modest attempt to study a small selection of other nutrients.[59] This survey only increased questions about nutrition and cancer, which culminated in the 1990 monograph.[60]

Biostatistics in the NIH

Between the 1940s to the late 1960s, the key shifts in the managerial climate at the NIH favored a shift in agency funding toward what National Heart Institute director Donald Fredrickson in 1968 called, "the benevolent tyranny of biostatistics."[61] The NIH funding granted to Campbell's group at Cornell enabled collaboration beginning in the 1990s and facilitated continued support for the 2006 follow up survey.[62] This funding can be viewed in part as a result of this paradigm shift which took place at the NIH in decades prior to the initial collaboration between Dr. Chen and Dr. Campbell.

In 1975 Donald Fredrickson was appointed as director to the NIH, where he remained until 1981, the year that Dr. Li Junyao, principal investigator on The Cancer Atlas, was invited to Washington to visit the NIH at the same time as Dr. Chen Junshi's visit to Dr. Campbell's lab at

[49] Martin Root, "China Project History Part 1.
[50] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[51] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[52] Campbell, *The China Study,* 70.
[53] Martin Root, "China Project History Part 1.
[54] Campbell, *The China Study*, 70.
[55] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[56] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[57] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[58] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[59] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[60] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 804.
[61] Sejal Patel. "The Benevolent Tyranny of Biostatistics: Public Administration and the Promotion of Biostatistics at the National Institutes of Health, 1946-1970." *Bulletin of the History of Medicine* 87 (2013). 622-623.
[62] Campbell, *The China Study*, 366.

Cornell.[63] Donaldson's NIH had manifested its interest in biostatistics in examining the chemical and environmental causes of disease. In the 1960s the NIH was particularly interested in funding research on the environmental causes of cancer, and Dr. Li's Cancer Atlas aligned closely with this institutional goal.[64] The shift in the NIH was driven by the recognition that studying chronic diseases, in which large population samples and long follow up periods are key components of experimental design, could be more appropriately studied with the use of statistical methods.[65]

Some of the most impressive features of *The China Study* are the large sample population of chronic disease mortality and the follow-up surveys. The NIH's willingness to provide funding to such a project clearly aligned with the organizational goal of promoting biostatistical research of long term and chronic illness. The 1990 and 2006 Monographs are above anything a huge data source from which epidemiologists may draw. The monographs do not present a formal set of conclusions alongside their presentation of results. The robust and varied data set alone is worth publication.

Molecular biologist and public health advocate, Marion Nestle says, "A study of this size and complexity could only be done in a population as large, geographically stable, dependent on the local food supply, and well monitored as that of China."[66] While the 1990 monograph was able to present over 100,000 correlations between biochemical, diet, environmental, and disease markers. Dr. Chen, notes that China's large rural population also made this possible. He wrote "We want to find out what kind of diet and lifestyle characteristics related to disease mortality, so we want the lifestyle and diet to be as simple as possible, and also there will be no interference from the other risk factors like air pollution or other chemicals, because in the rural area the Chinese farmers lived in a very simplified diet, and all the foods are produced in the local lands."[67]

1990 Monograph: Experimental Design and Data Sources

The introduction to the 1990 Monograph contains a statement echoed in some way or another by everyone involved with the project: "Rural China is extremely heterogeneous…The chief purpose of the present monograph is simply to describe that heterogeneity, by studying 65 rural counties and providing for each of them information on about 367 characteristics."[68] This is a statement that is echoed by all the principal researchers from each country in the film *Chinese Figures*. The 1990 Monograph uses three main sources of data for analysis: the 1973 mortality survey, the 1983 ecological survey, which included blood collection, urine collection and a subsequent urine nitrosamine analysis conducted in 1984, and the three-day household diet survey, and questionnaires.

The mortality survey was drawn from the 1973 Cancer Atlas.[69] According to World Bank data presented by Dr. Campbell in *The China Study*, the age of the Cancer Atlas mortality findings was not a problem for rural areas in China, in which economic and dietary conditions

[63] Root, "China Project History Part 2"
[64] Campbell, *The China Study*, 22.
[65] Patel, "Benevolent Tyranny" 626.
[66] Marion Nestle, "Review: Epidemiologists Paradise: Diet, Life-Style, and Mortality in China: A Study of the Characteristics of 65 Chinese Counties by Chen Junshi, T. Colin Campbell, Li Junyao, Richard Peto." BioScience 41, 10. (November 1991). 725-726.
[67] *Chinese Figures,* 8:26.
[68] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 1.
[69] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 4.

had remained largely the same in the decade after the mortality survey had been conducted.[70] The Cancer Atlas described mortality rates and causes of death in its large sample of roughly 96% of the Chinese population. Chen et al utilized the Cancer Atlas mortality survey data, limiting their inquiry into deaths before the age of 65 in order to capture chronic diseases with possible environmental causes, rather than death from natural causes in old age.[71] Chen et al, noted that for some causes of death in which diagnosis is straightforward, the data from the Cancer Atlas should be reliable, but for other more complicated diagnoses, "large errors may exist that will differ systematically" based on technology and expertise available to the diagnosing hospital at the time of diagnosis.[72]

The ecological survey drew from a survey of 65 Chinese counties collected in the autumn of 1983.[73] The ecological survey sampled 13,000 people across 65 counties, 6,500 of which gave blood samples to researchers.[74] Production brigades, also known as *danwei*, were an organizational feature of Chinese communist society that enabled such broad scale survey success. The surveying of the 65 counties was broken down administratively into two selected "communes" for a total of 130 communes, subdivided into one production brigade per county for 130 total production brigades, and two production teams in each of the 130 production brigades for a total of 260 production teams.[75] Selection of communes surveyed was random, with the stipulation that all communes surveyed must were within four hours travel time of a survey station.[76] Within each production team 25 households were selected, from which one male or female was asked to give blood and complete more detailed questionnaires.[77]

Dr. Campbell noted that for cultural reasons, getting blood donations proved to be challenging.[78] Researchers obtained blood samples from one person in each of the 25 selected households in each of the 260 production teams.[79] If the person who was initially randomly selected for blood donation was absent or unwilling, which Chen at al note happened less than 1% of the time, another subject from one of the other 25 households in the production team was then selected.[80] Blood samples were shipped to the Institute of Nutrition and Food Hygiene in Beijing, which Dr. Chen was deputy director of at the time, where samples of the same sex, same age range, and same commune were pooled into a combined batch, which yielded a total of 8,580 portions in December of 1983.[81] The blood pooling method was a contribution from Oxford University researcher, and author Richard Peto.[82]

In February 1984, a number of samples from each pool were sent to Cornell University for further assay, where they were broken into smaller portions for assay and distribution to a number of other labs at various universities outside of China. Urine collection functioned similarly, with donations collected from 3,318 initial participants, which resulted in a total of 384

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[70] Campbell, *The China Study*, 70.
[71] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 2
[72] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 3.
[73] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 6.
[74] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 7.
[75] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 8.
[76] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 8.
[77] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 8-9.
[78] Campbell, *The China Study*, 355.
[79] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 9.
[80] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 9.
[81] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 9.
[82] Martin Root, "China Project History Part 3: An Unprecedented Collaboration," *Colin T. Campbell Center for Nutrition Studies* website, written July 17, 2015, updated January 7, 2019, accessed August 15, 2024.

age and sex specific pooled samples.[83] Notably only some urine donors participated in the nitrosamine study, which occurred in 1984, one year after the original ecological survey.[84] As many of the original subjects as possible were resurveyed, but where original subjects were not available, their neighbors were substituted.[85]

Initially, food samples were collected only for estimation of fiber intake.[86] Crude protein, carbohydrates, heavy metals, nutrient minerals, and various pesticide residues were also analyzed in these samples.[87] In each of the 65 counties 30 households were selected for the three-day food intake survey.[88] Each surveyor recorded food consumption in 4-6 households for three consecutive days.[89] Surveying practices were drawn from a 1982 survey of dietary practices in 230 counties.[90] The number of people present at each meal was recorded, as well as the presence of any pregnant or lactating women, while records for children below two years of age were excluded.[91] All raw and processed foods after the last meal of each of the three days were recorded and weighed, and foods purchased during the three day period were quantitatively recorded.[92]

The 65 counties across which the surveys were conducted required a multilingual survey team. There are over three hundred languages spoken in China, and rural areas especially required translation in minority languages other than Mandarin. The documentary, *Chinese Figures* demonstrated the process of surveying participants in inner Mongolia, which required the presence of both a surveyor and a translator to convey the surveyor's Mandarin questions in Mongolian.[93]

2006 Monograph: Experimental Design, Data Analysis Methodology, and Results

The 2006 monograph surveyed the residents of 69 Chinese rural counties, and 16 Taiwanese survey areas. In the initial survey presented in the 1990 monograph, counties were surveyed on the basis of commune and production brigade also known as *danwei*, but by 1989, due to reforms of the Deng Xiaoping regime, the *danwei* system was a relic of the past. The survey units were no longer organized along *danwei*, and as such the 2006 Monograph referred to administrative areas previously labeled "communes" as *xiang*,[94] and the production brigades, which for the most part followed natural villages, as "villages" likely referring to the

[83] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 10.
[84] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 18.
[85] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 18.
[86] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 10.
[87] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 10-11.
[88] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 16.
[89] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 16.
[90] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 16.
[91] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 16.
[92] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 16.
[93] *Chinese Figures,* 23:46.
[94] *Xiang* (乡) refers to a township-level administrative division in China's rural governance structure, positioned below the county (xian, 县) level but above the village (cun, 村) level. During the Mao era, *xiang* functioned as an integral part of the *danwei* system, coordinating agricultural production and resource distribution. After the economic reforms of the Deng era and the dissolution of the People's Communes, *xiang* continued to be a meaningful unit of local government, public services, and economic development.

administrative unit, *cun*.[95] The same geographical areas matching the *xiang* boundaries that were studied in the 1983 survey, were again studied for the 1989 survey, as well as of four additional counties that the 1983 survey had originally selected, but had been unable to survey.[96]

Like the 1990 Monograph, the 2006 Monograph contained data from mortality surveys, blood sampling, urine sampling and nitrosamine analysis, three-day dietary surveys, and environmental questionnaires. A total of 8,307 people were interviewed from 7,888 households, and a total of 4,140 households completed the dietary survey. The 1989 resurvey provided a chance for researchers to polish methodologies used in the original surveys. The main point of variation in ecological methods between 1983 and 1986 is that nitrosamine analysis was done on all urine donors at the same time as the initial urine donation.[97] The 2006 monograph does not indicate the use of the urine pooling method. Urine samples from the 1989 resurvey, were also sent to the WHO International Agency for Research on Cancer in Lyon, France, further integrating the international public health community's participation in analysis of the findings.[98]

The 2006 monograph utilized two sources for mortality data. The Cancer Atlas mortality survey from 1973-1975 was used alongside a 1989 resurvey of mortality rates and causes by county and a separate 1986-1988 survey of urban deaths done for other purposes.[99] The 1989 retrospective survey used village or administrative records and WHO standardized death certificate codes to categorize what authors estimate was roughly 90% of all deaths that occurred in 67 of the 69 selected counties (two counties did not have the necessary records available).[100] The 1983 survey by this account had more comprehensive mortality data, made available by the centralized efforts of the PRC in the wake of Zhou Enlai's cancer diagnosis, while the 1986 survey had more recent data available, albeit from far fewer data points.

The 2006 Monograph was also able to undertake a smaller scale survey of 16 counties in Taiwan in cooperation with Taiwanese National University, Academia Sinica.[101] Taiwan was not included in the Cancer Atlas mortality survey conducted in the PRC in 1973-1975, so between 1986-1988 a mortality survey was conducted retroactively through the review of death certificates and census data.[102] In Taiwan survey areas were separated by postal code.[103] Areas were chosen to vary in population density, socioeconomic status, ethnicity (Hakka, Han, and aboriginal Taiwanese), crude cancer mortality rates, and geographic location.[104]

The 2006 Monograph described the desired use of the results data similarly to the 1990 monograph, saying, "The chief purpose of this study is to describe the wide range of differences among counties… rather than to analyse these differences in search of direct evidence of causes."[105]

Data Analysis Methodology and Results

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[95] Junshi Chen, Richard Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle in Rural China: Geographic Study of the Characteristics of 69 Counties in Mainland China and 16 Areas in Taiwan* (Oxford: Oxford University Press, 2006), 7.
[96] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 6.
[97] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 11.
[98] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 11.
[99] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 3.
[100] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 9.
[101] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 6.
[102] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 10.
[103] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 10.
[104] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 7.
[105] Chen, Peto, et al., *Mortality, Biochemistry, Diet and Lifestyle*, 1.

The authors of both the 1990 and 2006 Monographs openly acknowledge that their data collection methodology and experimental design do not allow for causal conclusions. The 1990 Monograph authors are very clear that their research at most can establish correlational relationships between factors surveyed. They also note that "correlations cannot, therefore be considered in isolation from other evidence from other sources as to which are likely to be considered artefacts of chance or confounding" continuing to say, "the major task is to determine which of the very large number of statistically significant associations result from the play of chance and which are biologically possible."[106]

The methodology of the study is to compare every single variable to every other single variable surveyed. The results include over 100,000 univariate comparisons, 20% of which were found to be "conventionally significant."[107] However, statistical significance does not imply biological significance. A correlation that is statistically significant may have no meaningful biological impact, while a biologically important relationship may not meet conventional statistical thresholds due to sample variability or other factors. The authors, preeminent researchers on a NIH grant in the era that saw an institutional shift toward biostatistics methodologies, were well aware of the limitations of their work with Chinese institutions. National scale data collection in the "last medical frontier" was the point, and perhaps through collection and discovery of statistical significance among variables measured. They expressed their hopes to continue to work with Chinese institutions into the future. Chen and Campbell recommended in the 1990 monograph, using the statistically significant univariate correlations as a starting point for selecting specific counties with unusual characteristics for deeper study, thus expressing hope for continued collaboration.[108]

Because of any lack of prior biomedical research relationships between Chinese and Western institutions, and possibly also because of China's political turmoil during the period of surveying, it is also possible that researchers sought to gather as many correlatable variables as possible, because of the uncertainty of future research access. Recalling Dr. Chen Junshi's comment in *Chinese Figures*, "[Cornell has] the assay center of coordination and the center of communication, so we can easily get access to the outside world, which in China, that's too difficult. We cannot say impossible, but it's too difficult."[109] The concerns about political volatility appeared to be mutually held by both western and Chinese research teams alongside the hope for future research collaboration.

Conclusions: Success in International Research Collaboration and National Bestseller

To return to *The China Study*, the American diet self-help best-seller, it is helpful to ask why Dr. Campbell has framed his diet advice to the American public in terms of the correlational surveying done in the preceding monographs. The 1990 Monograph, as well as the 2006 Monograph resurvey, are both very clearly presented as correlational survey data. Epidemiologists, and those familiar with statistics are capable of understanding the limitations of these findings, but this is not true for less technically inclined readers. The target audience for author Dr. Campbell's book, *The China Study*, was not epidemiologists or biostatisticians, it was the American public.[110]

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[106] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 42.
[107] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 42.
[108] Chen, Campbell, et al., *Diet, Life-Style and Mortality in China*, 42.
[109] *Chinese Figures,* 3:38.
[110] Campbell, *The China Study*, 1.

In the Appendices of *The China Study*, Dr. Campbell endeavors to explain the research and its unorthodox methodology. He says "[because this survey] was a one-of-a-kind opportunity, we intended that it be the best of its kind ever undertaken. It was comprehensive; it was high quality; and its uniqueness allowed new opportunities to investigate diet and disease that were never before possible.[111] Campbell repeatedly stresses that this study opened the door to new opportunities in international research, and opened the door to China, a genetically homogenous country with massive variation ecologically and dietarily, echoing Sir Richard Doll's "last medical frontier" sentiment.[112]

Diverging from the title, and the claims of the robust research in China, the majority of the research presented in *The China Study* is in fact research that occurred after the Chinese survey projects. Campbell expands upon limitations of the survey data, saying "I could not, and did not, rest on the findings of… the massive human study in China, however impressive they may have been. I sought out the findings of other researchers and clinicians."[113] The research Dr. Campbell sought out to present in *The China Study* is primarily research that takes place in the United States.

Though the research itself that backs Dr. Campbell's central plant-based diet claims in *The China Study* was undertaken by American researchers, on American subjects, there is a clear reason he refers to this body of work as *The China Study*. Much like ping-pong diplomacy, *The China Study* is a story of science diplomacy. China provided Dr. Campbell's project with the opportunity to observe what he views to be the underlying trends for individuals who consume limited amounts of animal protein. Furthermore, Chinese institutions provided the vast majority of the funding and labor for the research in the 1980s. Campbell writes, "Although the U.S. National Cancer Institute (NCI) and the National Institutes of Health (NIH) provided the initial funding for this project, the Chinese Ministry of Health paid the salaries of the approximately 350 health workers. It is my estimate that the Chinese contribution to the project was approximately $5-6 million over a ten-year period. This compares with the U.S. contribution of about $2.9 million over a ten-year period. Were the U.S. government to have paid for this service in a similar project in the U.S., it would have cost at least ten times this amount, or $50-60 million."[114]

There may yet be another reason for *The China Study* being named such. Dr. Campbell positions his book, as well as his life's work as a body of research in opposition to the US food industry and its lobbying power. Campbell began his career working on projects devoted to advancing animal science and food industry interests. Campbell arguably used the ethos of Chinese researchers and of the Chinese people, far removed, at least at the time of the original surveying from the interests of the American food industry, as a way to substantiate his observations in the United States.[115]

The decades of transnational research, of which Dr. Campbell was an integral part, did not have to succeed by way of its magnitude and ambition. In fact, there was a very real chance of its failure as a research project and an international relations project. A similar project in international science collaboration is explored by Michael Lewis in his writing on Project Tiger, a conservation biology collaboration between the United States and India. Lewis writes,

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[111] Campbell. *The China Study*. 355-356.
[112] *Chinese Figures,* 4:07.
[113] Campbell. *The China Study*. 7.
[114] Campbell, *The China Study*, 359.
[115] Campbell, *The China Study*, 4.

> "Ultimately, the story of Project Tiger is useful in understanding the limitations of conservation biology. This science is practiced and applied not in laboratories but in a world laden with power differentials between governments, between institutions, and between people."[116]

Project Tiger, which occurred during the same period as the collaborative survey projects in China, was ultimately characterized by an oppositional relationship between US conservation biologists and the Indian Government, and the success of the project was impeded by the political tensions of the period.

The three decades of collaboration between western biomedical researchers and newly founded Chinese Medical Colleges could easily have taken a similar course, but what stood to be gained by researchers from China and the West was too great to risk. Chinese institutions maintained authority over the portions of the project undertaken in China, and communist infrastructure seen in *danwei* became a resource rather than a hindrance despite the wide chasm between political ideologies of China and the West. As such, research relationships between Chinese institutions and Western universities were able to flourish over the decades.

Western researchers like Doll, Peto and Campbell, saw China as a resource not in spite of its political situation but because of it. The relative isolation of rural areas in a rapidly globalizing world, among a relatively ethnically homogeneous population was an exciting and unique case to Western epidemiologists, one they could not access anywhere but China. Rather than approach with friction toward the limitation of China's political system and research institutions, these features were resources. Chinese researchers also sought access to resources such as assay centers and testing methods only available outside of China at the time. By 2006 even more parties from an even greater number of countries were involved, and researchers at both mainland Chinese institutions, and at Academia Sinica in Taiwan were working toward common epidemiological understanding.

In light of the depth of research done in this project, Dr. Campbell's popular book, *The China Study*, being pigeonholed in the public conscience as plant-based diet pop-science, abandons a rich history beginning decades ago when the old guard Chinese leaders began to succumb to diseases of old age. The scale of projects done to survey the PRC to find answers for ailments faced by leaders like Zhou Enlai and Mao Zedong have made an unmistakable contribution to international epidemiological research. This contribution was made possible by Deng era internationalism, and by the transnational research relationships forged in the 1980s by a handful of individual researchers who over the decades maintained a dedication to collaborative relationships that worked beyond geopolitics.

[116] Michael Lewis "Indian Science for Indian Tigers?: Conservation Biology and the Question of Cultural Values" *Journal of the History of Biology* 38 (2005). 186.