

Making Postcolonial Connections: The Role of a Japanese Research Network in the Emergence of Human Genetics in South Korea, 1941-1968*

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Although scholars of contemporary Korea may acknowledge the role of the colonial past in the post-liberation period of South Korea, the question of continuity or rupture between the colonial and post-liberation periods, concerning the rapid economic growth in South Korea, remains unresolved.¹ Only historians of science have clearly affirmed their view on this issue—discontinuity. According to them, a dramatic advancement in science and technology in the 1960s, the so-called “formation of a modern science and technology system” in South Korea, was possible only through the replacement of the Japanese colonial system and the mainstream scientists trained in Japan during the colonial period with the U.S. system and the manpower returning from the United States.² In other words, a comprehensive system for promoting science and technology—allegedly the engine of “compressed growth” of

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¹ Nak Nyeon Kim, “A Reconsideration of ‘Colonial Modernization’,” *Korean Social Sciences Review* 1:1 (2011), 221-262.

² Moon Manyong, “1960 nyeondae ‘gwahak gisul bum’: Han’guk ui hyeondaejeok gwahak gisul chejeui hyeongseong” 1960년대 ‘과학기술 붐’: 한국의 현대적 과학기술 체제의 형성 (‘The Science and Technology Boom’ in the 1960s: The Formation of Science and Technology System in Korea), *Han’guk gwahaksa hakhoeji* 한국과학사학회지 (The Korean Journal for the History of Science) 29:1 (2007), 67-96; Geun Bae Kim, “An Anatomical Chart of South Korean Science and Technology in the 1960s: Their Relationships with Political Power,” *East Asian Science, Technology and Society: An International Journal* 5:4 (2011), 529-542; Kim Geun Bae, “Singminji gwahakgisul eul neomeoseo: geundae gwahakgisul ui Han’gukjeok jinhwa” 식민지 과학기술을 넘어서: 근대 과학기술의 한국적 진화 (Beyond the Colonial Science and Technology: Korean Evolution of Modern Science and Technology), *Han’guk geunhyeondaesa yeon’gu* 한국

the Korean economy and technological capacity—was established, thanks to a successful break with the colonial past and the influx of the U.S. system and U.S.-trained workforce.³ Historians of science have thus highlighted cases showing a strong U.S. influence on the reconstruction of the Korean science and technology system and the effective disruption of the colonial system in the 1950s and 1960s.⁴

This emphasis on the rupture in science and technology in South Korea has often been questioned by scholars outside the history of science. They give more attention to individual scientists than to the formation of science institutions and policies. According to them, an agricultural scientist Woo Chang Choon (U Jangchun, 1898-1959) held on to his colonial scientific practices in the post-liberation period. Similarly, an examination of physical anthropologist Na Sejin's (1908-1984) academic career shows the continuity of physical anthropology through the colonial and the post-liberation periods. For them, the impressive achievement of South Korean scientists in the 1960s was, in fact, a postcolonial recycling of Japanese colonial science repackaged in nationalistic terms.⁵ Their observations of colonial continuity indicate

근현대사연구 (Journal of the Association for Korean Modern and Contemporary History) 58 (2011), 252-282.

³ On the characteristics of South Korean society's "compressed growth," see Kyung-sup Chang, "Compressed Modernity and Its Discontents: South Korean Society in Transition," *Economy and Society* 28:1 (1999), 30-55.

⁴ The U.S. Cold War science policies, which contributed to the development of science in South Korea, include the following international aid programs: the U.S. State Department's cultural and educational exchange programs (1949-61), the International Cooperation Administration (ICA, the successor of the US Foreign Operations Administration) aid program for rehabilitating Seoul National University via institutional exchange with the University of Minnesota (1954-62), the China Medical Board's financial support to numerous numbers of medical schools in South Korea (1953-76), Atoms for Peace Program (1956-66), and the establishment of the Korean Institute for Science and Technology in 1966. Ock Joo Kim and Sang Ik Hwang, "The Minnesota Project," *Korean Journal of Medical History* 9:1 (2000), 112-123; John P. DiMoia, "Atoms for Sale?: Cold War Institution-Building and the South Korean Atomic Energy Project, 1945-1965," *Technology and Culture* 51:3 (2010), 589-618; Yeo In Seok, "Sebeuransereul jungsimeuro bon CMBui Han'guk uihak jaegon saeop" 세브란스를 중심으로 본 CMB의 한국의학 재건사업 (The China Medical Board and the Reconstruction of Korean Medicine after the Korean War: The Case of Yonsei Medical College and Severance Hospital), *Yeonse uisahak 연세의사학* (Yonsei Journal of Medical History) 18:1 (2015), 175-196; Kim Geun Bae, "Han'guk gwahakgisul yeon'guso seollip gwajeonge gwanhan yeon'gu: Migukui wonjowa yeonghyangeul jungsimeuro" 한국 과학기술 연구소 설립과정에 관한 연구: 미국의 원조와 영향을 중심으로 (A Study on the Process of Establishing KIST: Focusing on U.S. Assistance and Its Influence), *Han'guk gwahaksa hakhoeji 한국과학사학회지* (The Korean Journal for the History of Science) 12:1 (1990), 44-69; Koh Dae Seung, "Han'gukui wonjaryeokgigu seollip gwajeonggwa geu baegyeong" 한국의 원자력기구 설립과정과 그 배경 (The Establishment of the Korea Atomic Institute and Its Background), *Han'guk gwahaksa hakhoeji* 14:1 (1992), 62-87.

⁵ Jeong Jong-hyun, "Gwahakgwa naesyeneollijeum: Haebang jeonhu gwahakjaui idonggwa U Jangchun seosau gwahak damnoneul jungsimeuro" 과학과 내셔널리즘 '해방전후' 과학(자)의 이동과 우장춘 서사의 과학 담론을 중심으로 (Science and Nationalism Focusing on the Movement of Science(Scientist) 'Before and After Liberation' and on Science Discourse of U Jang-

that the neat picture of rupture with the colonial research system and workforce in South Korea in the 1960s obscures the messy and complicated realities of scientific activities at the time.⁶

Instead of siding with either continuity or rupture, this paper questions the continuity-discontinuity binary itself as a frame by which to understand the complicated picture of scientific change in postcolonial South Korea.⁷ In fact, the binary scheme presupposes some questionable assumptions concerning Japanese science. First, it views Japanese science as being fixed and given, which was already established and unchanged since the colonial period. However, Japanese scientists experienced

chun's Narration), *Sangheo hakbo* 상허학보 39 (2013), 207-249; Hoi-eun Kim, "Reauthenticating Race: Na Sejin and the Recycling of Colonial Physical Anthropology in Postcolonial Korea," *Journal of Korean Studies* 21:2 (2016), 449-483.

⁶ There are several reasons why historians of science highlight the rupture with the colonial precedents compared to historians of other fields. First, historians of science have shown that, in the colonial period, Koreans' access to science education and research was extremely limited, and that the colonial government did not promote any educational or research institutions for basic sciences, which had no direct relevance to colonial rule. The Korean War and its devastating outcomes—many elite scientists moved on to North Korea, and the research facilities built in the colonial period were destroyed—also facilitated the disconnection with the colonial science and technology system in postwar South Korea. Those historical contexts have led them to conclude that the impressive growth of science after the 1960s could not be attributed to the colonial science system. Second, science, as a symbol of modernization, is one of the most contentious areas in relation to the debate of "colonial modernization." Historians of science have recognized the risk of misuse of their historical studies as proof of Japan's contribution to Korea's modernization. In this context—while avoiding terms like exploitation or modernization—they have tried to explain the limited impact of colonial rule in the development of science and technology in the post-liberation period in terms of the rupture. Kim Geun Bae, "20segi singminji Joseonui gwahakgwa gisul—gaebal ui ssiat?" 20세기 식민지 조선의 과학과 기술 - 개발의 씨앗? (Science and Technology in Colonial Korea in the Twentieth Century: A Seed for Development?), *Yeoksa bipyeong* 역사비평 (Critical Review of History) 56 (2001), 297-313.

⁷ In a recent article on Na Sejin's postcolonial physical anthropology research, I proposed a "hybridization" thesis between Japanese colonial legacy and new American influence, by showing that Na newly synthesized Japanese colonial science and American research tradition. Yet this "hybridization" thesis also has its limitation, because a "hybrid" between two sciences presumes essentially two different sciences, thus shares the problematic assumption on Japanese science with the binary scheme. Hyun Jaehwan, "Jibangchawa goribhan Mendel jipddan: du jungsimbu gwahakgwa Na Sejinui honjongjeok chejil illyuhak, 1932-1964" 지방차와 "고립한 멘델 집단": 두 "중심부" 과학과 나세진의 혼종적 체질 인류학, 1932-1964 (Sejin Rha's Hybrid Physical Anthropology Between Two "Metropolitan" Sciences, 1932-1964)," *Han'guk gwahaksa hakhoeji* 37:1 (2015), 345-382. For a critical review of binary scheme based on "Western" and "Eastern" civilizations in the history of Chinese science, see Roger Hart, "Beyond Science and Civilization: A Post-Needham Critique," *East Asian Science, Technology, and Medicine* 16 (1999), 88-114.

‘Americanization’ during the post-World War II period as much as their South Korean counterparts did.⁸ Second, it ignores the fact that there was scientific exchange between Korean and Japanese scientists, even after the end of the Japanese colonial rule. The binary scheme assumes that the Japanese scientists, the main giver in scientific exchange with Korean scientists during the colonial period, were completely replaced by the American scientists in the post-liberation period. However, many Korean scientists continued the scientific exchange with Japanese scientists, while at the same time developing a new relationship with American scientists in the post-liberation period. As Paik Sang Gi, a retired biologist, recollected, “The main international partners of Korean biologists were, in fact, Japanese scientists, until the mid-1970s.”⁹

Taking the case of Kang Yung Sun (Gang Yeongseon, 1917-1999), professor of zoology at Seoul National University and one of the most respected Korean scientists in the 1960s, this article tries to offer a new perspective on Korean science in the 1960s, by which to circumvent that binary scheme.¹⁰ Engaging with the transnational turn in the history of contemporary science, this article focuses on the intensive scientific exchange of Kang with the American and Japanese geneticists.¹¹ Particular attention will be placed on Kang’s ongoing relationships with Japanese geneticists and their influence on his new research program and his connections with the United States, from 1941 to 1968. This article shows that he was able to make a successful relationship with American geneticists by way of his Japanese ties. Kang

⁸ After defeat in the Pacific War, Japan was occupied by the Supreme Command of the Allied Powers (SCAP), during which time (1945-1952) SCAP sought to reshape the Japanese higher education system, which affected scientific activities in Japan. Shigeru Nakayama, “Introduction,” in Shigeru Nakayama ed., *A Social History of Science and Technology in Contemporary Japan, Vol.1, The Occupation Period 1945-1952* (Melbourne: Trans Pacific Press, 2001).

⁹ Interview with Paik Sang-gi [Baek Sanggi], Emeritus Professor at Chungnam National University (Daejeon, South Korea, February 23, 2017). Paik Sang-gi studied genetics under the guidance of Kang Yung Sun at the Department of Zoology, Seoul National University, from 1965 to 1978.

¹⁰ For a biographical sketch of Kang Yung Sun, see Moon Manyong and Yung Sik Kim, *Han’guk geundae gwahak hyeongseong gwa jeong jaryo* 한국 근대과학 형성과정 자료 (A Documentary History of the Development of Modern Science in Korea) (Seoul: Seoul daehakgyo chulpan munhwawon, 2004); Shin Hyang Sook, “Gang Yeongseon [Kang Yung Sun],” in Kim Geun Ba-e, *Han’guk haksul yeon’gu 100nyeongwa mirae: gwahak gisul bunya yeon’gusa mit usu gwahak jaii josa yeon’gu* 한국학술연구 100년과 미래: 과학기술분야 연구사 및 우수 과학자의 조사 연구 (The Past and Future of Academic Research in Korea: A Survey Study on the Research History and Outstanding Figures in Science and Technology) (Daejeon: National Research Foundation, 2012), 5-12.

¹¹ A transnational approach on the contemporary history of science focuses on the transnational circulations of people, knowledge, materials, and technology, and the ways in which global contexts influence research trajectories of science. Simone Turchetti, Néstor Herran, and Soraya Boudia, “Introduction: Have We Ever Been ‘Transnational’? Towards a History of Science across and beyond Borders,” *The British Journal for the History of Science* 45:3 (2012), 319-336.

initiated his scientific exchanges with American scientists through his former Japanese teachers, who had become engaged with a research group in the United States and had developed a new research agenda on human genetics. In this respect, this paper argues that Kang's genetic studies in the 1960s were an outcome of his efforts to make new postcolonial connections among American, Japanese, and Korean geneticists, relying on his colonial connections with Japan.

This article consists of three main sections. The first briefly examines Kang's education and research during the colonial period, and shows how he joined a Japanese geneticist network (1941-1945). In the next section, I examine how Kang retained his membership in the Japanese geneticist network, even after Korea's independence from Japan (1946-1953), and mobilized it in establishing the biology department at Seoul National University. The last section analyzes how Kang participated in the international U.S.-based science programs as a member of the Japanese geneticist network, after the Korean War. To demonstrate this, I investigate two of Kang's human genetics research projects on the Korean population—population statistics (1954-1959) and chromosome research (1960-1968).

1. Kang Yung Sun, a “Japanese” Geneticist in the Colonial Period, 1941-1945

Kang Yung Sun was born in Seoul in 1917 and educated in 1937-1940 in the Department of Animal Husbandry, the Agricultural and Forestry College, Suigen (currently Suwon, South Korea). In 1941, he entered the Zoological Institute of Hokkaido Imperial University in Japan, where he was trained in animal cytological genetics under the guidance of Oguma Mamoru (1886-1971).¹² As the Japanese title of the institute, “Animal Morphology” (*Dōbutsu keitaigaku kōza*) indicates, the major work of the institute was a morphological observation on animal cells, particularly chromosomes. Oguma, a specialist on animal chromosomes in Japan, was also involved in the debate on human chromosome numbers.¹³ Since Oguma was preoccupied with his official duties as dean of the Faculty of Science, Kang's *de facto*

¹² His Japanese name can be written and pronounced either Oguma Kan or Oguma Mamoru. Here, I present his name as Oguma Mamoru, because Makino remarked that “the correct pronunciation [of his name] was ‘Mamoru,’ though Oguma wrote ‘Kan’ as his first name in his English-written papers.” Makino Sajiro, “Oguma Mamoru (Kan),” in Hitoshi Kihara, et al., ed., *Kindai Nippon seibutsu gakusha shōden* 近代日本生物學者小傳 (A Dictionary of History of Modern Biology in Japan) (Tōkyō: Hirakawa shuppansha, 1988), 416.

¹³ Oguma had been involved in debates on human chromosome counting between Hans de Winiwarter and Theophilus S. Painter, and completely agreed with the former. Oguma's position that the human chromosome number is 47, and that sex chromosomes consist of XX and XO, was influential in imperial Japan. Aryn Martin, “Can't Any Body Count?: Counting as an Epistemic Theme in the History of Human Chromosomes,” *Social Studies of Science* 34:6 (2004), 923-948.

supervisor was Makino Sajiro (1906-1989), an associate professor of the Zoological Institute. Because his professors and senior colleagues were carrying out animal chromosome studies, Kang developed interests in chromosome cytology. But before focusing on chromosome studies, he performed cytological research on the ova of Norway rats (*Rattus norvegicus*) in collaboration with Makino, from April 1942 to March 1943.¹⁴

As can be seen from the frequent appearances of Kang's Japanese name (Sigemoro Eizen) in the articles by Makino Sajiro during the war, Kang was Makino's faithful student.¹⁵ Thus, after graduating from Hokkaido Imperial University in 1944 and submitting his undergraduate thesis on the cytological analysis of the Norway rat, Kang took the position of research assistant (*joshu*) at his alma mater. While continuing his cytological studies on Norway rat ova, Kang began a new research project on the chromosome of such animals as the grey red-backed vole, with his supervisor Makino.¹⁶ Due to the Pacific War, however, he could not finish the project. Though Makino persuaded him to remain in Sapporo, Kang finally returned to colonial Korea in March 1945. Makino helped him obtain a position in the Anatomical Institute at the Faculty of Medicine, Keijō Imperial University, Keijō (currently Seoul, South Korea). Kang continued his cytological research under the supervision of animal chromosome researcher Suzuki Kiyoshi (1898-1967) and remained in that position until the end of the war, in August 1945.¹⁷

Although he spent only four years in Japanese academic institutions, his activities at Hokkaido and Keijō Imperial Universities would become an invaluable resource for Kang, particularly after he became virtually the sole geneticist of an independent (South) Korea. Above all, during his academic life in the colonial period, he became a member of the newly emerging geneticist community, consisting of scholars from the major Japanese imperial universities in mainland Japan and its colonies. In mainland Japan, Oguma Mamoru at Hokkaido Imperial University, Tanaka Yoshimaro (1884-1972) at Kyūshū Imperial University, and Komai Taku (1886-1972) and Kihara Hitoshi (1893-1986) at Kyōtō Imperial University, were leading scholars of cyto-genetic research. The base of their research was the Genetics Society of Japan

¹⁴ Kang Yung Sun, *Hagok Gang Yeongseon baksa jeongnyeon toeim ginyeom munjip* 하곡 강영선 박사 정년퇴임기념 문집 (The Collected Works of Doctor Kang Yung Sun for the Celebration of His Retirement) (hereafter *Collected Works*) (Seoul: Hagok Gang Yeongseon baksa jeongnyeon toeim ginyeom munjip saeophoe, 1982), 173-176.

¹⁵ Sugiyama Shigeo, *Kita no kagakusha gunzō: rigaku monogurafu 1947-1950* 北の科學者群像 : 〈理學モノグラフ〉 1947-1950 (Northern Scientists: Monographs of Natural Sciences) (Sapporo: Hokkaidōdaigaku tosho kankōkai, 2005), 8.

¹⁶ Makino Sajiro and Sigemoro Eizen, "Dobunezumi oyobi eriyanezumi no ranbo saibō senshokutai" (Oocyte Chromosomes of *Rattus norvegicus* and *Clethrionomys rufocanus bedfordiae*), *Igaku to seibutsugaku* (Science and Biology) 4 (1944), 76-78.

¹⁷ Kang Yung Sun, *Collected Works* (cit. n. 14), 178.

(*Nihon idengakukai*), which had been formed in 1920.¹⁸ In colonial Korea, Suzuki Kiyoshi and Takenaka Yō (1903-1966) of Keijō Imperial University joined the society and actively conducted cytogenetic research on bird fauna and cherry blossoms (*sakura*).¹⁹ During the war, these geneticists made collective efforts to establish a national institute for genetic research. After the establishment of the Japanese National Institute of Genetics (NIG), Mishima, in 1949, Oguma Mamoru became its first director.²⁰ Later, Kihara, Komai, Tanaka, and other geneticists mentioned above also took positions at the NIG. In the postwar period, the NIG became a center for rehabilitating Japanese genetics, through its well-planned and intensive scientific exchanges with the U.S. genetics community.²¹

As an active researcher in the Zoological Institute of the Hokkaido Imperial University, Kang was a recognized member of this Japanese geneticist network, from the early stages of his academic career. Kang presented his undergraduate research at the 17th Annual Meeting of the Genetics Society of Japan, held in 1944, and listed his name and abstract in *Idengaku zasshi* (Japanese Journal of Genetics).²² Further, Kang was able to take the position in Keijō Imperial University, thanks to the fact that Suzuki Kiyoshi in Keijō was a member of this Japanese geneticist network, and had close ties with the Hokkaido group.²³ As will be discussed in the next section, Kang's involvement in the Japanese geneticist network would also contribute to his efforts to build a human genetics program in South Korea.

¹⁸ Kaori Iida, "Practice and Politics in Japanese Science: Hitoshi Kihara and the Formation of a Genetics Discipline" (Ph.D. diss., Johns Hopkins University, 2012), 65-66.

¹⁹ Suzuki Kiyoshi, "Senshokutai kansatsuhō no kyakkanka ni tsuite" 染色體觀察法の客観化に就いて (On Some Technical Advices in the Study of the Chromosomes), *Idengaku zasshi* (Japanese Journal of Genetics) 18:3 (1942), 151-53; Moriwaki Kazuo, "Takenaka Yō hakushi to iden ken no sakura" 竹中要博士と遺傳研の櫻 (Dr. Takenaka and Cherry Blossoms in the National Institute of Genetics) (2013), (<https://www.ffpri.affrc.go.jp/tmk/event/documents/2013021602.pdf>, accessed on March 23, 2017).

²⁰ Makino Sajiro, "Oguma Mamoru (Kan)" (cit. n. 12), 420-421.

²¹ Kaori Iida, *Practice and Politics in Japanese Science* (cit. n. 18), Ch. 4.

²² Sigemoro Eizen, "Abstracts Communicated in the 17th Annual Meeting of Genetic Society of Japan held in 1944: Seasonal Change of the Abnormal Follicles in the Ovaries of the Norway Rat," *Idengaku zasshi* (Japanese Journal of Genetics) 21:5-6 (1946), 101.

²³ Kang Yung Sun, *Collected Works* (cit. n. 14), 178.

2. The Unofficial Japanese Geneticist Network Across Japan and South Korea, 1946-1953

The Hokkaido alma mater,
as a model of a new Department of Biology in South Korea

After the Korean Peninsula was liberated from Japan by the Allies on August 15, 1945, this region was divided along the 38th parallel, and the American military occupied its southern half. In September of that year, the U.S. military established the U.S. Army Military Government in Korea (USAMGIK) as the official ruling body of Southern Korea.

The liberation of Korea from imperial Japan rapidly transformed Kang's life. His academic standing skyrocketed. Owing to the lack of personnel in science education and research after Korea's independence, USAMGIK nominated him to the position of professor of zoology at the Preparatory Department of the former Keijō Imperial University, which had recently been renamed Gyeongseong University (and currently, Seoul National University).²⁴ Soon after, he became a leading scholar of the community of biologists in Korea. In particular, he played a significant role in the establishment of the first biology department in that country in 1946.²⁵

Kang used Hokkaido Imperial University as a model for the establishment of this new biology department. As the first step, Kang mobilized his colonial ties by which to construct the faculty of this new department. At the time of its establishment, Kang and Seonu Gi were the only faculty members of the Department of Biology of Seoul National University. Seonu Gi, who was appointed as a professor of botany at the Preparatory Department of Gyeongseong University in 1945, had graduated from the Department of Botany of Hokkaido Imperial University in 1942. Owing to their common educational backgrounds, Kang and Seonu depended on their Hokkaido ties as they drew up a list of faculty nominees. For example, they initially contacted Kim Hojik (1905-1959), who had graduated from the Department of Biology at Tōhoku Imperial University and had a connection with their alma mater's professor

²⁴ Kim Geun Bae, "Singminji gwahakgisureul neomeoseo" (cit. n. 2), 268. After the establishment of Seoul National University in August 1946, through a merger of several institutions of higher education in and around Seoul, Kang was also appointed as professor of zoology at this university.

²⁵ In the colonial period, there were virtually no institutions for research and education in the field of biology. Biologists, who actively conducted research in the colonial period, were mostly naturalists who had not received professional education in Japanese imperial universities. In this regard, the establishment of the Department of Biology in Seoul National University in 1946 can be viewed a monumental event in the history of biology in contemporary Korea. Manyong Moon, "Becoming a Biologist in Colonial Korea: Cultural Nationalism in a Teacher-cum-Biologist," *East Asian Science, Technology and Society: An International Journal* 6:1 (2012), 65-82.

of animal physiology, Aoki Kiyoshi. When Kim Hojik declined the offer, they contacted Kim Yonggyu, a graduate of the Hokkaido Imperial University College of Agriculture. At last, Kang and Seonu succeeded in persuading Lee Min Jae (Yi Minjae, 1917-1991), who had received a bachelor's degree from Hokkaido Imperial University, Department of Botany, in 1942, to become a faculty member of the Department of Biology of Seoul National University.²⁶

Second, Kang and Seonu designed the undergraduate curriculum of the department, modeling after that of the Departments of Botany and Zoology, Hokkaido Imperial University.²⁷ In 1946, they introduced classes in General Botany (*Ilban singmulhak*) and General Zoology (*Ilban dongmulhak*) for second-year undergraduate students, and Botany Laboratory (*Singmulhak silheom*) for third-year undergraduate students.²⁸ This undergraduate curriculum was the same as that of the Departments of Botany and Zoology in the Hokkaido Imperial University (the word 'Imperial' was omitted from its title after 1947) in the early postwar period.²⁹ In addition, in his classes, Kang used the genetics and cytology textbooks written by Japanese geneticists such as Tanaka Yoshimaro, who was a member of the Japanese geneticist network in the early postwar period.³⁰

Finally, Kang tried to introduce his alma mater's research program to his new department. Cytological research on animal chromosomes was Oguma and Makino's main research focus. Oguma had a worldwide reputation for his work on the morphological observation of animal chromosomes.³¹ During the latter half of the 1940s, Kang tried to replicate the animal chromosome research of his Japanese teachers. For example, in 1949, Kang designed a research project on the chromosomes in Korean snakes and lizards, including the Mongolia racerunner.³² Although

²⁶ Hah Doo Bong (Ha Dubong), *Seoul daehakgyo jayeon gwahak daehak chogi yaksa, 1920-1953* 서울대학교 자연과학대학 초기약사, 1920-1953 (An Early History of Seoul National University College of Natural Science, 1920-1953) (Seoul: Seoul daehakgyo chulpan munhwawon, 1999), 160.

²⁷ Hah Doo Bong, one of Kang's disciples who later became a professor of zoology, Seoul National University, speculated that the educational program in the Departments of Botany and Zoology at Hokkaido might have provided Kang with a model for the biology curriculum of Seoul National University in its early days. Ibid., 166.

²⁸ Ibid., 168.

²⁹ Hokkaidō daigakkō (Hokkaido University), "Sengo kaikaku to daigaku funsō" (The Postwar Reformation and University Dispute), in *Hokudai hyaku nen shi: tsūsetsu* (The One Hundred Year History of Hokkaido University) (Sapporo: Hokkaidō daigakkō, 1982), 1147.

³⁰ Hah Doo Bong, *Chogi yaksa* (cit. n. 26), 171.

³¹ Richard Goldschmidt, "Preface," in Makino Sajiro, ed., *Hokkaidō daigaku kyōju nōgaku hakushi Oguma Mamoru shi taishoku kinen saibōgaku idengaku ronbunshū 1* (Cytological and Genetic Research Papers for the Commemoration of the Retirement of Professor Oguma Mamoru, Volume 1) (Sapporo: Hoppō shuppansha, 1948), i.

³² Kim Hoon Soo, *Baekpa Kim Hunsu gyosu jeongnyeon toeim ginyeom munjip* 백파 김훈수 교수 정년퇴임기념 문집 (The Collected Works of Professor Kim Hoon-soo for the Celebration of His

his ambitious efforts toward cytological observation of reptile chromosome failed, morphological cytology became established as a research tradition of this department. In the mid-1950s, Kang divided his graduate research teams into the Cytology Lab (*Sepo bang*) and the Genetics Lab (*Yujeon bang*). In the Cytology Lab, Kim Yung Jin, Park Sang Dai, and other prospective students maintained morphological research on chromosomes in animals' cells during the 1960s and the 1970s.³³ Later, Park Sang Dai became a professor of this department and continued the tradition of morphological research.³⁴

Kang adhered strongly to the morphological tradition of cytology in his department. As the American cytologists who adhered to the morphological tradition of their field did, Kang also showed no appetite for biochemistry.³⁵ In the mid-1960s, Kang rejected the proposal of a young professor, Hah Doo Bong, to introduce the organic chemistry course and other biochemistry-related courses to teach molecular biology.³⁶ Kang and his disciples in the Cytology Lab still preferred morphological observation over biochemical approach on the cells of those animals. His last research subject at Seoul National University, during the late 1970s, was also karyotyping of fishes' chromosome.³⁷

In sum, Kang continued the Hokkaido alma mater's research in a newly established university of de-colonized Korea. It is ironic, given that the USAMGIK hoped to construct Seoul National University following the model of the American state

Retirement) (Seoul: Baekpa Kim Hunsu gyosu jeongnyeon toeim ginyeom munjip saeophoe, 1988).

³³ Interview with Paik Sang-gi (cit. n. 9). Hah Doo Bong also testified to the strong morphological cytology tradition in the Department of Biology of Seoul National University. Hah Doo Bong, *Bittuseongi insaeng: jukhyeon ildaegi* 빛투성이 인생: 죽현 일대기 (Debt-laden Life: An Autobiography of Hah Doo Bong) (Seoul: Doseochulpan pungnam, 2011), 208-211.

³⁴ Interview with Paik Sang-gi.

³⁵ In the late 1970s, the U.S. leading cytogeneticist T. C. Hsu (1917-2003) stated that many cytogeneticists put the taboo on learning biochemical methods from molecular biology. Tao-Chiu Hsu, *Human and Mammalian Cytogenetics: An Historical Perspective* (New York: Springer, 1979).

³⁶ Hah Doo Bong, *Bittuseongi insaeng* (cit. n. 33), 173-174. In 1959, the Department of Biology of Seoul National University was divided into two departments, the Department of Botany and the Department of Zoology. Lee In-kyu, who was a professor of botany at Seoul National University, recollected that this division also reflected Kang Yung Sun and Lee Min-jae's efforts to follow the institutional and intellectual legacy of the Hokkaido Imperial University during the colonial period. Lee In-kyu, "'Namgigo sippeun iyagi' jayeon gwahak daehak, 1989-1995 '남기고 싶은 이야기' 자연과학대학, 1989-1995 (A Recollection on College of Natural Sciences, 1989-1995)," in Seoul daehakgyo jayeon gwahak daehak chilsip nyeonsa pyeonchan wiwonhoe ed., *Seoul daehakgyo jayeon gwahak 70 nyeon*, 1946-2016 서울대학교 자연과학 70년, 1946-2016 (The 70 Years of Natural Sciences in Seoul National University, 1946-2016) (Seoul: Seoul daehakgyo chulpan munhwawon, 2017), 342.

³⁷ Lee Chung Choo (Yi Jeongju), "Yujeonhak" 유전학 (Genetics), in Korean National Academy of Sciences ed., *Han'guk ui haksul yeon'gu: saengmulhak* 한국의 학술연구: 생물학 (Academic Research in Korea: Biology) (Seoul: Haksurwon, 2001), 76-78.

university system, while eliminating the legacy of imperial Japan.³⁸ To this end, USAMGIK invited Glenn Arthur Noble (1909-2001) as a civilian biology consultant for higher education. USAMGIK expected that Noble would encourage Kang to learn U.S. biology and its education system. Despite Noble's close relationship with Kang, however, there was no intellectual spark between them.³⁹ Under these circumstances, Kang took his colonial alma mater as the model for the new biology department in Seoul National University.

Kang as a member of the Japanese geneticist network,
following Korea's independence from Japan

Kang not only established his Department of Biology after the model of his Japanese alma mater; he also maintained his membership in the Japanese geneticist network, even after Korea's independence from Japan. We can find plenty of evidence showing his continuous ties with his former Japanese teachers at Hokkaido. Even after the war, for example, Makino still recognized Kang as his faithful student. In 1947, Makino Sajiro became editor of a new journal, *Seibutsu* (The Life), and published a report on cytogenetic research on the Norway rat ova that he had written with Kang during the war.⁴⁰ In the same year, Kang's cytological research on the Norway rat, written in English during the war, was published in *The Journal of the Faculty of Science, Hokkaido Imperial University*.⁴¹ In these articles, Kang's affiliation was still listed as Hokkaido Imperial University, and his Japanese name, Sigemoro Eizen,

³⁸ Kim Jung In (Kim Jeongin), "Haebang ihu miguksik daehak model ui isikgwa hangmun jongsok" 해방이후 미국식 대학 모델의 이식과 학문종속 (The Implantation of American University Model and the Subordination of Academic Scholarship after Independence from Japan), in *Uri hangmun sogui Miguk: Migukjeok hangmun paereodaim isige daehan bipanjeok seongchal* 우리 학문 속의 미국: 미국적 학문 패러다임 이식에 대한 비판적 성찰 (The United States in Our Scholarship: A Critical Reflection on the Implantation of the American Scholarship Paradigm) (Seoul: Han'guk haksul danche hyeobuihoe, 2003), 81-83.

³⁹ Glenn Noble recalled that he met Kang in 1946, 1950, and 1953. Kang also stated that, in 1946, he invited Noble to give a lecture on comparative anatomy to medical students, when he was a professor at the Preparatory Department. In two recollections, both scientists stated only that they were "friends" without mentioning any intellectual commitment. In fact, Noble's major was parasitology, which Kang never studied and thus did not regard as his research subject. This difference of disciplines might be the main reason for the lack of intellectual spark between them. Glenn Noble, "Commemoration of the Retirement of Dr. Yung Sun Kang," in Kang Yung Sun, *Collected Works*, 288; *Ibid.*, 211.

⁴⁰ Sigemoro Eizen and Makino Sajiro, "On the Polyovular Follicles Found in Ovaries of the Norway Rat, *Rattus Norvegicus*," *Seibutsu* (The Life) 1 (1947), 63-67.

⁴¹ Sigemoro Eizen, "Morphological Observations of Abnormal Follicles in Mature Ovaries of the Norway Rat, *Rattus norvegicus*," *Journal of the Faculty of Science Hokkaido Imperial University Series VI. Zoology* 9 (1947), 233-241.

was given as the author's name.

エゾヤチネズミにおける卵子の成熟について¹⁾

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哺乳動物における卵子の成熟に関する、細胞學的研究は主に嚙齒類について行はれてゐる。中でもネズミ類についてはネズミ屬 *Rattus* に関する Coe ('08), Kirkham ('10), Sobotta & Burkhard ('10), Kirkham & Burr ('13) 等の古典的な研究の外、最近 makino ('41) はハツカネズミ *Mus musculus* に於ける詳細な観察を行つており、著者もさきにこれと屬を異にするドブネズミ *Rattus norvegicus* について卵子の成熟及び受精の現象を細胞學的に行つた。エゾヤチネズミは Muridae に屬するも上記の *Rattus*, *Mus* とは全然 Subfamily を異にし細鼠亞科 Microtinae に屬する純野生の種類である故、著者は本種を材料とし、これが卵子の成熟に関する細胞學的研究を行ひ、上記既に報告せられた屋内鼠類と比較して見た。本研究に當り終始御懇篤な御指導を賜つた北大教授牧野恩師に深く謝意を表し、あわせて舊京城大學教授鈴木清先生の御教示に感謝す。

材料は上記の如くエゾヤチネズミ *Clethrionomys rufocanus bedfordiae* (Thomas) で、主に終戦前著者が北大動物學教室在席時に札幌市近邊の農地並びに野原に於て採集したものにして、その卵巣を棕卵管と共に固定した。固定には Allen-Bouin 液を専用し、Delafield のヘマトキシリン液、或は Heidenhain 鐵ヘマトキシリン液で染色して観察をした。

Figure 1. Kang Yung Sun (Sigemoro Eizen)'s article, "On the Maturation of Eggs in the Vole, *Clethrionomys refocanus bedfordiae*," printed in *The Second Oguma Commemoration Volume* (Source: Makino Saji, *Hokkaidō daigaku kyōju nōgaku hakushi Oguma Mamoru*, 177).

Neither did Kang deny his connection to his former Japanese teachers. In August 1947, Makino launched a committee to publish a festschrift for the retirement of Oguma Mamoru, the master of the Hokkaido Zoological Institute.⁴² To this end, Makino's committee planned to collect scientific articles on genetics and cytology, Oguma's main research areas, from "the colleagues (*dōgaku*) in the whole of Japan."⁴³ The seventy-four articles were collected from the "best experts of our country (*waga-kuni*), who were currently working in the fields of cytology and genetics," and Kang's was included in the second volume, published in 1950.⁴⁴ In his article, reporting cytological observations on the eggs of the grey red-backed vole, Kang

⁴² Oguma became sixty years old in 1945, but there was no celebration for him at the time due to the shortage of goods at the peak of the Pacific War. Makino Saji, "Oguma Mamoru (Kan)" (cit. n. 12), 425.

⁴³ Makino Saji, *Hokkaidō daigaku kyōju nōgaku hakushi Oguma Mamoru shi taishoku kinen saibōgaku idengaku ronbunshū 1* (Cytological and Genetic Research Papers for the Commemoration of the Retirement of Professor Oguma Mamoru Volume 1) (Sapporo: Hoppō shuppansha, 1948), i-ii.

⁴⁴ Ibid., ii.

stated that “I appreciate my beloved teacher (*onsi*) Makino Sajiro at Hokkaido University, and the professor of the former Keijō University Suzuki Kiyoshi for their guidance of this research.”⁴⁵

A detailed examination of his name and affiliation in this article is quite intriguing, because it reveals Kang’s ambiguous position in the postwar Japanese geneticist network. In this article, Kang was named “Kang Yung Sun (Sigemoro Eizen)” (in Chinese characters), and his affiliation was stated as “Biology Institute, College of Liberal Arts, Keijō University” (see Figure 1). Kang was now a Korean, no longer a Japanese; however, to Makino and other Japanese scientists, Kang was still one of the best geneticists in Japan and a faithful disciple of the Hokkaido group, despite the change in his nationality. Kang also thought of his Japanese teacher Makino as his beloved teacher, and he was delighted to contribute a scientific article to celebrate his teacher’s (Oguma) retirement. Clearly, he was still regarded as a member of the Japanese genetics and cytology community. Reflecting Kang’s ambiguous identity, fluctuating between a member of the Japanese scientific community and a leading biologist of independent Korea, Kang’s Japanese colleagues called him by both names, Kang Yung Sun and Sigemoro Eizen.

A similar kind of complication and confusion was found in the way Kang’s institutional affiliation was expressed in the article. At that time Kang’s real affiliation was “Department of Biology, College of Liberal Arts and Sciences, Seoul National University.” Since 1946, “Keijō University” and “Biology Institute (*Seibutsugaku kyōshitsu*)” were no longer in existence in the South Korean higher education system, because the educational reformers in USAMGIK had abolished them as parts of imperial Japan’s educational system.⁴⁶ For Japanese geneticists, however, Kang was an academic successor of Takenaka Yō, who was the professor studying genetics at the “Biology Institute” of “Keijō Imperial University.” In this context, they stated his affiliation as “Biology Institute, College of Liberal Arts, Keijō University.”

It is worth noting that Kang and his Korean students kept silent about Kang’s continuous involvement with his former Japanese teachers and colleagues. Under

⁴⁵ Kang Yung Sun (Sigemoro Eizen), “On the Maturation of Eggs in the Vole, *Clethrionomys refo-canus bedfordiae*,” in Makino Sajiro ed., *Hokkaidō daigaku kyōju nōgaku hakushi Oguma Mamoru shi taishoku kinen saibōgaku idengaku ronbunshū 2* (Cytological and Genetic Research Papers for the Commemoration of the Retirement of Professor Oguma Mamoru Volume 2) (Sapporo: Hoppō shuppansa, 1950), 177.

⁴⁶ During the colonial period, biological institutes like “the Zoological Institute” or “the Botanical Institute” were located in “the Preparatory Department of the Keijō Imperial University Medical School.” For the institutional system of the Keijō Imperial University during the colonial period, see Jeong Gun Sik, Jeong Jin Seong, Park Myoung Kyu, Jung Jun Young, Cho Jung Woo, and Kim Mi Jung, *Singmin gwollyeokgwa geundae jisik: Gyeongseong jeguk daehak yeon’gu* 식민 권력과 근대 지식: 경성제국대학 연구 (Colonial Power and Modern Knowledge: A Study on the Keijō Imperial University) (Seoul: Seoul daehakgyo chulpan munhwawon, 2011).

the circumstances of the prevalence of harsh anti-Japanese sentiment among decolonized Koreans, Kang could not officially express his relationship with the Japanese geneticists. Yet Kang continuously maintained his Japanese ties after Korea's independence. In the context of the U.S. science policy, in which both Japanese and Korean scientists went through the postwar transformation, Kang's Japanese connections would contribute not only to establishing a new department but also to developing research activities after the conclusion of the Korean War.

3. Making Connections to American Scientists, 1954-1968

Following Japanese teacher's journey for 'Americanization':

The U.S. Educational Exchange Program and U.C. Berkeley, 1954-1959

The devastating Korean War (1950-1953) ironically provided Korean scientists with a great opportunity for promoting research activities. The war had placed Korea at the center of Cold War tensions, and U.S. policymakers began to significantly increase financial support to South Korea after the war. In April 1950, the U.S. National Security Council (NSC) proclaimed Korea's importance to the struggle against communism. In response, Washington decided to support the economic reconstruction of South Korea, notably by offering vocational educational assistance to it via the United Nations Korean Reconstruction Agency (UNKRA). In the mid-1950s, the U.S. government enhanced its educational support to higher education. The Minnesota Project, in which the U.S. Foreign Operations Administration (later the International Cooperation Administration) supported the reconstruction of Seoul National University, was at the core of the America-led reconstruction aid, although its support was limited to the fields of medicine, engineering, agriculture, and public administration.⁴⁷

The Educational and Cultural Exchange program was another support program that played a significant role in the postwar development of science in South Korea. In 1949, the U.S. State Department initiated the Educational and Cultural Exchange program with South Korea, supported by funding made possible by the Smith-Mundt Act.⁴⁸ This program worked well after the conclusion of the Korean War in

⁴⁷ Tae Gyun Park, "The Roles of the United States and Japan in the Development of South Korea's Science and Technology during the Cold War," *Korea Journal* 52 (2012), 214-215.

⁴⁸ The Smith-Mundt Act, or the U.S. Information and Educational Exchange Act of 1948, was the basic legislative authorization for the U.S. Department of State's activities concerning public diplomacy.

July 1953.⁴⁹ The number of South Korean university professors who benefited from the program increased significantly in 1954, and more than four hundred South Korean elites studied in the United States, from 1949 to 1961. Kang was one of them. He received financial support from both the Fulbright Program and the Smith–Mundt Act, which afforded him the means to visit the United States to study genetics.

Human genetics, “a young science of human heredity,” then separated from mainstream eugenics, was the name of the new science that Kang introduced to South Korea after his study in the United States.⁵⁰ In July 1954, Kang visited the University of California, Berkeley, and, until June 1955, studied human genetics under Curt Stern (1902–1981), a German-born U.S. scientist, who was known to be one of the re-founders of human genetics.⁵¹ After returning to his university in Seoul, and aided by his protégé Cho Wan Kyu [Jo Wan’gyu], Kang carried out a series of genetic studies on the Korean population during the second half of the 1950s. He addressed topics concerning population statistics such as birth and death rates, twinning ratios, and sex ratio at birth.⁵² Previous studies have interpreted Kang’s work in the United States as a typical case demonstrating that U.S. aid policies toward science enabled Korean scientists to absorb advanced American science, and to develop new research agendas based on their experiences at U.S. research institutions.⁵³ Indeed, in 1956, within a year of his return to South Korea, Kang wrote Stern, stating, “[now w]e are doing in my laboratory some human genetical problem [sic] sex ratio, consanguinity,

⁴⁹ Heo Eun, “1950 nyeondae Migugui daehan gyoyuk gyohwan gyehoekgwa Han’guk sahoe ellipseu chinmihwa” 1950년대 미국의 대한 교육교환 계획과 한국사회 엘리트의 친미화 (The U.S. Government’s Educational Exchange Program and the Making of Korean Elite as Pro-American), *Han’guk minjok undongsa yeon’gu* (Studies on Korean National Movement) 44 (2005), 229–265.

⁵⁰ Curt Stern, *Principles of Human Genetics* (San Francisco, CA: W.H. Freeman and Co, 1949), 3. To gain a visiting professorship grant from the Smith–Mundt Act, Kang received his doctorate in biology in 1953, from Seoul National University, by submitting his previous papers on Norway rats. He was among the first who earned doctoral degrees in the postwar South Korea university system. “Se baksa hagwido suy eo: isipparil Seoul dae joreopsik 세 박사 학위도 수여: 28일 서울 대 졸업식 (The Graduation Ceremony of Seoul National University, Including Three Doctors),” *Gyeonghyang sinmun*, February 26, 1953.

⁵¹ James V. Neel, “Curt Stern, 1902–1981,” *Annual Review of Genetics* 17 (1983), 1–11. Although his teaching a course and developing a textbook in human genetics in the 1940s and the 1950s are considered as re-founding this science on a non-racist frame, scientific practitioners of postwar human genetics did not cease to keep considerations of eugenics in mind. For a classical analysis of the continuation and pervasiveness of eugenics in postwar human genetics, see Daniel J. Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (Cambridge, MA: Harvard University Press, 1985). Comfort also offers new, comprehensive insights on the topic by tracing the promise of medical genetics—that is, genetic research will offer an individualized and preventive medicine. Nathaniel Comfort, *The Science of Human Perfection: How Genes Became the Heart of American Medicine* (New Haven: Yale University Press, 2012).

⁵² Kang Yung Sun, *Collected Works* (cit. n. 14), 199.

⁵³ Park Sang Dai, “Ihakbu: Gang Yeongseon gyosu hoesangnok 이학부: 강영선 교수 회상록 (In Memoriam Professor Kang Yung Sun),” <http://www.kast.or.kr/>, Accessed in April 14, 2016. And see also footnote 10.

twin's sex and average [sic] death age [sic] so on in the Korean population. I got some data about this projection [sic] at several area [sic], Seoul and other places since the last summer. Of course, this work was stimulated from your advice when I was [sic] in the United States."⁵⁴

But the initiating process of human genetics in Korea was messier than what previous studies have concluded. The scientific exchange between Korean and American geneticists at the time was facilitated by Japanese geneticists who had already been cooperating with the American geneticists since the late 1940s. How Kang's relationship with Japanese geneticists impacted his engagement with the U.S. geneticists, as well as his development of a new genetic research program can be demonstrated in the following two aspects related to Kang's stay at U.C. Berkeley: Kang's preference for U.C. Berkeley as a site for studying abroad in the United States and his choice of human population genetics as a research subject for his new research program.

In 1954, Kang opted to visit U.C. Berkeley, among several U.S. research institutions that specialized in genetics and cytology, because in U.C. Berkeley, "Richard Goldschmidt was working on state-of-the-art genetics in the United States."⁵⁵ But the choice seems bizarre, given that Goldschmidt (1878-1958) was considered a scientific heretic by other U.S. geneticists. His arguments were ridiculed by the U.S. geneticists as he controversially rejected the classical concepts of genes and the theory of incremental evolution, which were widely accepted principles in the U.S. genetics community during and after the war.⁵⁶ If Kang had really wanted to learn the accepted genetics experimental practices in the United States, U.C. Berkeley and Goldschmidt were not the right choices.

Kang's choice makes sense, however, if one considers the fact that he was a young member of the Japanese geneticist network. Richard Goldschmidt had been a good friend of the Japanese geneticists since the pre-war period.⁵⁷ From 1924 to 1926, Goldschmidt had worked as a professor of genetics at Tōkyō Imperial University College of Agriculture.⁵⁸ Kihara, Oguma, and other first-generation Japanese geneticists had a close relationship with him, as seen from the fact that Goldschmidt wrote a preface to *The Oguma Commemoration Volume on Cytology and Genetics*, which Makino Sajiro edited for his teacher in 1948.⁵⁹

In addition to Goldschmidt's familiarity with Japanese geneticists in general,

⁵⁴ Yung Sun Kang's letter to Curt Stern (November 17, 1956), Curt Stern Papers, 1907–1981, American Philosophical Society Archive, Box 2, Folder "Kang, Y. S., and w/ Curt Stern."

⁵⁵ Kang Yung Sun, *Collected Works* (cit. n. 14), 197.

⁵⁶ Michael R. Dietrich, "Richard Goldschmidt: Hopeful Monsters and Other 'Heresies'," *Nature Reviews Genetics* 4 (2003), 68-74.

⁵⁷ Kaori Iida, "Practice and Politics in Japanese Science" (cit. n. 18), 208, 288.

⁵⁸ Taku Komai, "Genetics of Japan, Past and Present," *Science* 123: 3202 (1956), 823-826.

⁵⁹ Richard Goldschmidt, "Preface" (cit. n. 31), i.

Makino Sajiro's visit to U.C. Berkeley one year before Kang should also be considered. Since 1949, Japanese geneticists began visiting the United States and actively tried to learn 'American genetics' and make new academic connections with the U.S. geneticists. Through this process, they utilized the well-established connection with Richard Goldschmidt, who provided Japanese geneticists with opportunities to contact U.S. geneticists by inviting them to stay at Berkeley.⁶⁰ In this context, when Makino Sajiro traveled to thirty-one research institutions in the United States, from March 1952 to April 1953, with support from the Japanese Ministry of Education, his first and last destinations in the United States were the Department of Zoology at U.C. Berkeley.⁶¹ In this regard, Kang's choice on visiting U.C. Berkeley was no surprise. As a young member of the Japanese geneticist network, Kang started his U.S. visit at U.C. Berkeley, where Japan's friend Goldschmidt worked, following his Japanese teacher Makino.

Making Kang choose U.C. Berkeley as the place for his study in United States was not the only contribution of the Japanese geneticist network. Kang's interest in human genetics was also motivated by his Japanese colleagues' encouragement. In April 1953, Kang decided to launch two new research programs, fruit fly and human genetics. They soon became the main research projects for Kang's graduate students in the Genetics Lab.⁶² Kang's knowledge in genetics and ties based on the postwar Japanese geneticist network contributed to the making of these two research programs. For example, Kang's former Hokkaido classmate Kawabe Masata at Kōbe University dispatched a research technician, concerning fruit fly genetics, to Kang's lab.⁶³ In relation to human genetics, Kang relied on the genetics knowledge he acquired from two textbooks on genetics written by Tanaka Yoshimaro in the postwar years. These textbooks introduced Komai Taku's two types of human genetic research on the Japanese twins: population statistics and normal traits study. The first studied the ratio of multiple births of the Japanese population during the imperial period of Japan and the racial differences of the ratio between the Japanese and Eu-

⁶⁰ After Kihara Hitoshi's visit to 25 research institutions in the U.S. in 1949, Japanese geneticists began research travels to the U.S. to learn new genetics theories and practices and used U.C. Berkeley as a temporary stop in their research travel. Kihara Hitoshi, *Kagakusha no mita sengo no Ōbei : Daihachikai kokusai iden gakkai ni shusseki shite* 科学者の見た戦後の欧米 : 第八回国際遺傳學會に出席して (Postwar Europe and America, as Seen Through the Eyes of a Scientist) (Ōsaka: Mainichi shinbunsha, 1949).

⁶¹ When Makino first arrived at Berkeley, Goldschmidt was absent; Makino eventually met Goldschmidt in March 25, 1953, with Kihara and Yamashita. Makino Sajiro, *Kono tabi ni: Gaikoku ryokō no kiroku* (This Travel: A Travel Diary of Foreign Countries) (Sendai: Sentorōsōmu, 1982), 2, 66.

⁶² Interview with Paik Sang-gi. In the Genetics Lab, Jeong Ok-gi, who was a Korean Japanese technician from Kōbe University and was introduced to Kang by Kawabe, took a position of managing fruit-fly genetics research until the mid-1960s.

⁶³ Kang Yung Sun, *Collected Works* (cit. n. 14), 199-200.

ropean populations, whereas the latter was to examine classic genetic markers—finger and palm prints and hair whorls—as comparison variables in the genetic studies of twins.⁶⁴ Before going to the United States, Kang conducted twin studies following the latter-type studies with his protégé. As Komai had done during the imperial period, he investigated the type of twins (homozygotes or heterozygotes) and comparable variables, such as finger and palm prints and whorls of twenty-seven young twins in Seoul in April 1953.⁶⁵ In other words, Kang already had an interest in human genetics and conducted a pilot study on Korean twins before learning “human genetics” in the United States, through his network with the Japanese geneticists.

Studying at U.C. Berkeley gave Kang a good opportunity to pursue another type of human genetic research on twins—population statistics—following Komai’s Japanese twin studies. During Kang’s stay at Berkeley, Komai Taku visited the department and stayed there for several days.⁶⁶ Kang’s Japanese teachers sent a letter to him in which they asked him to take care of the elder geneticist during his stay at U.C. Berkeley.⁶⁷ It is impossible to identify the detailed process of their exchange, due to the lack of documentary evidence, except for Kang’s acknowledgment of Komai in relation to his twinning ratio studies.⁶⁸ However, one can easily recognize how Kang began population statistics research on the Korean twins by applying the research method of Komai’s study on the Japanese twins.

We can examine Komai’s influence on Kang’s human genetic research after his return from the United States by analyzing the contents of two English articles that Kang published in 1959.⁶⁹ First, Kang adopted Komai’s data collection methods. For

⁶⁴ Tanaka Yoshimaro, *Idengaku* 遺傳學 (Genetics, 8th edition) (Tōkyō: Mo hana bō, 1951), 408–412; Tanaka Yoshimaro, *Kiso idengaku* (The Fundamentals of Genetics, 2nd edition) (Tōkyō: Mo hana bō, 1956), 228–231.

⁶⁵ Kang Yung Sun and Lee Ung Jik, “Ssangsaengae gwanhan yeon’gu (1)” 쌍생아에 관한 연구 (1) (A Study on the Twin (1)), *Saengmulhak yeon’gu* 생물학연구 (The Bulletin of the Biological Research Group of Seoul National University, College of Liberal Arts and Sciences) 2 (1955), 89–98.

⁶⁶ In June 1955, Komai was invited as the Chairman of the Opening Session of the 20th Cold Spring Harbor Symposia on Quantitative Biology, entitled “Population Genetics: The Nature and Causes of Genetic Variability in Populations” (New York). As Japanese geneticists usually did in their travel to the U.S., Komai first visited U.C. Berkeley and stayed there for several days, before going to New York. Biological Laboratory of Cold Spring Harbor, *Cold Spring Harbor Symposia on Quantitative Biology Volume XX: Population Genetics—The Nature and Causes of Genetic Variability in Populations* (New York: The Biological Laboratory of Cold Spring Harbor, 1955), ix–xii.

⁶⁷ Kang Yung Sun, *Collected Works* (cit. n. 14), 198.

⁶⁸ Kang Yung Sun and Cho Wan Kyoo [Jo Wan’gyu], “On the Twin Births of the Korean Population (Researches of the Korean Population Genetics 5),” *Haksurwon nonmunjip* 학술원논문집 (The Journal of National Academy of Sciences, Republic of Korea) 2 (1960), 90–101.

⁶⁹ Yung Sun Kang and Wan Kyoo Cho, “The Sex Ratio at Birth of Korean Population,” *Eugenics Quarterly* 6 (1959), 187–195; Yung Sun Kang and Wan Kyoo Cho, “Data on the Biology of Korean Populations,” *Human Biology* 31 (1959), 244–251.

collecting the population data on Koreans, Kang utilized the questionnaire survey method. He requested that schoolteachers let students, along with their parents, fill out surveys asking their sex, number of births, and marriages with cousins. Kang and his protégé continued these surveys in 1957 and 1958, albeit with modifications to the variables.⁷⁰ This questionnaire survey method for schoolchildren was Komai's main strategy for collecting massive data about the handedness—the unequal distribution of dexterity between the left and right hands—of Japanese twins in 1934.⁷¹

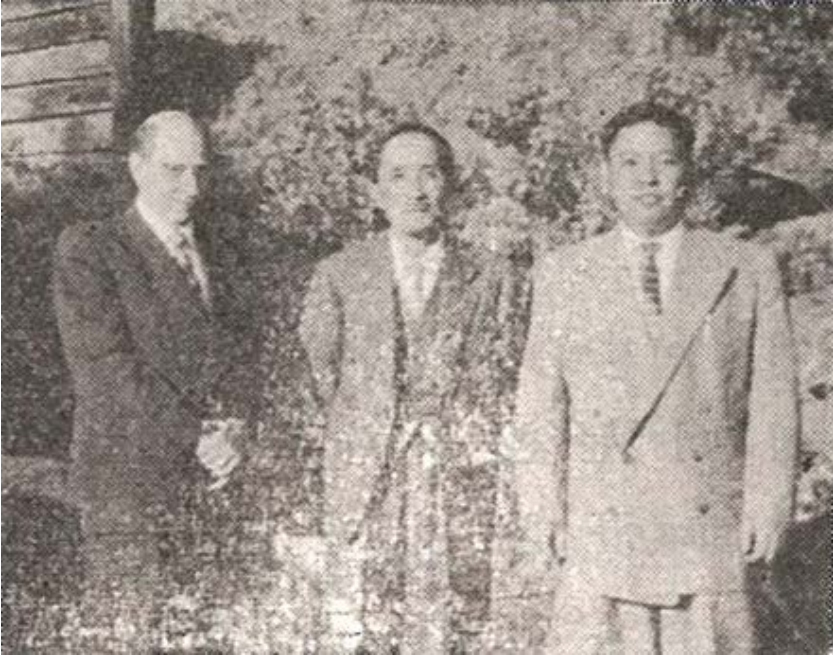


Figure 2. From the left, Curt Stern, Komai Taku, and Kang Yung Sun in front of Stern's house, 1955 (Source: Kang Yung Sun, *Collected Works*, 199).

Next, Kang used Komai's criticism on the reliability of hospital records in his new study on the Korean population. Published in *Eugenics Quarterly* in 1959, Kang and his student Cho Wan Kyu reported the sex ratio at birth of the Korean population.⁷² In this article, Kang mobilized Komai's criticism of the methodology of the previous

⁷⁰ Ibid.

⁷¹ Taku Komai and Goro Fukuoka, "A Study on the Frequency of Left-Handedness among Japanese School Children," *Human Biology* 6 (1934), 33-42.

⁷² Yung Sun Kang and Wan Kyoo Cho, "The Sex Ratio at Birth of Korean Population" (cit. n. 69), 189.

studies on the twinning ratio of the Japanese population. In a 1936 paper, titled “Frequency of Multiple Births among the Japanese and Related Peoples,” Komai and his student emphasized the truthfulness of birth records collected from midwives in comparison with the unreliability of birth records obtained from hospitals. He contended that “this value [obtained from hospital birth records] can hardly be taken as the standard of twin frequency of the whole [Japanese] population, because most Japanese women give birth to their babies in their homes, unless they expect difficult labors,” while “in Japan, especially in the rural districts, labors are attended invariably by licensed midwives, who are supposed to keep accurate records.”⁷³ By borrowing Komai’s criticism of hospital birth records, Kang questioned the reliability of the previous data on the sex ratio at the births of Koreans. In 1944, Matsuyama Shigeru, at Keijō Imperial University, published an article in the Japanese eugenics journal *Minzoku eisei* (The Race Hygiene), which reported that the sex ratio at birth of Koreans was 100.7.⁷⁴ According to Matsuyama’s study, the sex ratio of Koreans was one of the lowest in the world. In contrast, Kang and Cho concluded that the sex ratio at birth in the South Korean population was the highest in the world (114.99). To refute Matsuyama’s result, Kang contended that Matsuyama’s data, which were based on hospital records, was unreliable, because Korean women usually delivered their babies at their homes, and only unhealthy women went to obstetrics and gynecology hospitals. Kang argued that his own data were more accurate than Matsuyama’s hospital data, because he collected them through direct contact with families by surveying questionnaires sent to them.⁷⁵ This criticism of Matsuyama’s method, which highlighted the unreliability of hospital records and truthfulness of direct contact data with families, relied primarily on Komai’s main argument in his 1936 article.⁷⁶

Finally, Kang took Komai’s study as the key reference for his human genetic research, and tried to make his academic contribution by confirming Komai’s inference on the genetic relationship between Korean and Japanese populations. In his second English article, published in *Human Biology* in 1959, reporting both general

⁷³ Taku Komai and Goro Fukuoka, “Frequency of Multiple Births among the Japanese and Related Peoples,” *American Journal of Physical Anthropology* 21 (1936), 434.

⁷⁴ Matsuyama Shigeru, “Shussanno seihi kotonni ichi kazokuni seino shūsekisuru kotonno mondai” (The Problem on the Summation of Sex Ratio at Birth in a Family), *Minzoku eisei* (The Race Hygiene) 12 (1944), 87-114.

⁷⁵ Yung Sun Kang and Wan Kyoo Cho, “The Sex Ratio at Birth of Korean Population” (cit. n. 70), 189.

⁷⁶ Kang more directly stated his borrowing of Komai’s criticism in an article, published in *The Japanese Journal of Human Genetics*: “Most deliveries in Korea are not performed in hospitals, and therefore the sample cannot be regarded as representative of the Korean population. As Komai and Fukuoka point out for Japanese population, the real figure of twin-birth rate in the general population is expected to be lower than that obtained from hospital records.” Yung Sun Kang, “On Twin-Births in Korean Population,” *Jinrui idengaku zasshi* (The Japanese Journal of Human Genetics) (March 7, 1962), 33.

vital statistics and genetic data on the Korean population, Kang emphasized the similarity between the twinning ratios of the Korean and Japanese populations. Kang agreed upon the conclusions of Komai's study in 1936 on the frequency of multiple births in imperial Japan. Komai reported that "although they [Koreans] share with the Japanese the characteristic scarcity of dizygotic twin births, the materials on Koreans were obtained from hospitals in Korea, [which] is too meager for anything definite on this point."⁷⁷ In this article, Kang and Cho confirmed Komai's hypothesis under the basis of the new, more reliable data acquired from direct contacts with families: "The Korean populations thus resemble closely those of Japan in their proportions of mono- to dizygotic twin pairs."⁷⁸

In fact, correspondence materials between Kang and Curt Stern reveal that Kang could not have learned the three points discussed above from Stern. First, Stern did not conduct any population statistics employing the questionnaire survey method for schoolchildren. Instead he used the official statistics published by the U.S. Bureau of the Census as other U.S. geneticists did.⁷⁹ Second, Stern highly recommended Kang to collect hospital records on sex ratio at birth, rather than questioning the reliability of the hospital records. Stern advised him that the hospital records are the most objective data for population statistics.⁸⁰ Third, Stern only recommended Kang to survey the sex ratio at birth, not of the twinning ratio.⁸¹ In this regard, it is likely that not only Stern—as Kang explicitly expressed in his 1956 letter to Stern—but also Komai, motivated Kang to conduct genetic studies on the Korean population.

In sum, the Japanese network was pivotal to Kang's introduction of human genetics in South Korea. His choice of U.C. Berkeley as the venue to study in the United States was the result of following his Japanese teachers who pursued the Americanization of Japanese genetics earlier than Kang did. Further, his academic interest in the population genetics of Koreans strongly depended on both the Japanese geneticist Komai's prewar studies and the direct intellectual exchange with him at U.C. Berkeley. By 1962, Kang had published three English-language articles in international journals and presented his work at international conferences.⁸² His successful

⁷⁷ Taku Komai and Goro Fukuoka, "Frequency of Multiple Births" (cit. n. 73), 440.

⁷⁸ Yung Sun Kang and Wan Kyoo Cho, "Data on the Biology of Korean Populations" (cit. n. 69), 249.

⁷⁹ Trudy Enders and Curt Stern, "The Frequencies of Twins, Relative to Age of Mothers, in American Populations," *Genetics* 33:3 (1948), 263-272.

⁸⁰ Stern to Kang, 13 March 1961; Stern to Kang, 11 May 1961; Stern to Kang, 18 August 1961. All in Box 2, Folder "Kang, Y. S., and w/Curt Stern," Curt Stern Papers, 1907-1981, American Philosophical Society Archives [hereafter, Stern Papers].

⁸¹ Ibid.

⁸² In 1961, Kang himself presented his research in the Second Congress of Human Genetics in Rome, Italy. This was his first presentation of his own research in an international conference. Although Kang took part in the 12th International Genetic Symposia in Tōkyō and Kyōto in 1956, his status of this symposium was "an observer." Kang Yung Sun, "Gukje yujeon hakhoe bogo: je 12hoe gukje yujeon hakhoe danyeowaseo" 국제유전학회 보고: 제 12회 국제 유전학회에 다녀와서

debut in the Western geneticist community (dominated by U.S. scientists) and his introduction of the new American science of human genetics into South Korea was achieved only through his direct, but unofficial, connection with the Japanese geneticist network. As will be discussed in the next section, the importance of the Japanese geneticist network for directing Kang's research would remain unchanged, even in the mid-1960s, when he developed his "original" research program, while engaging only with U.S. science policy agencies, without an apparent connection with the Japanese.

Remaining a faithful disciple of the Japanese:

The Atoms for Peace Program and Kang's cancer cytogenetics, 1960-1968

As with the U.S. and European geneticists in the 1950s and the 1960s, Kang also profited from the explosive growth of research funds for "peaceful uses of atomic energy."⁸³ In 1960, the International Atomic Energy Agency (IAEA) provided him with a fellowship to study radiation genetics at the Worcester Foundation for Experimental Biology in Shrewsbury, Massachusetts. Kang expected to learn state-of-the-art techniques for studying human chromosomes during his second academic sojourn in the United States. At the time, cytogeneticists studying human chromosomes had enjoyed a golden period with Joe Hin Tjio (1919-2001) and Albert Levan's (1905-1998) discovery of the fact that the human diploid chromosome number is 46. One of their methodological innovations was to use cells grown in tissue culture outside the human body (*in vitro*) instead of using fresh tissues obtained directly from the body. With the introduction of this innovation into cytogenetic research on the human chromosome, chromosome analyses of tissue culture cell-lines, such as the mouse L strain and the human carcinoma line HeLa, became a fad. On the basis of the hypothesis of Theodor Heinrich Boveri (1862-1915)—changing the makeup of chromosomes is one of the prerequisites for carcinogenesis—cytogeneticists made an effort to discover chromosome aberration in the mouse L strain and HeLa.⁸⁴ In this context, Kang studied the steroidal effect on the change of chromosomes in the HeLa cell-line with David Stone at the Worcester Foundation.⁸⁵ For Stone's lack of knowledge on karyotyping human chromosomes, Kang had to unofficially learn new

(A Postscript on the Participation in the International Congress of Genetics), *Sasanggye* 사상계 102 (1961), 314-319. At that time Kang additionally published an article about the sex and twin ratio at birth among Koreans in *Human Biology*. Yung Sun Kang and Wan Kyoo Cho, "The Sex Ratio at Birth and Other Attributes of the Newborn from Maternity Hospitals in Korea," *Human Biology* 34 (1962), 38-48.

⁸³ Soraya de Chadarevian, "Mice and the Reactor: the "Genetics Experiment" in 1950s Britain," *Journal of the History of Biology* 39 (2006), 707-35; Angela Creager, "Radiation, Cancer, and Mutation in the Atomic Age," *Historical Studies in the Natural Sciences* 45 (2015), 14-48.

⁸⁴ Tao-Chiuh Hsu, *Human and Mammalian Cytogenetics* (cit. n. 35), 28-37.

⁸⁵ Kang Yung Sun, *Collected Works* (cit. n. 14), 201.

chromosome analysis techniques such as cell culture, colchicine pretreatment, hypotonic solution pretreatment, and new squashing methods from George Yerganian (1923-), the chief researcher of cytogenetics at the Dana-Farber Cancer Center in Boston.⁸⁶

After returning to Korea in 1962, Kang pursued morphological observation of human chromosomes with graduate students of the Cytology Lab. His new chromosome research included observing the chromosome variation in normal cells and tumor cells obtained from Koreans and the HeLa cell-line with radiation treatment on those cells.⁸⁷ This research program was defined as one for studying the effects of atomic radiation on cancer and was supported by the IAEA and the Korean Office of Atomic Energy.⁸⁸ The U.S.-led Atoms for Peace Program played a major role in the technological importation and financial assistance of this cancer cytogenetics study based on human chromosome analysis.

Several biographies of Kang Yung Sun describe cancer cytogenetics as the starting point of Kang's international-level research program in human genetics, thus a sign of Kang's overtaking of Japanese geneticists. According to Park Sang Dai, for example, "through initiating cell-culture techniques [from his study at the U.S. research institutions], Kang overcame his unfortunate life in his early academic career during the colonial period, which was mostly caused by his Japanese supervisor [Makino Sajiro]'s prejudice on the colonial student; later he pioneered an original research area [...] that enabled him to overtake Japanese chromosome research, and finally led him to become an eminent international scholar."⁸⁹ In this description, Kang's achievement in the 1960s is understood in the context of a deep rupture with

⁸⁶ Ibid., 202.

⁸⁷ One of his early discoveries in chromosome research was the observation of a changed chromosome number in steroid-treated HeLa cell lines. David Stone and Yung Sun Kang, "Isolation of a HeLa Sub-Strain Exhibiting Stem-lines of 138 and 148 Chromosomes," *Nature* 202 (1964), 516-518.

⁸⁸ Man Yong Moon, "Understanding Compressed Growth of Science and Technology in South Korea: Focusing on Public Research Institutes," *The Korean Journal for the History of Science* 37:2 (2015), 431-453. The OAE spent roughly \$600 on Kang's research titled "Chromosome Analysis on Cultured Carcinoma," in 1962, and the IAEA provided \$4,000 to him as part of a research contract for "Studies on Radiosensitivity of Cultured Human Normal and Cancer Cells," from 1964 to 1968. International Atomic Energy Association (IAEA), *Technical Reports Series No. 97: IAEA Research Contracts – Ninth Annual Report* (Vienna: International Atomic Energy Association, 1969). By 1964, Kang gained financial support from the IAEA, with which he systematically carried out comparative studies on the radiation effect of human normal and carcinoma cells. Through these studies, his lab tried to discern the effects of radiation on numerical and morphological aberrations, DNA synthesis, and each chromosome group and cellular stage, among other things.

⁸⁹ Park Sang Dai, "Gang Yeongseon hoewon" 강영선 회원 (Kang Yung Sun as a Member of Korean National Academy of Sciences), in *Apseo gasin hoewonui baljachwi* 앞서 가신 회원의 발자취 (Traces of the Previous Members of the Korean National Academy of Sciences) (Seoul: Haksurwon, 2001), 494.

the Japanese scientific legacy, as well as a profound U.S. influence on the development of South Korean science.

At this point, I wish to emphasize Kang's membership of the Japanese geneticist network again. Kang did not replace his old Japanese style cytological research with a new American one. Rather, he went through the postwar transformation of genetics with his former Japanese teachers and colleagues, who had tried to engage with the new American genetics community before Kang pursued his research career in the United States. Without doubt, the U.S.-led Atoms for Peace Program enabled Kang to pursue cancer cytogenetics. Nevertheless, it should be recognized that his Japanese teacher's postwar research program, collaborating with U.S. cytogeneticists, encouraged Kang to join this research program.

In this context, it is worth examining Makino Sajiro's postwar human chromosome research in more detail. Before his research trip to the United States, from 1952 to 1953, Makino launched a new research program on chromosome studies of tumor cells in 1951. He was one of the pioneer scientists in the early 1950s who tried to prove Boveri's hypothesis on the relationship of structural change of chromosome with carcinogenesis. Makino and his students at Hokkaido used their common experimental animal—the Norway rat—for morphological observation on chromosomes in tumor cells in 1951 and 1952.⁹⁰ In addition, in 1952, Makino accidentally invented a new squashing technique (“water pretreatment squash technique”), applying hypotonic solutions on chromosomes. This observation of the effect of hypotonic solutions on chromosomes would become one of the new main techniques for chromosome karyotyping.⁹¹ Equipped with the results of chromosome analysis in tumor cells, which was favorable to Boveri's theory, and a new innovative chromosome technique, Makino presented his cancer cytogenetics to the American geneticists, exchanged experimental techniques, and developed academic relationships with them.⁹² Particularly, Makino learned cell-culture techniques from T. C. Hsu (1917-2003) at Charles Pomerat's laboratory of the University of Texas Medical Branch in February 1953, while at the same time sharing with him the information of hypotonic solutions on chromosomes.⁹³

⁹⁰ Makino Sajiro, *Makino Sajiro kyōju kanreki kinen ronbunshū* (Jubilee Volume of Papers Dedicated to Professor Sajiro Makino in Celebration of His Sixtieth Birthday) (Sapporo: Hoppō shuppan, 1966).

⁹¹ The spread effect of hypotonic solutions on animal chromosomes contributed to making accurate cytogenetic analysis by swelling the cells and separating the dividing chromosomes. T.C. Hsu in the United States, Henry Harris in the United Kingdom, and Makino Sajiro in Japan, had all discovered the utility of hypotonic solutions in chromosome research almost simultaneously, though Hsu is credited with its first use. Peter S. Harper, *First Years of Human Chromosomes: The Beginnings of Hyman Cytogenetics* (Oxfordshire: Scion Publication, 2007), 12-17.

⁹² Sajiro Makino and I. Nishimura, “Water-Pretreatment Squash Technique: A New and Simple Practical Method for the Chromosome Study of Animals,” *Stain Technology* 27 (1952), 1-7.

⁹³ Makino Sajiro, *Kono tabi ni* (cit. n. 62), 72.

For the same interest on cancer cytogenetics, Makino and Hsu conducted collaborative cancer cytogenetic research on the Norway rat, employing new cell-culture techniques.⁹⁴ Since then, Makino and his Japanese students included cell-culture techniques in their cancer cytogenetics, and developed a research program on chromosome abnormalities in human tumor cells. They expanded their cancer cytogenetic research employing new technological developments such as living-cell analysis, cinematography, autoradiography, and spectrophotometric measurements of DNA.⁹⁵ In the late 1960s, Makino expanded his chromosome research program through the establishment of the Chromosome Research Unit at Hokkaido University. Appreciating Makino's dedication to the chromosome research, U.S. geneticists called him "Mr. Chromosome" or "the doyen of animal cytogenetics."⁹⁶

As Makino's research program on chromosome analysis of human tumor cells progressed, he helped Kang Yung Sun, his Korean disciple, to participate in this new research program, albeit indirectly. As stated above, Kang learned new chromosome analysis techniques from George Yerganian during his stay at the Worcester Laboratory, in 1960.⁹⁷ Makino had already established close ties with Yerganian, in 1953, when he made the research trip to U.S. institutions. At the time, Yerganian, who was a postdoctoral fellow at Boston University, and Makino identified their common interest in cancer cytogenetics using rodents as experimental animals, and exchanged ideas and techniques with each other.⁹⁸ Later, from 1955 to 1957, Makino sent his graduate student Tonomura Akira (1926-2004) to Yerganian's lab for training in cancer cytogenetics employing Chinese hamsters.⁹⁹ Makino might also have introduced Kang to Yerganian, because Kang had no other connection with this Bostonian chromosome researcher except for his Japanese teacher. Like Tonomura, Kang also learned chromosome analysis techniques employing Chinese hamsters. For this reason, Kang's lab in Seoul also employed Chinese hamsters when the group conducted non-human chromosome research.¹⁰⁰

In this context, one can easily surmise that Kang's interest in cancer cytogenetics followed the same line as that of Makino. The case of Kang's human chromosome numbering studies shows that Kang's work was closely related to Makino's research program. In the late 1950s and the early 1960s, many cytogeneticists attempted to

⁹⁴ Saji-ro Makino and T.C. Hsu, "Mammalian Chromosomes in Vitro. V. The Somatic Complement of the Norway Rat, *Rattus norvegicus*," *Cytologia* 19:1 (1954), 23-28.

⁹⁵ A. Lima-de-Faria, "Preface," in Saji-ro Makino, *Human Chromosomes* (Tōkyō: Igaku shoin, 1975), xi-xii.

⁹⁶ Ibid., xi; Curt Stern, "Preface: Professor Makino," in Saji-ro, *Makino Saji-ro kyōju kanreki kinen ronbunshū* (cit. n. 31), 16.

⁹⁷ Kang Yung Sun, *Collected Works* (cit. n. 14), 202.

⁹⁸ Makino Saji-ro, *Kono tabi ni* (cit. n. 62), 43-45.

⁹⁹ Sasaki Motomichi, "Akira sensei no shi o itamu (In Memoriam Mr. Tonomura Akira)," *Genetics Society of Japan News Letter* 79 (2004), 3-4.

¹⁰⁰ See his publication list after 1961 in Kang Yung Sun, *Collected Works*.

investigate racial differences in human chromosome.¹⁰¹ In this context, there was a small debate among them, concerning whether East Asians had different chromosome numbers and structures. After studying testicular cells from Japanese subjects, a Japanese American geneticist, Kodani Masuo of the University of Iowa, reported that the number of varieties of the Japanese ranged from 46 to 48 chromosomes, whereas Chang Chien-Pin of Provincial Taipei Hospital, Taiwan, discovered that the oogonia of a female Chinese fetus had 48 chromosomes.¹⁰² They proposed that there were racial differences in the number of chromosomes between “Caucasians (whites) and Orientals.” In 1959, Curt Stern also supported this position by saying that “the present limited data indicated that the 46-chromosome type is the most frequent and that, perhaps, the frequencies of 47 and 48 chromosome types are higher in Japanese than in European and American Whites.”¹⁰³ At the same time, Stern requested that Makino confirm this interpretation of the number of human chromosomes. In 1960, during his stay in the U.S., and with Tsu’s collaboration at the University of Texas, Makino finished his first study about racial differences in the number of chromosomes, sent this draft to Stern, and later published it in *American Journal of Human Genetics* in 1962.¹⁰⁴ Through his own research, Makino criticized Kodani and Chang, and led Stern to change his view of the human chromosome numbering. Makino reported that 46 chromosomes were identified in most of the research materials, by using 6,596 randomly sampled cells from various organs of 43 Japanese individuals and 136 legally aborted fetuses. According to his experiment, there were no racial differences to be found in the structure and number of chromosomes.¹⁰⁵

Makino’s objection to the claim on chromosomal variation among human populations was closely related to cytogeneticists’ efforts to standardize human chromosome at the time. In 1960, Makino participated in the first Human Chromosomes

¹⁰¹ Soraya de Chadarevian, “Chromosome Surveys of Human Populations: Between Epidemiology and Anthropology,” *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 47 (2014), 87-96, particularly 94.

¹⁰² Masuo Kodani, “Three Diploid Chromosome Numbers of Man,” *Proceedings of the National Academy of Sciences* 43 (1957), 285-292; Masuo Kodani, “The Supernumerary Chromosome of Man,” *American Journal of Human Genetics* 10 (1958), 125-140; Chien-Pin Chang, “Studies on the Chromosomes of Human Oogonia,” *Jinrui idengaku zasshi* (The Japanese Journal of Human Genetics) 4 (1958), 195-208.

¹⁰³ Curt Stern, “The Chromosomes of Man,” *Journal of Medical Education* 34 (1959), 305.

¹⁰⁴ Makino Sajiro, *Kono tabi ni* (cit. n. 61), 92. There is a discordance between Makino’s diary and correspondences with Stern. According to the record of correspondences, Makino sent the draft on the number of chromosomes in the Japanese population to Stern in 1959, before going to the U.S. Anyway, Stern revised Makino’s paper and encouraged him to publish it in English. See Makino to Stern, 10 June 1959, Box 16, Folder “Makino, Sajiro,” Stern Papers; Stern to Makino, 15 June 1959, Box 16, Folder “Makino, Sajiro,” Stern Papers.

¹⁰⁵ Sajiro Makino and Motomichi Sasaki, “A Study of Somatic Chromosomes in a Japanese Population,” *American Journal of Human Genetics* 13 (1962), 47-63; Sajiro Makino, Yasumoto Kikuchi, Masao S. Sasaki, Motomichi Sasaki, and Michihiro Yoshida, “A Further Survey of the Chromosome in the Japanese,” *Chromosoma* 13 (1962), 148-162.

Study Group, held in Denver. This group hoped to settle the nomenclature of human chromosomes, numbering the chromosomes 1 through 22, on the basis of their sizes. This standardization was the *sine qua non* for finding “chromosomal diseases,” which would be caused by chromosomal variation.¹⁰⁶ As shown above, Makino wanted to study the association between chromosomal change and carcinogenesis. For him, Kodani and Chang’s argument on the racial difference of chromosome numbers challenged the consensus of the Human Chromosomes Study Group, while at the same time challenging his own research project on cancer cytogenetics. In this context, other members of the group such as T. C. Hsu and A. Levan also strongly favored Makino’s research on the chromosome number of the Japanese population.¹⁰⁷

Kang participated in this debate to support his teacher’s point of view. Kang’s first human chromosome study, published in 1964, aimed to determine the differences in chromosome numbering between Korean and other populations.¹⁰⁸ Though the research subjects of this study were only six Koreans, he concluded that the modal chromosome number of the Korean population was 46, and was the same for those of other populations, such as Caucasian and Japanese.¹⁰⁹ In 1965, Kang repeated similar studies on Korean chromosomes. Kang’s group examined 886 cells from six healthy males and four healthy females in South Korea, and reported that 783 cells consistently showed 46 chromosomes, and thus were in accordance with that of other human races. Kang’s group also found that 100 cells obtained from normal Korean parents of children who had Down’s syndrome also had 46 chromosomes.¹¹⁰ Kang reported these results in English to the Japanese journal *Chromosome Information Service*, of which Makino served as editor. Kang’s group reported that the cells of the normal Korean population had 46 chromosomes, in agreement with the results in other races. In this article, Kang did not forget to acknowledge the help of his

¹⁰⁶ Susan Lindee, *Moments of Truth in Genetic Medicine* (Baltimore: Johns Hopkins University Press, 2005), 102-109.

¹⁰⁷ Makino Saijiro and Sasaki Motomichi, “A Study of Somatic Chromosomes in a Japanese Population” (cit. n. 105), 61.

¹⁰⁸ Kang Yung Sun, Kim Yung Jin, and Lee In Hae, “Hanguginui yeomsaekchee gwanhan yeon’gu (yebo)” 한국인의 염색체에 관한 연구 (예보) (The Chromosome Studies in the Korean Population (A Preliminary Note)), *Dongmul hakhoeji* 동물학회지 (The Korean Journal of Zoology) 6 (1964), 29-32.

¹⁰⁹ *Ibid.*, 30.

¹¹⁰ Kang Yung Sun and Kim Yung Jin, “Hanguginui yeomsaekchee gwanhan yeon’gu 3. Down’s Syndrome ui yeomsaekchee” 한국인의 염색체에 관한 연구 3. Down’s Syndrome의 염색체, *Zoologica* (The Journal of Department of Zoology, Seoul National University) 4 (1965), 1-8. It is worthy to note that Makino already conducted similar research with Kang’s chromosome studies on the parents of children who had Down’s Syndrome in 1962. Saijiro Makino and M. Mitani, “Chromosome Studies in Children with Down’s Syndrome and Their Parents,” *Proceedings of the Japanese Academy* 38 (1962), 47-51.

teacher, Makino.¹¹¹ Later, Makino cited Kang's article on chromosome research as supportive evidence of his argument in chromosome numbering.¹¹² In a nutshell, Kang's cancer cytogenetics were formed under the influence of his former Japanese teacher's postwar research program.

When it comes to research topics, Kang's cancer cytogenetics was originally distinct from the crude and old-fashioned morphological research of the colonial period on cells and chromosomes of the Norway rat. It was a newly rising research program in the U.S. genetics community since the 1950s. When it comes to research network, Kang continued to maintain his connection to the Hokkaido researchers, including Makino Sajiro. After the end of the U.S. occupation, Makino reformed his cytogenetic research through the scientific exchange with the U.S. cytogeneticists, such as T. C. Hsu, and joined the new research program led by American scientists—cancer cytogenetics. Makino's work belonged to the mainstream research of the U.S. cytogenetics community and his theoretical position—the universality of 46 chromosomes in the human species—was also the dominant view of U.S. cytogeneticists. For that reason, Kang's support of his former Japanese teacher meant his joining the mainstream U.S.-led cytogenetics community rather than simply repeating or recycling Japanese colonial science. For Kang, his ongoing connections with Japanese geneticists were vital links that connected him with the U.S. geneticists and allowed him to effectively absorb American science. Consequently, his impressive achievement in human chromosome research in the 1960s can be understood as an outcome of his newly forged postcolonial connections among the U.S., Japanese, and Korean geneticists, primarily by way of his Japanese connections.

4. Conclusion

In 1968, Kang invited his *onsi* Makino to South Korea. Makino introduced his research on human chromosomes to Korean geneticists in the special lecture delivered at the annual meeting of the Korean Association of Biological Sciences. When Makino arrived at Gimpo International Airport, Seoul, and returned to Japan, Kang came to meet and see off his teacher. Makino wrote in his diary, "I spent happy days in Korea with many pro-Japanese scholars."¹¹³ Many years ago, he had also proudly written to Curt Stern, "Dr. Kang Yung Sun, Professor of Zoology at Seoul University, will receive the Degree of Science from our [Hokkaido] University, a few months

¹¹¹ Yung Sun Kang, Yung Jin Kim, and Jung Hee Pai, "Chromosome Studies in the Korean Population 3. Notes on the Somatic Chromosomes," *Chromosome Information Service* 8 (1967), 24-27.

¹¹² Sajiro Makino, *Human Chromosomes* (cit. n. 95).

¹¹³ Makino Sajiro, *Kono tabi ni* (cit. n. 61), 126.

later, with his studies of Korean populations which were carried out under your expert guidance.”¹¹⁴



Figure 3. From the left, Makino Sajiro, Kang Yung Sun, and Kim Hoon-soo at Seoul National University, South Korea, 1968 (Source: Kang Yung Sun, *Collected Works*, 175).

What does this episode tell us about the South Korean scientific activities in the 1960s? If one sustains the binary scheme—that is, of rupture or continuity with colonial precedents—one might argue that it shows an ongoing continuity of the colonial relationships with the postwar U.S. influence. But the episode can be interpreted differently. Makino was the first “international presenter” invited to deliver a special lecture at the Korean Association of Biological Sciences.¹¹⁵ Kang invited him not only because Makino was his beloved former teacher, but also because he was a

¹¹⁴ Makino to Stern, 19 July 1960, Box 16, Folder “Makino, Sajiro,” Stern Papers. Kang earned his doctoral degree from his alma mater, Hokkaido University, in November 1960, based on the outcome of his genetic studies on Koreans. Although Kang had earned a doctorate from Seoul National University in 1953, he obtained another doctorate by submitting his series of articles on the population of South Korea, titled “Genetic and Statistical Studies on Korean Populations,” to Hokkaido University. For more detailed information on Kang’s thesis, see <http://www.lib.hokudai.ac.jp/en/dissertations/list/>.

¹¹⁵ Lee Chung Choo, “Yujeonhak” (cit. n. 37), 77-78.

scientist of international stature in human cytogenetics. As shown in this paper, Makino enabled Kang to forge the connection with U.S. scientists, such as Stern and Yerganian, as well as to join U.S.-led cytogenetics research programs. In that context, Kang's invitation of his teacher to Seoul was a component of his effort to make postcolonial connections with Japanese and U.S. scientists, and Makino's thanks to Stern regarding his pupil indicates intensive trans-pacific scientific exchange among U.S., Japanese, and Korean geneticists in the 1960s.

Throughout this paper, I have shown how Kang's postwar research career developed alongside his relationships with a network of Japanese geneticists, who had pursued Americanization of their research prior to Kang. Without doubt, the U.S. Educational Exchange and the Atoms for Peace Programs afforded Kang an opportunity to study human genetics in the U.S., by which he established direct contacts with U.S. geneticists. Despite the importance of the U.S. science policy in the emergence of human genetics in South Korea, the role of the Japanese geneticist network should not be ignored. In establishing the Department of Biology at Seoul National University, choosing an appropriate institution to study in the U.S., designing research surveys and experiments, and constructing intellectual networks with U.S. geneticists, Kang exploited his connections with Japanese geneticists to the fullest. Particularly, Japanese geneticists, who had already reformed their research programs and forged connections with the U.S. geneticists, helped Kang to develop new research programs, such as human population genetics and cancer cytogenetics. In this respect, if historians wish to define Kang's human genetic activity in the 1960s as the Americanization of Korean genetics, they need first to read his work as being interconnected with, or as part of, Japanese genetics.

Historians of science, who have discovered the discontinuity of the "new" science and technology system in South Korea with the Japanese colonial system, have mainly focused on institutional changes at a macro-level. On the contrary, Korean scholars outside the field of history of science, who have found the continuity of scientific activities in South Korea with Japanese colonial science, have usually concentrated on the intellectual persistence of individual scientists at a micro-level. Scientific connections and exchanges can be a unit of analysis at a meso-level, for capturing scientific activities conducted by the micro-level of individual scientists situated in the macro-level of institutional change.¹¹⁶ I propose that Kang's scientific advancements in the 1960s can be understood as the outcome of his forging new postcolonial connections among the U.S., Japanese, and Korean geneticists, primarily by way of his Japanese colonial connections. This new image of Kang's scientific activity in the 1960s indicates that concentrating on scientific connections and exchanges among scientists, beyond national borders, provides a useful lens through

¹¹⁶ On the distinction of the micro-, meso-, and macro-levels in historical analysis of science, see Steven J. Harris, "Long-Distance Corporations, Big Sciences, and the Geography of Knowledge," *Configurations* 6:2 (1998), 269-304.

which to investigate the history of scientific activity during the period, circumventing the binary scheme of continuity or rupture.

Abstract

South Korea in the 1960s is remembered as an era marked by the rapid development of science and technology, as well as the growth of the domestic economy. Historians of science have described the meaningful advancement of science during this period as a result of the establishment of a Korean science and technology system that overturned Japanese colonial precedents and sought support from U.S. science policy. In this study, however, I seek to understand the scientific achievement of South Korea in the 1960s by circumventing the binary scheme advocating either the continuity of, or departure from, colonial precedents. To that end, I shall explore Korean geneticist Kang Yung Sun's academic career, and his ongoing connections with the Japanese scientific community, from 1941 to 1968. I argue that Kang's scientific achievement in human genetics can be understood as an outcome of his efforts to develop new postcolonial relationships among U.S., Japanese, and Korean geneticists, by way of his colonial connections to a network of Japanese geneticists. Throughout the paper, I demonstrate that focusing on connections and exchanges among scientists beyond national borders can afford historians of science an opportunity to investigate scientific activities and trends in the 1960s, without sustaining the binary scheme of continuation or rupture.

Keywords: human genetics, Kang Yung Sun, Japanese colonial legacy, Americanization, postcolonial connections, transnational approach