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CHINA REVISITED

MAY 14, 1978 - JUNE 11, 1978

GLENN T. SEABORG



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Cover: Map of Cities visited in the
People's Republic of China
by the members of the Pure and
Applied Chemistry Delegation,
May-June 1978.

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CHINA REVISITED

BY

GLENN T. SEABORG

This is an on-the-spot account of my visit to The People's Republic of China, during the period May 17 to June 11, 1978, as the chairman of our Delegation on Pure and Applied Chemistry. The minimal editing, due to the pressures of time, has been largely confined to correcting the spelling of names and eliminating errors and inconsistencies. This is mainly a factual account. There was little time for philosophizing under the hurried circumstance of the writing, although it was possible to make a number of comparisons with a similar visit which I made almost exactly five years earlier (May 24 to June 10, 1973). These comparisons between my observations at the time of the Cultural Revolution (and as we now know, the "Gang of Four") and the present time are very striking. I express my appreciation to the members of our Delegation for sharing their observations with me, and especially to Robert Geyer, who lent his expertise to the transliteration (using the Wade-Giles system) of Chinese names. Also helpful were Yuan Lee, Pete Suttmeier and Jesse Hwa. For the preparation of the manuscript for publication I am indebted to Debbie Craig, Patricia Johnson, Sharon Date, Kathy Van Der Haeghen, Loretta Lizama and Helen Seaborg.

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Pure and Applied Chemistry

May - June 1978

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7-25 Members of Pure and Applied Chemistry Delegation, Hsi'ling Guest House, Hangchow, June 4, 1978. From left to right: John Baldeschwieler, James Ibers, Jacob Bigeleisen, Alan Schriesheim, James Wei, Richard Suttmeier, Ronald Breslow, Glenn Seaborg, Yuan Lee, Robert Geyer, Thurston Larson, Richard Stein.

CHRONOLOGY
CHINESE DYNASTIES

HSIA	2205-1766 B.C.
SHANG	1766-1122
WESTERN CHOU	1122-770
EASTERN CHOU	770-256
Spring and Autumn Annals	770-476
Warring States	476-221
CH'IN	221-206
HAN	206 B.C.-220 A.D.
THREE KINGDOMS	220-265
CHIN	265-420
SOUTHERN AND NORTHERN	420-589
SUI	589-618
T'ANG	618-907
FIVE DYNASTIES AND	
TEN KINGDOMS	907-960
SUNG	960-1280
YUAN (MONGOLS)	1280-1368
MING	1368-1644
Hung Wu	1368-1399
Chien Wen	1399-1403
Yung Lo	1403-1425
Hung Hsi	1425-1426
Hsuan Teh	1426-1436
Cheng T'ung	1436-1450
Ching T'ai	1450-1457
T'ien Shun	1457-1465
Ch'eng Hua	1465-1488
Hung Chih	1488-1506
Cheng Teh	1506-1522
Chia Ching	1522-1567
Lung Ch'ing	1567-1573
Wan Li	1573-1620
T'ai Ch'ang	1620-1621
T'ien Ch'i	1621-1628
Ch'ung Chen	1628-1644
CH'ING (MANCHUS)	1644-1911
Shun Chih	1644-1662
K'ang Hsi	1662-1723
Yung Cheng	1723-1736
Ch'ien Lung	1736-1796
Chia Ch'ing	1796-1821
Tao Kuang	1821-1851
Hsien Feng	1851-1862
T'ung Chih	1862-1875
Kuang Hsu	1875-1908
Hsuan T'ung	1908-1911

A CHRONOLOGY OF CONTEMPORARY CHINA

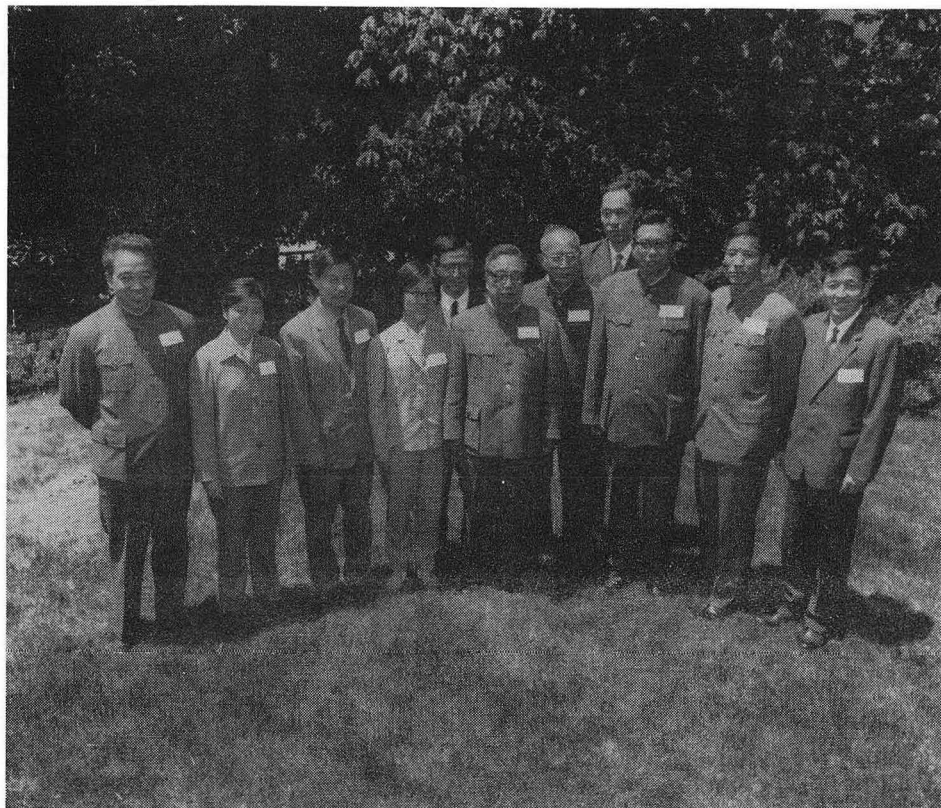
- 1911 Manchu Dynasty overthrown. Republic of China established (Sun Yat-sen).
- 1919 May Fourth Movement in Peking.
- 1921 Founding of the Chinese Communist Party (CCP).
- 1926-27 The CCP and the Chinese Nationalists (Kuomintang) jointly support "Northern Expedition" to unify China. A split occurs in 1927. CCP suffers severe losses as a result of Kuomintang (KMT) suppression. Chiang Kai-shek proclaims the unification of China under Nationalists.
- 1931 Japan invades and occupies Manchuria (the Mukden Incident).
- 1934-35 Red Army "Long March." Under strong military pressure from the Nationalists, the Chinese Communists give up their bases in Kiangsi, Hunan, and Hupeh, and march to North Shensi where they establish their famous base in Yen-an.
- 1937-45 The Chinese Communists and Chinese Nationalists agree to cooperate in opposing Japanese aggression. The formal start of hostilities occurs on July 7, 1937, at the Marco Polo Bridge. Chinese Communist political and military strength grows during the eight year struggle.
- 1945-49 After World War II, efforts to resolve CCP-KMT differences fail. Civil War ensues. The Chinese Communists win and formally establish the People's Republic of China under the leadership of Mao Tse-tung. Chiang Kai-shek and Chinese Nationalists retreat to Taiwan.
- 1950-53 Chinese Communists initiate domestic change, including land, marriage reforms. The Korean War begins in 1950 and terminates when armistice occurs in July 1953.
- 1953-57 First Five-Year Economic Plan.
- 1957 Hundred Flowers Campaign. A period of "blooming and contending of views" is followed by criticisms of rightists. Heaviest pressure on intellectuals to reform.
- 1958-61 The Great Leap Forward (GLF) in economic development begins. Communes are formed. Decentralization of industries to local control starts, but poor weather, planning difficulties, and 1960 withdrawal of Soviet technicians forces severe economic hardships on China and result in revision of many GLF policies. Liu Shao-ch'i replaces Mao as head of state though Mao remains head of the party (1959).

- 1957-63 Sino-Soviet dispute emerges. In 1957 Soviet Union agrees to furnish nuclear aid. But disagreements develop, partially as result of Formosa Straits controversy, Chinese views of nuclear and party development, and modernization programs (Great Leap Forward). In 1963 public exchange of hostile letters replaces earlier efforts to avoid open conflict. Sino-Soviet talks in Moscow adjourn without result.
- 1964 October. China's first atomic bomb test.
- 1966-69 Great Proletarian Cultural Revolution. Initial criticisms of revisionism in literature spread to wholesale attack on Liu Shao-ch'i and those who have abandoned revolutionary road. Through use of "Red Guards," i.e., middle school, university, and some grammar school students, many key leaders including Liu are removed from office, sent to work in the countryside (May 7th schools, named for Mao's statement of May 7, 1966, for reestablishing contact with the people). The holding of the Ninth Party Congress in Peking with Lin Piao designated as Mao's successor-to-be marks the supposed end of this period.
- 1971 Reports of growing criticism of Lin Piao. Lin Piao incident, i.e., death in crash of plane during reported escape attempt.
- 1972 President Nixon visits Peking.
- 1973 Liaison office is established in Peking and Washington.

First rehabilitation of Teng Hsiao-p'ing, important army and government official purged during Cultural Revolution and again in 1976.
- 1975-76 Ascendancy of the "Gang of Four," Shanghai based clique, Chiang Ch'ing (Madame Mao), Chang Chun-chiao, Yao Wen-yuan, Wang Hung-wen.
- 1976 Hua Kuo-feng becomes Chairman of Chinese Communist Party upon death of Chairman Mao Tse-tung in September.

"Gang of Four" is arrested by Chairman Hua Kuo-feng. Chou En-lai and Marshall Cho Teh also die.
- 1977 Second rehabilitation of Teng Hsiao-p'ing who reasserts top party and government posts.

Mass criticism of the "Gang of Four."
- 1978 March. National Science Conference heralds new era of freedom and importance for Chinese scientists.



Chemistry Group from the People's Republic of China Visit to the United States, April-May 1977, Visit to Berkeley, California, May 26-27, 1977. From left to right: Su Feng-lin, Staff Member, Foreign Affairs Bureau, Science and Technology Association of the People's Republic of China, Peking; Ms. Chou En-lo, Polymer Physicist, Kirin Institute of Applied Chemistry, Changchun; Wang Erh-k'ang, Inorganic Analyst, Kirin Institute of Applied Chemistry, Changchun; Ms. Hsia Tsung-hsiang, Organic Analyst, Institute of Organic Chemistry, Shanghai; Wu Yueh, Physical Chemist, Division Head, Kirin Institute of Applied Chemistry, Changchun; T'ang Ao-ch'ing, (Head of the Delegation), Professor of Physical Chemistry, President, Kirin University, Changchun; Huang Wei-yuan, Organic Chemist, Deputy Director, Institute of Organic Chemistry, Shanghai; Chang Lo-feng, Organic Analyst, Institute of Chemical Physics, Talien; Chiang Ping-nan, Physical Chemist, Deputy Division Head, Institute of Chemical Physics, Talien; Yin Yuan-ken, Physical Chemist, Division Head, Institute of Chemical Physics, Lanchow; Hsu Mao, Polymer Physicist, Institute of Chemistry, Peking.

Sunday, May 14, 1978 - Monday, May 15, 1978

- San Francisco; Fairbanks; Tokyo

Today Helen is driving me to the San Francisco Airport where I am starting on my second visit to the People's Republic of China. We leave our home in Lafayette at about 11:40 a.m. and arrive at the airport at about 12:20 p.m. Unfortunately Helen is not accompanying me this time. Wives are not included in the exchange visits sponsored by, on our side, the Committee on Scholarly Communication with the People's Republic of China and, on the Chinese side, the Science and Technology Association and the Academy of Sciences. We have learned that our "Pure and Applied Chemistry" group (consisting of chemists and chemical engineers) is being sponsored by the Chinese Academy of Sciences, the first American group to be so sponsored. This may be one of the beneficial results of the overthrow of the "Gang of Four" (Chiang Ch'ing, widow of Mao Tse-tung, Chang Chun-Chiao, Yao Wen-yuan, Wang Hung-wen).

I am, of course, very interested in comparing what we find in China now with what we found five years ago, near the end of the Cultural Revolution and during the regime of Chairman Mao when science was not held in high esteem.

I am heading a delegation of U.S. chemists and chemical engineers, chosen by a careful process of selection through a nominating committee. The members of our delegation are: John D. Baldeschwieler, California Institute of Technology, Deputy Chairman of the Delegation; Robert B. Geyer, Committee on Scholarly Communication with the People's Republic of China, Secretary of the Delegation; Jacob Bigeleisen, University of Rochester; Ronald Breslow, Columbia University; James A. Ibers, Northwestern University; Thurston E. Larson, Illinois State Water Survey; Yuan T. Lee, University of California, Berkeley; Alan Schriesheim, Exxon Research and Engineering Company; Richard S. Stein, University of Massachusetts; Richard P. Suttmeier, Hamilton College; and James Wei, Massachusetts Institute of Technology. We are scheduled to meet in Tokyo.

I board Pan American flight no. 11, which leaves at about 2:45 p.m., an hour and a half late. I check my 3-suiter and a little brown bag (that I bought in Stockholm last September) and keep with me my carry-on bag and a briefcase. I have with me, in my luggage, my Olympus camera, with a large supply of Kodachrome-64 film and my pocket size Chinon movie camera, with an ample supply of Type G movie film.

Due to the full load on our 747 we learn that we will make a refueling stop at Fairbanks, Alaska, rather than go non-stop as scheduled. Yuan Lee is aboard and we have seats side by side on the crowded plane.

During the stop in Fairbanks we talk to fellow passenger, Herbert Stein, whom I knew during his days in Washington when he served as a member of the Council of Economic Advisors during the Nixon administration, and who is on his way to give some lectures in Osaka. We also talk to my long-time friend Nathaniel Owings, world-famed architect and co-founder of the architectural firm Skidmore, Owings and Merrill, from which he has now retired although maintaining close contact. He is on his way to Japan to give a series of lectures covering aspects of his work throughout the world. As we fly out of Fairbanks we have a look at the famous oil pipeline, carrying oil from the Prudho Bay oil field. The pipeline looks like a long meandering strip of concrete below us. It disappears into the ground toward the north. We fly just south of Nome and north of Mt. McKinley, across the Bering Sea and head southwest toward Japan with assurances from our pilot that we will not fly over any territory of the Soviet Union (an obvious reference to the recent South Korean plane that strayed far from its route into the Soviet Union and was forced down by fighter planes).

We arrive at Tokyo (Haneda) Airport at about 7 p.m. (3 hours late). Since Tokyo time is 16 hours ahead of California time this means we have been in transit about 12 hours. As we approach Tokyo we have a view of the controversial Narita Airport, where we had been scheduled to land before it was put out of commission by sabotage about 2 months ago. Since we have crossed the international dateline, it is now Monday, May 15.

We go through customs (without the inspectors looking into our bags) and I change \$100 into 22,350 yen. A cab driver quotes us a price of 8,000 yen to take us to the Sanno Hotel in the Akasaka section of Tokyo and then disappears; so we find another cab driver who transports us there for a cost of 4,000 yen.

At the Sanno Hotel I find a memorandum from Clifton B. Forster, Counselor of the U.S. Embassy for Public Affairs and representing the International Communication Agency, under whose auspices I am to brief a contingent of representatives from the Japanese press on the U.S. energy problem tomorrow. The memorandum gives me the details of the arrangements and a list of the Japanese press representatives who will attend my briefing at Forster's home. I also receive a message from Bob Geyer of our delegation suggesting that he, John Baldeschwieler, and I have breakfast together tomorrow morning.

I check into room 206 and retire at about 10 p.m. (6 a.m. yesterday according to Lafayette time). The Sanno Hotel is an U.S. armed services transient billeting facility and operates with U.S. currency. Only eligible U.S. guests are accommodated.

Monday, May 15, 1978

Today is lost as we cross the International Date Line.

Tuesday, May 16, 1978 - Tokyo

I awaken at about 7 a.m. and read my various briefing papers awhile and then go down to the Sanno cafeteria to have breakfast with Bob Geyer. We go over plans for the meeting of our delegation this morning. Most of the members of our delegation also have breakfast in the cafeteria.

I go to the USFJ Conference Room to preside over a meeting of our 12-member delegation. All members (John Baldeschwieler, Robert Geyer, Jacob Bigeleisen, Ronald Breslow, James Ibers, Thurston Larson, Yuan Lee, Alan Schrieshiem, Richard Stein, Richard Suttmeier, and James Wei) are present. The meeting starts at 9 a.m., on schedule, and I begin with a remark taking note of the remarkable fact that here we are in Tokyo, at 9 a.m., Tuesday, May 16, 1978, and ready to hold our planning meeting as we had planned during our meeting in Washington, D.C. on March 27, 1978. I make some general remarks about the adventure before us and then we go on to discuss plans for preparing our report (actually a book to be prepared upon our return), holding evaluation meetings of our delegation during our visit, travel plans tomorrow, etc. We end our meeting at about 11:15 a.m.

Yuan Lee, Jacob Bigeleisen and I take the subway to the Ginza and walk around awhile and visit the Ginza Mitsukoshi Department Store where we view the Japanese art on sale. We go up to the Roof Garden to see the bonsai plants and then go down to the restaurant on the eighth floor for lunch.

We take the subway back to the Sanno district, where Lee, Richard Stein and I walk up the steps of the hill to see the Niki Jinzia (Shrine). (On June 15 it will be 500 years old.) We return to the nearby Sanno Hotel.

At about 3 p.m. I ride with Harry Kendall, Program Chief of the International Communication Agency (formerly USIA), and John Ohta, Press Section of the International Communication Agency, to the home of Justin and Robbie Bloom in the Hiroo district. Here I spend an hour with Robbie (Justin, the Science Attache in our Embassy in Tokyo, is in Washington, D.C. on a home visit) over refreshments.

I go next door to the home of Clifton B. Forster, Counselor of the Embassy for Public Affairs, for my press conference with representatives of the Japanese press. Present are: Masao Kimiwada, Economic Reporter, *Asahi Shimbun*; Yoshiyuki Watanabe, Economic Reporter, *Mainichi Shimbun*; Tetsuo Komatsu, Economic Reporter, *Yomiuri Shimbun*; Shoichi Hohri, Economic Reporter, *Yomiuri Shimbun*; Tsuyoshi Yamamoto, Political Reporter, *Sankei Shimbun*; Naomasa Fujita, Industrial Reporter, *Nihon Keizai*; Tomochika Chosokabe, Economic Reporter, *Kyodo News Service*; Takeshi Murai, Economic Reporter, *Jiji Press*; Akio Akagi, News Commentator, *NHK*; (Ms.)



Members of U.S. Delegation on Pure and Applied Chemistry, Sanno Hotel, Tokyo, May 16, 1978. From left to right: Richard Stein, Yuan Lee, Glenn Seaborg, Jacob Bigeleisen, James Ibers, John Baldeschwieler, Ronald Breslow, Alan Schriesheim, Robert Geyer, Thurston Larson. (Not in photo: Richard Suttmeier, James Wei).

Tamaki Mizutani, Interpreter (Communication International); and the following members of the Embassy: William Henoeh, Science Representative, U.S. Department of Energy; Harry H. Kendall, Press Officer; Daniel Howard, Press Officer; John T. Ohta, Press Officer; Ryonosuke Yugami, Press Officer; and Clifton Forster and myself.

I begin by telling them that I visited Japan in 1965 and 1970 as Chairman of the U.S. Atomic Energy Commission. I summarize the U.S. energy problem and describe the U.S. energy demand and supply picture. I next summarize the six sources of future energy supply (fossil fuels and their improvement, conventional nuclear, breeders, fusion, solar and geothermal). I then answer numerous questions on the energy problem (with some help from Henoeh) and also answer questions on my forthcoming visit to the People's Republic of China and on the transuranium elements. I spend a total of about two and a half hours with the press group.

I ride back to the Sanno Hotel, under the guidance of Kendall, and join Yuan Lee for dinner at a nearby restaurant, Yakiniku House. After dinner we take a walk along some of the neighboring narrow streets lined with restaurants. We return to the Sanno Hotel and I retire at about 10 p.m.

Wednesday, May 17, 1978 - Tokyo; Peking

I wake up at 5:30 a.m. and join the other members of our delegation in the Sanno Hotel cafeteria. We all ride by chartered bus to the Tokyo (Haneda) Airport. We leave the Hotel about 6:40 a.m. and arrive at the Airport at about 7:30 a.m. We spend nearly an hour checking our luggage and going through passport control, etc. and then board Japan Airlines flight no. 781, which leaves at about 9:15 a.m.

We fly southeast to the Shanghai area and then north to Peking, presumably taking this detour to avoid flying over Korea. The distance is about 2,000 miles, substantially more than it would be in a direct flight.

We arrive at Peking Airport at 12:45 p.m., exactly on time. We disembark into a slight drizzle and walk to the Airport Building.

We go through the health control (showing our yellow health cards), passport control, and then meet our hosts. Our greeting group consists of Dr. Liu Ta-kang (Director of the Institute of Chemistry in Peking), Ch'ien Jen-yuan (Deputy Director of the Institute of Chemistry and a member of the Chinese Delegation to the U.S. in November 1972), Hsu Mao (Institute of Chemistry, member of the Chinese Chemistry Delegation to the U.S. last year and a polymer physicist), Hu Ya-tung (Scientific Secretary, Institute of Chemistry, and a polymer chemist), Ch'iu Ping-chun (Foreign Affairs Bureau, Chinese Academy of Sciences), Shih Wei-ming (Foreign Relations Department of Institute of Chemistry), and Ms. Hu Feng-hsien (Oceania and Foreign Affairs Ministry). We also meet David L. Denny (who works for Bill Thomas), Commercial Economic Officer, U.S. Liaison Office in Peking, who invites us to a USLO reception Friday at 5 p.m.

We enter the huge central waiting room where we sit on the sofas and converse while our suitcases are being procured. There are now huge portraits of former Chairman Mao Tse-tung and Chairman Hua Kuo-feng high on the center wall dominating the scene.

After our suitcases are procured we ride in a caravan of 7 cars (of the familiar Shanghai type), with Liu, Ch'iu and I in the lead car; Baldeschwieler and Ch'ien in the second car; the others in the following cars. We drive along the long stretch of tree-lined Airport Road and on to Ch'ang An Boulevard to the Peking Hotel. We enter the new 17-story wing (under construction when Helen and I were here in 1973).

We receive copies of our proposed agenda (following) in China and then go to our rooms on the 8th floor. John Baldeschwieler and I have single rooms, the others double up. I am in room 8021.

ITINERARY FOR THE AMERICAN DELEGATION
OF PURE AND APPLIED CHEMISTRY

Wednesday, May 17

12:55 PM arrive at Peking Airport by JL781
4:30 PM discussion on itinerary

Thursday, May 18 (entire group)

8:30 AM Institute of Chemistry
2:00 PM Institute of Physics
6:30 PM welcome banquet hosted by Prof. Chou Pei-yuan

Friday, May 19 (entire group)

8:30 AM Peking University
12:30 PM luncheon in Summer Palace
2:15 PM Tsinghua University

Saturday, May 20 (for the whole day, Lectures and Symposiums)

8:00 AM Dr. Seaborg, Dr. Bigeleisen: Institute of Atomic Energy
8:30 AM Dr. Breslow: Institute of Materia Medica
8:30 AM Dr. Wei: Institute of Petrochemical Engineering
8:30 AM Dr. Ibers: Peking University
8:30 AM Dr. Lee, Dr. Stein: Institute of Chemistry
8:30 AM Dr. Larson: Institute of Environmental Chemistry
8:30 AM Dr. Baldeschwieler, Dr. Geyer, Dr. Shriesheim,
Dr. Suttmeier: Peking General Petroleum
Chemical Works

in the afternoon, visit to Chou Kow Tien

2:00 PM Dr. Schriesheim: lecture in Peking General Petroleum
Chemical Works

Sunday, May 21 (entire group)

8:00 AM visit the Great Wall, the Ming Tombs

Monday, May 22

8:00 AM Dr. Seaborg, Dr. Bigeleisen: Institute of Atomic Energy
8:30 AM Dr. Breslow, Dr. Baldeschwieler: Institute of Biophysics
8:30 AM Dr. Ibers, Dr. Larson: Institute of Materia Medica
8:30 AM Dr. Schriesheim, Dr. Wei: Institute of Petrochemical
Engineering
8:00 AM Dr. Stein, Dr. Geyer, Dr. Lee, Dr. Suttmeier: Peking
Vinylon Plant
2:00 PM (entire group) Palace Museum

Tuesday, May 23

8:15 AM - 1:25 PM Group A (six people) depart Peking for Harbin
by CA161, then proceed to Tach'ing by train
8:30 AM Group B (six people) Dr Larson: Institute of
Environmental Chemistry
Dr. Lee, Dr. Stein: Institute of Chemistry
Dr. Seaborg, Dr. Bigeleison, Dr. Geyer: The Museum
of the Chinese History

4:00 PM - 5:30 PM Group B (six people) depart Peking for
Talien by CA163

Friday, May 26

2:15 PM - 3:10 PM Group A depart Harbin for Changchun by CA162
Group B depart Talien for Changchun by train in the
evening of May 25 or the next morning (May 26)

Sunday, May 28 (entire group)

3:45 PM - 4:40 PM Leave Changchun for Shenyang by CA162
then proceed to Fushun by bus

Tuesday, May 30 Leave Shenyang by train at 7:35 PM

Wednesday, May 31

5:26 AM Arrive in Peking by train and proceed to Peking Airport
directly, breakfast at the airport
10:00 AM Leave Peking for Shanghai by CA151

Saturday, June 3 (entire group)

Leave Shanghai for Hangchow in the evening by train
Return to Shanghai the next evening (June 4)

Monday, June 5

1:20 PM - 3:05 PM Dr. Breslow leaves Shanghai for Peking by CA152

Tuesday, June 6 (entire group, 11 people)

7:45 AM - 11:00 AM Leave Shanghai for Sian by CA527
8:00 PM Dr. Breslow leaves Peking for Paris

Wednesday, June 7 (entire group)

6:00 PM - 8:30 AM (June 8) Leave Sian for Lanchow by train

Saturday, June 10 (entire group)

6:20 PM - 8:15 PM Leave Lanchow for Peking by CA124

Sunday, June 11 (entire group)

10:30 AM Leave Peking for Tokyo by IR800

We all have lunch at our assigned table (number 2) in the dining room - Chinese fare.

While the others set out in a number of different directions (Tien An Men Square, etc.), Baldeschwieler, Geyer and I go down to the third floor sitting room where we meet, with the traditional green tea served in large covered cups, with Ch'ien Jen-yuan (he uses the spelling Ch'ien Jen-yuan, although we spelled his name Tsien during his 1972 visit to the U.S.), Hu Ya-tung, Ch'iu Ping-chun and Shih Wei-ming to discuss our schedule. We express pleasure that all of our requests are being granted with the exception of arrangements for talks with Chinese officials on science policy matters. We request that a meeting or two with Chou Pei-yuan, and perhaps others, be added and Ch'ien Jen-yuan agrees to investigate this possibility. We also suggest a wind-up session for Saturday night, June 10, when we return from Lanchow and just before we head home to the U.S. on June 11. Ch'ien also agrees to pursue this. Finally we ask that a time be set aside, probably next Monday evening, when we can give a dinner for our Chinese hosts. This meeting runs from about 4 to 4:45 p.m.

John Baldeschwieler and I then engage Ch'ien and Hu in informal conversation on a number of Chinese policy issues. We learn that the Chinese Academy of Sciences does not have members, is a semi-governmental, operating, entity with its President and Vice President appointed by the Premier. The Academy is hosting our delegation which is somewhat unusual in that the Science and Technology Association has been playing this role. Tsien San-tsiang is now Vice President of the Academy of Sciences. He is no longer active as director of the Institute of Atomic Energy.

The Chinese Chemical Society effectively ceased to function during and after the Cultural Revolution and its membership roll has been lost. The President is Yang Shih-hsian of Nankai University in Tientsin, who is old and not very active. Liu Ta-kang is Vice President, Hu Ya-tung is Secretary, and the secretariat is located at the Institute of Chemistry. The Chemical Society is being reactivated since the overthrow of the "Gang of Four" and a General Assembly is planned for next October in Shanghai and will presumably elect officers.

Graduate students are being selected by examination procedures since the overthrow of the "Gang of Four." Today happens to be the last day of the 3-day examination. The Institute of Chemistry will admit about 20 students out of a total number of applicants exceeding 300.

The Institute of Chemistry's budget is being substantially increased. The budgeting is done in two categories, Chinese yuan and U.S. dollars. The latter is used to buy equipment and is the most difficult to acquire. They are also given manpower allocations.

Physics is better supported than Chemistry in China. A new Institute of High Energy Physics has been created and they will build a high energy proton accelerator somewhere in the Peking area.

We inquire about Chien Hsueh-sen, the space scientist who returned to China in 1955. He is working in some ministry on governmental work. This discussion lasts about 45 minutes.

John Baldeschwieler, Robert Geyer and I then take a walk down Ch'ang An Boulevard to Tien An Men Square. I find that the huge pictures of Marx and Engels, to the left, and of Lenin and Stalin, to the right, are still there as well as the huge picture of Mao in front of the Great Hall of the People, as I found them in 1973. There is no such picture of Chairman Hua to be seen. We see the new Mao Mausoleum at the south end of the square. We get caught in a rather heavy shower and find some shelter under the columns in front of the Museum of the Revolutions and then return to the Peking Hotel.

As we enter the hotel lobby we meet members of the UPI delegation visiting China, who arrived today on the same plane as we from Tokyo — my old friends Ted and Jean Scripps and Jack Howard of the Scripps-Howard Newspapers; Rod Beaton, President of UPI; H. L. Stevensen, Editor of UPI; Jim Schurz, formerly of the San Francisco Examiner, and others.

The Scripps tell me that they were present for my commencement address at Duke University a week ago Sunday.

I go up to my room. Bill Thomas, of the U.S. Liaison Office, drops by to say hello.

Our delegation members, except Jim Wei (who is visiting with his sister), have dinner at our table in the dining room. After dinner we assemble, with the gifts we brought for our hosts, in my room and make decisions as to how to apportion them.

Thursday, May 18, 1978 — Peking

I awake about 6 a.m. after finding it somewhat difficult to sleep.

My room is more modern than our room 5 years ago. It has twin beds, as before, a TV set and bedside controls for radio. The bathroom also conforms very much to American standards, with its toilet, wash basin, tub, and, in this case, a hand-operated shower apparatus.

We all have breakfast at our table (number 2), eight choosing Chinese and four (Stein, Larson, Bigeleisen and I) western style breakfasts. I go over plans for our visit to the Institute of Chemistry this morning, coordination of note taking, picture taking, etc.

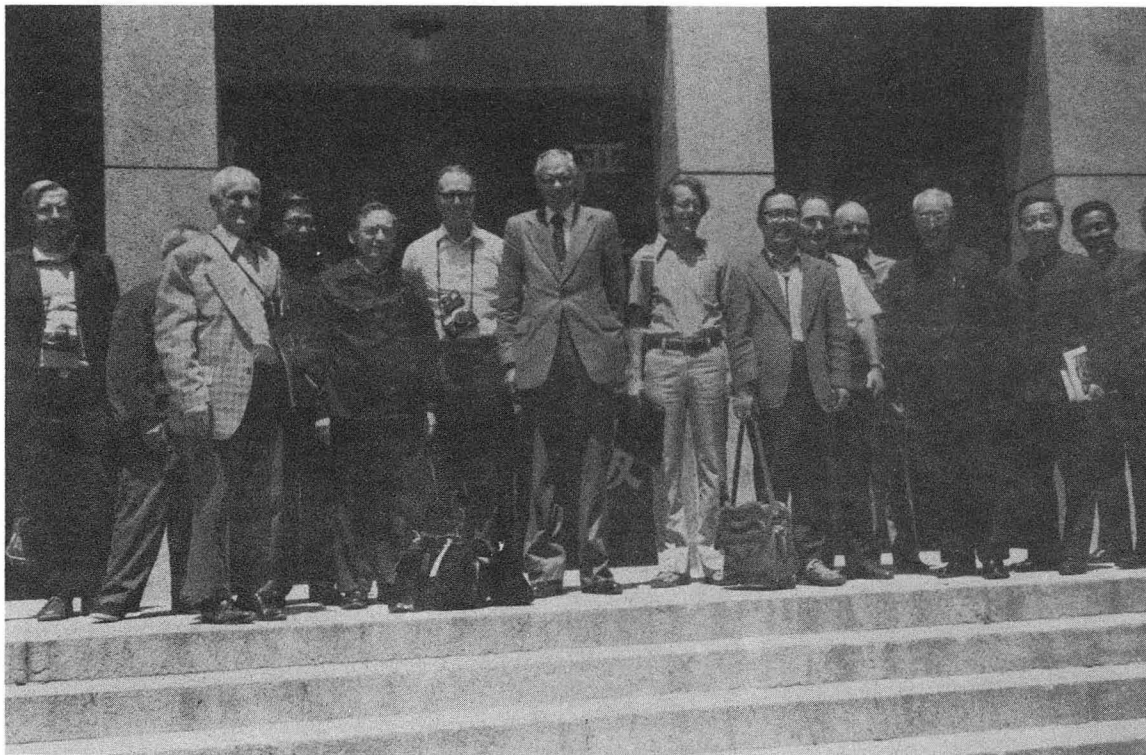
We assemble in the lobby at about 8:15 a.m. and find we are due at the Institute of Chemistry at 8:30 a.m. The word hadn't reached us. We are met by Ch'iu Ping-chun; Shih Wei-ming; Ms. Hu Feng-hsien, Oceania and Foreign Affairs Ministry; Ms. Ts'ao Hsuan-hsuan, Institute of Environmental Chemistry, Academy of Sciences; Ms. Chang Hsiao-hsiao, Foreign Affairs Bureau, Academy of Sciences.

We leave at about 8:35 a.m. in our caravan of cars. I ride in the lead car with Yuan Lee and Shih Wei-ming. John Balde-schwielier and Geyer follow in the second car, and the others are in following cars.

We drive west along Ch'ang An Boulevard, then generally north and west to the area where the Institute of Chemistry is located — many Chinese Academy of Sciences (CAS) Institutes are located here. We meet many trucks with PLA personnel enroute and other trucks and buses and almost no passenger cars. There are many bicycles of course. There is much more traffic than in 1973 when the trip could be easily made in 30 minutes. The horns are honked incessantly as in 1973.

We arrive at the Institute of Chemistry at about 9:15 a.m. and are met by Director Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Shih Liang-ho (Professor), Chiang Ming-ch'ien (Professor), Wang Pao-jen (Professor), Hsu Mao, joined by additional laboratory members.

After taking pictures of the combined groups on the front steps of the Institute we go to the same second floor reception room as in 1973, joined by additional laboratory members, and take our places in chairs and sofas with the large covered white cups of green tea. Those present include Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Shih Liang-ho, Wang Pao-jen, Ms. Woo Mel-yein, Chiang Ming-ch'ien, Hsu Mao, Ms. Ma Fu-jung (Peking University), Wang Shou-tao, Tsui Men-yuan, Huang Chih-t'ang (polymer chemist), Yen Chi-min, Yeh Ch'eng, Wu P'ei-chi, Ms. Teng Li-ju, Teng Shao-lin



Institute of Chemistry, Peking, May 18, 1978. From left to right: Suttmeier, Chiang Ming-ch'ien (Professor), Stein, Hu Ya-tung (Scientific Secretary), Bigeleisen, Schriesheim, Seaborg, Geyer, Wei, Ibers, Larson, Liu Ta-kang (Director), Ch'ien Jen-yuan (Deputy Director), Hsu Mao, Shih Liang-ho (Foreign Relations Department).

(Librarian), Chuei Men-yuan, and the guides who escorted us here this morning. (Liu Ta-kang did his graduate work with Albert Noyes at the University of Rochester and received his Ph.D. in 1946.)

We see large pictures of Engels, Marx, Lenin and Stalin on the wall, over the entrance door.

Liu makes his welcoming remarks, speaking Chinese with Shih Liang-ho serving as interpreter, and I introduce the members of our delegation individually, with Geyer as interpreter. Liu describes the history of the Institute, as he did in 1973. There are about 700 workers (300 scientists, of which 40 have a Ph.D. degree or equivalent) at the Institute and of these about 150 are working in polymer chemistry and 50 in polymer physics. The polymer research started at the Institute of Organic Chemistry in Shanghai in 1953, and moved to Peking in 1956, when the Institute of Chemistry was started. He then calls on members of the Institute to give short preview reports on their work that we are about to visit. Shih Liang-ho serves as interpreter and as a sort of introducer of the speakers. Liu tells us they will speak in English, for practice, the first time this is being attempted.

The first person to report is Chuei Men-yuan who speaks on photo-oxidation and photo-degradation of polypropylenes, the copolymerization of polypropylene and co-blending of polypropylene and substituted piperidines. He shows us a sample of their product in the form of string on a spool. He reads from prepared text with the help of charts (as do the following speakers).

Next Huang Chih-t'ang speaks on heterocyclic polymers, such as polyimides, also reading from prepared text and using charts. He describes work on polyphenylquinoxaline. This can be used for coating electrical conducting wire. He also describes the polymerization of dinitriles.

Chiang Ming-ch'ien next reports on "A Quantitative Relationship Between Molecular Structure and Physico-Chemical Properties." He gives us reprints of his work published in *Scientia Sinica* in November-December 1977, and March-April 1978.

Next Yen Chi-min reports on "Graph Theory of Molecular Orbitals." His presentation evokes questions and comments from John Baldeschwieler, Ronald Breslow and Jacob Bigeleisen. Our group finds this to represent a very interesting approach.

Yeh Ch'eng next speaks on the organic semi-conductors Tetrathiofulvalene (TTF) and Tetracyanoquinodimethythan (TCNQ). He circulates some samples for us to see. This talk evokes responses from James Ibers, Richard Stein, John Baldeschwieler and Jacob Bigeleisen.

Wu P'ei-chi speaks next on photography. He speaks in English without having to read his prepared text, describes the

use of organic polymers in photography. Development occurs as the result of dimensional change emanating from electrostatic force.

Ms. Teng Li-ju next reports on "Polymeric Stationary Phase of Chromatography." She reports on co-polymerized divinylbenzenes and other products and their use in liquid chromatography. These are used to separate C-10 to C-20 alkanes. Some of their compounds are used for the separation of steroids. She describes a sample mathematical expression to explain the mechanism of their separations.

The next speaker, Wang Shou-tao, is the most fluent in his English. He speaks on crystal structure determinations. In answer to a question from Jacob Bigeleisen he says he uses a TQ16 computer which is made in China and which has an operating time of 10 microseconds. They have developed a new computer program - Ronald Breslow asks if this will be published in international journals so this information can become available; Wang answers that they will publish it in China.

Hsu Mao speaks next on his work in polymer physics, solid state and polymer morphology studies, and illustrates his talk with slides. (He was a member of the delegation of Chinese chemists that visited the United States last year and I met him at that time.) He has built a photographic small-angle light-scattering apparatus (SALS), following a design conceived by Dick Stein of our Delegation.

I am impressed by the youth of the speakers, their obvious great effort to accommodate us by speaking English and the great amount of effort they have put into the preparations of charts, etc.

At the conclusion of these presentations we engage in a general discussion of their methods of conducting research, their relations with universities (students come from universities to conduct research at the Institute).

We finish the briefing at about 11:30 a.m. and then visit a laboratory in the building - the polypropylene laboratory on the fourth floor.

We then divide into our two groups and tour. My group, accompanied by Ch'ien, Liu and others, sees in two rooms the Gel Permeation Chromatography (GPC) equipment, shown us by Shih Liang-ho, (built in the Institute) and a holographic laser setup (made in West Germany, but they have the capability to manufacture this now), shown us by Wu P'ei-chi.

We then go to a nearby building where we see an x-ray crystallography laboratory, shown us by Wang Shou-Tao.

We then go to another building to see the thermochemistry laboratory, shown us by Yen Hai-ko. This second building was built 3 years ago. They have determined the heat of formation of benzoic

acid very accurately -- a reference standard. In the same building we see a mass spectrometer (AEI type, from England) shown us by Pian Tze-liang and Ms. Li Chung-ming.

We return to the second floor reception room, and, after some windup remarks by Liu, I express thanks and present some gifts (ACS centennial neckties, ACS centennial first-day covers and Joseph Priestley bicentennial first-day covers to Liu, Ch'ien and Hu; an HP-21 calculator and battery charger to Liu; some of my reprints and books to Liu, and Bigeleisen gives Liu some NAS publications). I express a final thank you and then we assemble in front for more pictures.

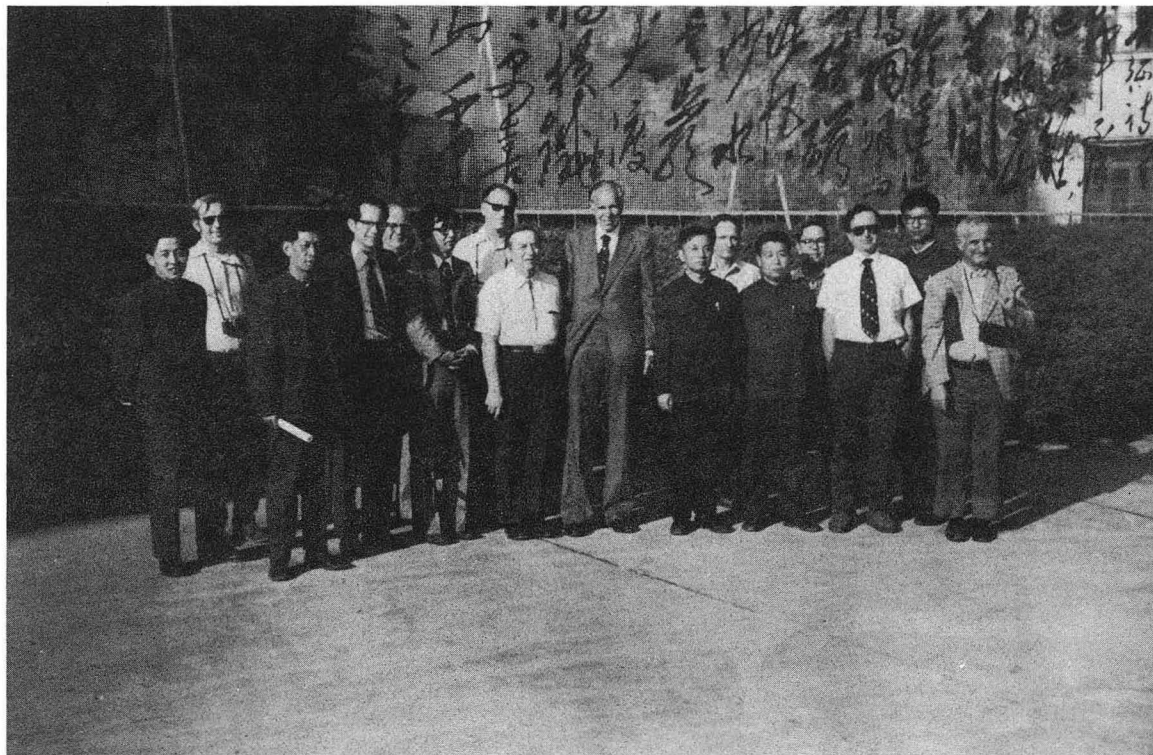
We take our leave at about 12:30 p.m. I ride back to the Peking Hotel with Yuan Lee and Hsu Mao.

Our delegation has lunch at our table and we compare notes about our morning and decide that we have a generally favorable impression.

At 2 p.m. we start off in cars, as this morning, to the area of research institutes to visit the Institute of Physics. The weather is sunny and warm but not hot. Yuan Lee and Hsu Mao are in the car with me and Hsu points out the Guest House on "Two Mile" Street where Nixon stayed when he visited Peking in 1972.

We arrive at the Institute of Physics at about 2:40 p.m. and are greeted at the entrance by Kuan Wei-yen, Deputy Director (who was trained in the Soviet Union); Wang Ju-ching, Foreign Affairs Division; Han Chian-kuo, interpreter; and Hsieh Chang-hsian, staff.

We go to the reception room on the second floor where I met with my hosts in 1973; again there are pictures of Marx, Engels, Lenin and Stalin on the wall at the far end of the room. We are greeted by Kuan Wei-yen. I introduce the members of our delegation. Kuan says there are 1,200 people working at the Institute and that they have a Tokamak, study amorphous magnetic material, magnetic bubbles, microwave absorption by ferrite, work on crystals such as lithium iodate, have a low temperature laboratory with a helium liquifier (built in the Institute), a superconducting magnet (with a field of 110,000 gauss) and reach temperatures of 0.07°C, have a high pressure laboratory, a laser laboratory (10.6 micron wavelength, carbon dioxide laser), intend to use lasers in isotope separation, have a program on information processing in the laser laboratory, have an acoustic laboratory (with voice and linguistic equipment), have a theoretical group (which studies gravitational effects and elementary particles). He briefs us on the eight-year scientific research plan established at the recent National Science Congress in Peking and emphasizes that high energy physics is included in this plan. They are participating in the national eight-year program as part of their planning. In this connection he mentions the recently created High Energy Physics Institute in Peking. A proton accelerator, much like the Brookhaven AGS, is planned, the



Institute of Physics, Peking, May 18, 1978. From left to right: Hsu Mao (Institute of Chemistry), Suttmeier, Hsieh Chang-hsien (staff), Baldeschwieler, Larson, Lee, Schriesheim, Bigeleisen, Seaborg, Kuan Wei-yen (Deputy Director), Ibers, Wang Ju-ching (Foreign Affairs Section), Wei, Breslow, Han Chien-kuo (interpreter), Stein.

energy is not yet determined, perhaps about 30 GeV, to be built in Peking with which they coordinate their programs.

In response to our questions they describe some of the publications of the Academia Sinica — the Acta Sinica (published in Chinese and English), Acta Sinica Physica, and other journals.

They are starting to enroll graduate students again. They also hope to have Institute members teach in universities as they used to before the actions of the "Gang of Four." They tell us the Chinese Physical Society is now active. We also touch on the relationship of the People's Republic of China to the International Union of Physics, and receive the answer that such a relationship cannot occur because of the Taiwan problem.

The priority order of emphasis on physics in China is (1) high energy physics, (2) material science, (3) lasers. Their energy problem is not so urgent as in the United States because of their sources of oil, coal, etc., and their only emerging industrial uses of energy. The emphasis on high energy physics is for prestige purposes and because of the practical "spinoff."

We terminate this discussion at about 3:30 p.m. and then begin our tour of laboratories in this building. We first go to the laser laboratory on the third floor, where the research program is explained by Shu Chi-jen. They are doing fundamental research on molecular fluorescence processes and plan to work on isotope separation. Their carbon dioxide Transfer Excitation Atmospheric-pressure (TEA) laser delivers 6 to 7 joules for pulse and has 3 to 4 seconds between pulses. They are studying the multiphoton dissociation of BCl_3 via observations on instantaneous and delayed fluorescence. They hope to produce the separated ^{10}B isotope.

We then go down to the laboratory on the second floor where the work on magnetic bubbles goes on. This is explained to us by Liu Yin-lieh.

In a neighboring room we hear a description of the work on magnetic resonance.

We then go down to a room at the far end of the first floor to visit the high pressure physics laboratory. Here we receive a description of the apparatus that can give a total force of 1,200 tons, resulting in a pressure of 100,000 atmospheres. They have synthesized diamonds, both by use of this press and by an explosive method. Many of their research results in the production of diamonds are shown to us in a series of slides projected on the wall of the laboratory. We see samples of artificial diamonds that they have produced and samples of rock cores drilled out using artificial diamond drills. They use such synthetic diamonds in industrial work already.

We go to the opposite end of the building to a room with

an exhibit of many kinds of crystals that they have produced, described by Mo Yu-chun. I take pictures of displays of crystals including diamonds, ruby rods (for lasers), lithium niobate.

We now go to a neighboring connecting laboratory where they make liquid helium, capacity 20 liters per hour, have a superconducting magnet which can produce fields up to 110,000 Gauss. Wang Ju-ching, who showed me this laboratory in 1973, shows me some new equipment here.

We walk to a nearby new building where fusion research takes place. Li Yin-an explains their work on the D plus T reaction. They are building a GBH-1 machine (high beta torus). They get 2.5 megajoules from their capacitor banks. They anticipate plasma densities of 10^{14} - 10^{15} per cm^3 , plasma temperature 100 - 600 eV and confinement times of 100 microseconds. Building of the machine started in 1977. In answer to my questions he says they have some limited supply of deuterium, for sure; but he isn't so sure about the supply of tritium. They measure the temperature by the emission of soft x-rays. He says they first saw thermonuclear neutrons from linear theta pinch in 1969. They expect GBH-1 to be completed in 1979. He says there is work on thermonuclear reactions going on at the Southwest Institute of Physics in Szechuan province and, on laser fusion, at the Institute of Optics and Fine Mechanics in Shanghai.

In a neighboring huge room we see their Tokamak device, built in Peking for which design started in 1973 and which has been operating since 1974. The electron temperature of the plasma is about 3,000,000 degrees. They have increased the minor diameter of the plasma from 10 cm to 12 cm. They have not yet measured confinement time and concentration, nor the ion temperature. The energy of the toroidal magnet field per pulse is 3,000,000 joules (storage capacity of discharge bank), discharged in a period of 60 milliseconds. Next year they will build a larger Tokamak at the Southwest Institute of Physics in Szechuan (twice as large in diameter with 10 times the present energy storage). They do not yet plan to use superconducting material. This explanation is by Liu Chia-juei. Shen Chu-t'ung and Ch'en Tsu-te help with the briefings on the fusion work.

We return to the reception room where Kuan Wei-yen makes some concluding remarks. I express our appreciation and present Kuan with our gifts — an HP-21 calculator and battery charger, a book on western U.S. parks (written in Chinese), book on New York, Chicago and San Francisco. We go out in front and take pictures.

I ride back to the Peking Hotel with Yuan Lee and Hsu Mao, arriving about 6 p.m.

After changing clothes we assemble in the lobby at 6:30 p.m. to ride in our cars to the Fan Shan Restaurant in Pei Hai (North Sea) Park. This restaurant and park were reopened on March 1,

as an imitation of the Imperial Kitchen, after being closed for about 8 years under order from the "Gang of Four." Chiang Ch'ing used this as her private retreat. It was built at the time of the Yuan Dynasty, 500 years ago. When we arrive we are greeted by Chou P'ei-yuan and about 30 others. Present are: from the Chinese Academy of Sciences — Chou P'ei-yuan, Vice President, Chinese Academy of Sciences and Director, Chinese Science and Technology Association, (also President, Peking University), Li Su (Secretary and Director of the Chemistry section); from the Foreign Affairs Bureau of the Chinese Academy of Sciences — Chu Yung-hang (Deputy Director), Feng Yin-fu (Deputy Director), Li Ming-te, Ms. Chang Hsiao-hsiao, Ch'iu Ping-chun; from the Institute of Chemistry — Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Kuo Ch'u, Shih Liang-ho, Ch'en Kuan-wen, Hsu Mao, Wang Pao-jen, Teng Shao-lin, Shih Wei-ming; from the Foreign Ministry — Hu Feng-hsien, Lian Cheng-pao, Hsiao Hsin-wen; from the Institute of Environmental Chemistry — Shen Pao-ch'eng, Ts'ao Hsuan-hsuan; from the Inner Mongolia Teacher's College — Li Kuan-hwa; from Peking University — Chang Ch'ing-lien (Professor of Chemistry); from the Petrochemical Research Institute — Wu Chin-ch'eng (Chief Engineer); from the Institute of Atomic Energy — Wang Te-hsi (Deputy Director); from the Institute of Material Medica — Huang Liang.

We sit in a reception room to converse with our hosts and have the traditional green tea. Ron Breslow and I sit with Chou P'ei-yuan. Soon we go to our tables for dinner.

I sit at a table with Chou P'ei-yuan, Li Ming-te (now with the Bureau of Foreign Affairs of the Chinese Academy of Sciences), Li Su (Deputy Secretary General and Head of the Chemistry Division, Chinese Academy of Sciences), Wang Pao-jen (Deputy Director, Institute of Chemistry), Lian Cheng-pao (Deputy Head, Department of Americas and Oceania, Foreign Ministry), Ms. Hu Feng-hsien, Department of Oceania and Foreign Affairs, Foreign Ministry), Chu Yung-hang (Deputy Director, Foreign Affairs Bureau, Chinese Academy of Sciences and who visited the U.S. with Chou P'ei-yuan in 1975), John Baldeschwieler, Thurston Larson and Bill Thomas.

Near the beginning of the dinner Chou makes his welcoming remarks, referring to the Shanghai Communique of 1972, the visit of Chinese chemists to the U.S. last year, expressing delight that our delegation on pure and applied chemistry is in China now.

The dinner is multi-course and tasty. The courses consist of five cold dishes in the form of a bird, fish maw, elephant eye dove eggs, fried Buddha's hand, squash, fried prawns, fried pork with hot pepper sauce, steamed fish, beans with chicken oil, meat pie in pancake, lotus seed bean paste soup, cold and hot cakes and fruit.

Toward the end I respond, with Li Ming-te serving as my interpreter, to Chou's welcome and toast. I say this is my second visit to China but it is the first for all the other members of our

delegation and emphasize how we are all the envy of our chemist colleagues because they all wanted to be members of our Delegation. I mention my visit five years ago and our meeting with Chou En-lai, compare my impressions now with those on my visit five years ago (noting the greater feeling of freedom for Chinese scientists now), describe the visit of the delegation of Chinese chemists to the U.S. last year and my hope to see Professor T'ang on this visit. I present Chou with an "Accelerator Forest" from the Lawrence Hall of Science and Professor Liu with an ACS Bicentennial key. I end with a toast to the continued friendship between the scientists and the peoples of our two countries.

Sitting next to Chou P'ei-yuan, I explore a number of items with him. I tell him we hope that the Chinese will become involved with Chemical Abstracts and exchange journals with the American Chemical Society; he says he will explore this. I ask if he knows of any historical letters of Chinese physicists and he says he thinks none have been preserved; he recalls for me Joseph Needham's great work "Science and Civilization in China."

I invite him to have Chinese chemists attend the Pacific Chemistry Congress in Honolulu next April. He indicates that this may be sooner than they can be ready to do this.

Chou tells me that it will be possible for western scientists to visit more and more places in China as we are going to do in Lanchow, as soon as Chinese industry can get the places ready. He tells me that soon after he returned to China after his visit to the United States in 1975 he found his situation and that of his scientific colleagues getting very difficult due to the anti-science attitudes of the "Gang of Four." He tells me the Science and Technology Association is an association of scientific societies of a non-governmental nature, whereas the Academy of Sciences is like a governmental agency.

Chou P'ei-yuan, Li Ming-te and Chu Yung-hang all ask me to pass on their best regards to Helen.

The dinner breaks up at about 8:30 p.m. and we say a lingering farewell to our hosts. I ride back to the Peking Hotel in a car with Yuan Lee and Ms. Chang Hsiao-hsiao. I retire at about 11 p.m.

Friday, May 19, 1978 - Peking

I arise at 6:30 a.m., do some journal writing and go down to breakfast with our Chemistry Delegation at our table. I brief the group on my visits in 1973 to Peking University and Tsinghua University because we are all scheduled to visit there today. I describe our briefings, then by the vice chairmen of the Revolutionary Committees, and the then prevalent system of education in the universities — shortening of curriculum to 3 years, political criteria for admissions of students, work of the students and professors in factories, cooperative method of student examinations, etc. We also go over plans for some members to go shopping, our plans for dinner in various Peking restaurants, the reception at the U.S. Liaison Office this afternoon, etc.

We assemble in the lobby for our visit to Peking University at 8:30 a.m. Here I meet Mr. and Mrs. Jack Howard and Mr. and Mrs. Edward E. Estlow (he is president of Scripps-Howard Newspapers). We exchange observations on our activities yesterday. Their UPI group is to visit the Mao Mausoleum this morning.

I ride with Yuan Lee and Bill Thomas (who will visit Peking University with us this morning). Bill points out the residence of Chairman Mao, just west of the Forbidden City. Bill tells me the period of peak activity of the "Gang of Four" was from January 1976 (time of Chou En-lai's death) to October 1976 (time just after Mao's death).

We arrive at about 9:15 a.m. and are greeted by Professor Chang Lung-hsiang (Dean of Studies and Professor of Biochemistry), Ch'ien Jen-yuan (here from the Institute of Chemistry), Chang Ch'ing-lien (Responsible Person, Department of Chemistry and Professor of Inorganic Chemistry), Hsu Chen-ya (Responsible Person, Department of Chemistry), Huang Tzu-ch'ing (Professor of Physical Chemistry), T'ang Yu-ch'i (Professor of Physical Chemistry), Kao Hsiao-hsia (Professor of Analytical Chemistry), Feng Hsin-te (Professor of Polymer Chemistry), Hsing Ch'i-yi (Professor of Organic Chemistry).

The huge statue of Chairman Mao dominates the entrance area.

We take a number of pictures of the combined group.

We go into a reception room in an attractive little building and sit at a long table. Dean Chang gives us a briefing on Peking University. The University was founded in 1898; so they celebrated their 80th anniversary recently. Chairman Mao attended this university (1918-1920) to study Marxism. The University is the site of the May 1st revolution. There are 22 departments, 2,000 staff with more than 6,400 students. They have had 20,000 graduated between 1949 (Liberation) and 1966 (start of the Cultural Revolution). This year 1,800 new undergraduates will enter.



Peking University, May 19, 1978. Schriesheim, Suttmeier, Seaborg, Ibers, Wei, Baldeschwieler, Geyer, Stein and Ch'ien Jen-yuan (Institute of Chemistry), Teng Shao-lin (Institute of Chemistry) with Peking University hosts, Kao Hsiao-hsia (Professor of Analytical Chemistry), to right of Seaborg, Chang Ch'ing-lien (Professor of Inorganic Chemistry), to right of Wei and Baldeschwieler, Huang Tzu-ch'ing (Professor of Physical Chemistry), extreme right, Tang Yu-ch'i (Professor of Physical Chemistry), next to Huang, Hsu Kuang-hsien (Professor of Physical Chemistry), Feng Hsin-te (Professor of Polymer Chemistry), Hsing Ch'i-yi (Professor of Organic Chemistry), Hsu Chen-ya (Responsible Person, Department of Chemistry).

He describes the setback due to the Cultural Revolution and especially the "Gang of Four" — the low academic standards, lack of entrance examinations, etc. This has all been changed within the last year since the overthrow of the "Gang of Four." Now they have entrance examinations and are reinstituting high academic standards. This introduces problems with the students who came in without examination with which they cope as best they can.

Professor Chang Ch'ing-lien describes the various departments. In chemistry they have 3½ buildings — North, South and Main and half of the geology building. The Chemistry Department has 250 teachers (including 12 professors) and 550 students. They are reinstituting research work. Each student must take some laboratory work. They are beginning to have graduate students again (they must pass an admission examination) — they plan to enroll 50 next fall. The final decisions for the admission of students are made by the University administration and professors. Political considerations are still a factor in admission.

They are reinstituting the ranks of assistant, associate and full professors. On the 80th anniversary they promoted 34 to full professor and 3 to associate professor. The last previous promotions were in 1963. They serve 6 or 7 years as associate professor. All three ranks have tenure — actually they can't leave if they want to. The academic staff spends about half-time teaching and half-time in research.

The graduate school admission examination was completed yesterday (the last of 3 days) — there will be a follow-up oral examination to provide further selection.

Jacob Bigeleisen asks for a copy of the graduate admission examination; the answer is they will inquire if they can furnish this.

The undergraduate curriculum is now back to 4 years (compared with 3 years during the Cultural Revolution). The graduate student period may average 3 years, varying with students' progress. The students will spend about half-time on courses and half-time on research and will write a dissertation.

There are quotas for different nationalities, some disparity between admission of men or women, depending on the major subject.

All the chemistry students take the same courses the first three years and then they can specialize. The curriculum includes, for the first year, English, general chemistry, mathematics and physics; the second year, English, analytical chemistry, organic chemistry, physics and mathematics; the third year, physical chemistry, structural chemistry and industrial engineering; the fourth year, advanced special courses and small research projects. They

do not have a course in inorganic chemistry, other than the specialized course in the fourth year. English is first choice as a foreign language and is taken the first two years.

A student can transfer from one department to another only in rare cases. This may be changed because they intend to introduce interdisciplinary courses.

In middle school they have 4 years of physics and 3 years of chemistry.

We wind up this session at about 10:15 a.m. and divide into two groups to visit laboratories. I go with the physical chemistry group to the South Chemistry Building (the organic chemistry group goes to the Main Chemistry Building). My group consists of Jacob Bigeleisen, Yuan Lee, James Wei, John Baldeschwieler, James Ibers, Alan Schriesheim, Robert Geyer and hosts Huang Tzu-ch'ing (a M.I.T. Ph.D., who tells me he reads all of Hildebrand's papers and admires him very much), T'ang Yu-ch'i (Cal Tech Ph.D., 1946-50, with Linus Pauling and David Shoemaker), Hsu Kuang-hsien (interested in actinide chemistry, whom I met in 1973), Chang Yu-ming (a student of T'ang), Chang Ch'ing-lien (who is interested in transactinide elements).

We go to a small room in the South Chemistry Building where Huang Tzu-ch'ing tells us about his problems due to lack of staff members and out-of-date equipment, a result of the actions of the "Gang of Four." He briefs us on the operation of his crystal structure research group. He shows us some of the books written in Chinese that they use for their students. One of T'ang's books has a section on statistical mechanics covering the work of Jacob Bigeleisen. He gives Jake a copy of this book entitled "Statistical Mechanics Applied to Physical Chemistry" and also gives us some reprints.

T'ang then takes us to see his crystallography laboratory with its x-ray diffraction equipment (built at Peking University machine shop) on the ground floor.

In a neighboring room Shu Shai-chen and Shao Mei-cheng show us a Weissenberg precision camera (built here).

In a room on the second floor Chang Yu-ming shows us his thermo-chemical laboratory. He studies ionic solvation by measuring heats, free energies and entropies of solvation of perchlorates in formamide as solvent. They have a microcalorimeter for measuring heats of solution.

We now walk across to the North Chemistry Building. I talk to Chang Ch'ing-lien (who worked with Bodenstein in Germany) and give him my reprints, "Chemistry of the Transactinide Elements" and "Actinides and Transactinides."

We go to a laboratory for isotopic analysis, where Chang Ch'ing-lien describes his research program and apparatus. They analyze for ^{15}N and ^{18}O and will do ^{13}C in the future. He tells us the separation of oxygen isotopes is carried out in "North China" by water distillation. Bigeleisen suggests that Chang participate with the U.S. Bureau of Standards in intercalibration experiments.

Chang Ch'ing-lien then takes us to the nearby infrared spectroscopy laboratory (which utilizes a Unicam SP 100, purchased from England in 1964). Ms. Wu Ching-kuan and Ms. Chang Shien-chi show us this equipment.

As we go back to our starting point, Chang Ch'ing-lien tells me he visited New York City, Niagara Falls and Vancouver (via the Canadian Pacific) in the summer of 1937 following a year in Stockholm and two years in Berlin University (1934-1936) in Bodenstein's Institute.

We assemble (both our groups) at the front yard of the Main Chemistry Building at the conclusion of our tours. I present Dean Chang Lung-hsiang with an HP-21 calculator and battery charger.

We say a lingering goodbye to our hosts and then our entire delegation rides to the nearby Summer Palace in our cars, I with Yuan Lee and Ch'ien Jen-yuan. We arrive at the Summer Palace at about 11:45 a.m., where Teng Shao-lin (of the Institute of Chemistry), Ms. Ts'ao Hsuan-hsuan and Ms. Hu Feng-hsien serve as our guides.

We enter the front gate and see first the Hall of Longevity and Happiness. We walk through the grounds stopping to go into many of the picturesque buildings. The construction of the Summer Palace started during the Ch'ing Dynasty. It is here that the Dowager Empress built so much using funds diverted from the Navy budget.

We walk by Quen Min Lake, go into the Hall of Harmonious Virtue, then pause in the area of the ancient Peking Opera.

We walk along the Long Corridor which is decorated with 3,000 painted pictures, see the Fragrance of Buddha Temple on the top of the nearby Hill of Longevity, arrive at the Restaurant of Listening Orioles where we are to have our lunch.

Here we are greeted by Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Li Ming-te, Chiang Ming-ch'ien (who got his Ph.D. in 1944 with Roger Adams and worked at the Eli Lilly Company until 1947), Feng Yin-fu, Ch'en Kuan-wen.

I sit at a table with Liu, Chiang, Hu, Li, Bigeleisen, Larson, Schriesheim, Suttmeier and Geyer. We have an excellent Chinese lunch, consisting of eight assorted cold plates, sea cucumber meatballs, wok-braised chicken, crispy live fish, Mu Shi



Fragrance of Buddha Temple on the Hill of Longevity, Summer Palace, Peking, May 19, 1978.

shrimp (shrimp with tree ears), meat cubes with hot pepper sauce, shredded beef with onions, mushrooms with vegetable flowers, and clear squid soup.

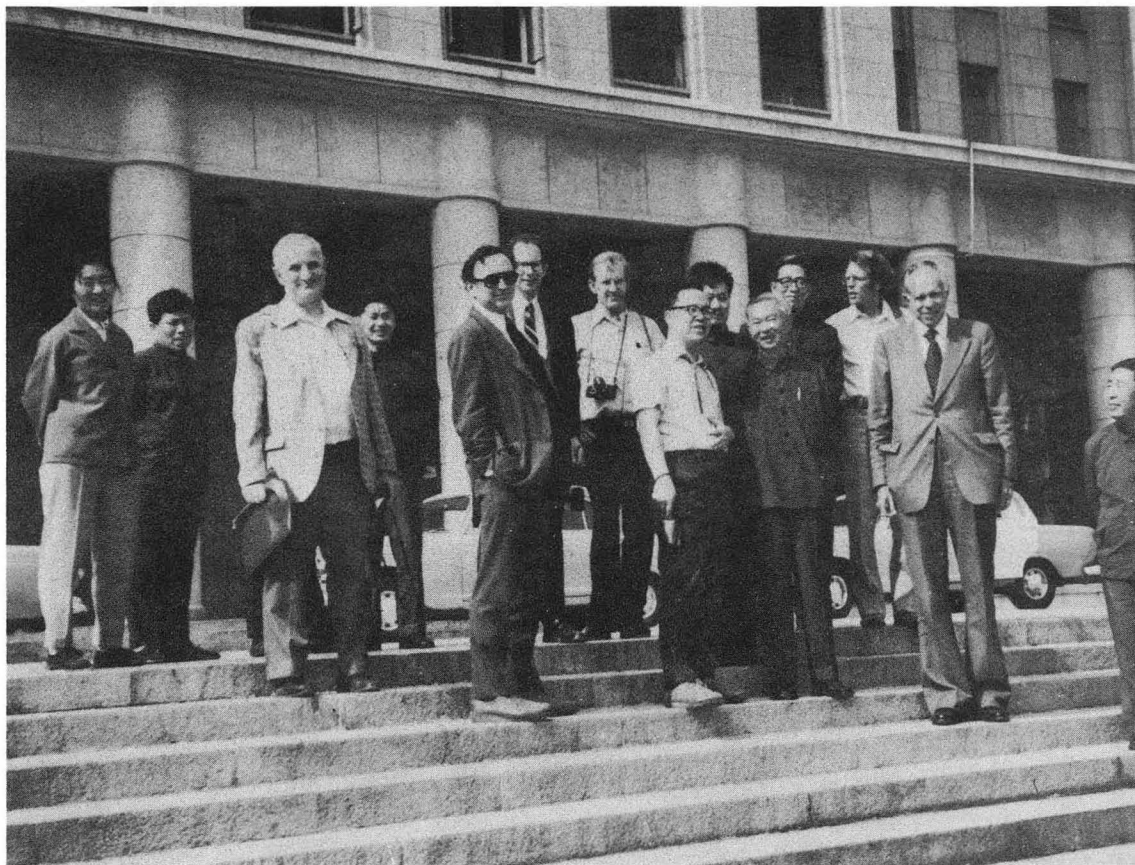
During lunch Jake Bigeleisen and I tell the group about our experiences in working with Gilbert N. Lewis, the great Berkeley physical chemist with whose great contributions to chemistry they are familiar.

After lunch we walk back along the Long Corridor and then through the Summer Palace grounds to our cars parked at the entrance. As we walk, I have a talk with Hu Ya-tung about the status of chemical information service in China. I tell him that Chemical Abstracts would like to set up an exchange relationship and he tells me this can best be done through him. Correspondence should be addressed to him at the Institute of Chemistry in Peking, where the Information Center for Chemistry in China is located. They would expect to pay the regular price for use of Chemical Abstracts information. He tells me that the Library of Natural Science is located about 500 meters from the Institute of Chemistry. The Institute of Information of the Chinese Academy of Sciences is located in the eastern part of Peking. He tells me that 80% of Chinese scientists can read scientific English. The Institute of Chemistry library subscribes to 600 chemistry or chemistry-related journals of which more than 50% are in the English language. I offer to give more subscriptions to *Science News* to Chinese institutes, etc., and he promises to give me a list of suggestions.

When we reach our cars, Bigeleisen, Larson, Ibers and Schriesheim leave us to go shopping under the guidance of Ms. Chang Hsiao-hsiao. I ask Ibers to buy me some Mao caps.

We ride in our cars to nearby Tsinghua University (situated on College Street); I in the lead car with Yuan Lee and Ms. Ts'ao Hsuan-hsuan. We arrive there at about 2:40 p.m. and are met by Wang Chia-ting, Chairman of the Chemical Engineering Department (a position he resumed 3 months ago after being deposed during the Cultural Revolution and "Gang of Four" aftermath — he did his M.S. with W. K. Lewis at M.I.T. in 1945), Chou Hsin (inorganic chemistry professor), Chou Ch'i-hsiang (polymer chemist), P'eng Ping-p'u, and Ma Wen-chung (vice deputy in the office of the president of the university). Dr. Chang Wei is Vice President of the University (a mechanics professor). The President hasn't been chosen yet.

We go to a reception room on the second floor of the main building where Wang introduces his colleagues and Ma Wen-chung gives us a briefing on Tsinghua University. The University was started in 1911 as a high school for students preparing to study abroad. In 1925 it was transformed to a state university; the subjects taught covered social studies, liberal arts and science. After 1948 great reforms took place. In 1952 it was transformed into an engineering university.



Tsinghua University, Peking, May 19, 1978. From left to right: Ms. Ts'ao Hsuan-hsuan (Guide), unidentified, Stein, unidentified, Breslow, Baldeschwieler, Suttmeier, Wei, unidentified, Wang Chia-ting (Chairman, Department of Chemical Engineering), Hu Ya-tung (Institute of Chemistry), Geyer, Seaborg, unidentified.

There are a number of departments — electronics, automation, chemical engineering, engineering mechanics, architecture, engineering physics, hydraulics, radio, etc. — a total of eleven in all.

There are 2,800 instructors, almost 7,000 students, including 100 foreign students from 25 nations. According to the dictates of Chairman Mao the university must serve the people; therefore many workshops have been set up, such as precision instrumentation. These workshops are connected to teaching. Historically, the university paid much attention to research, including basic research. They combine teaching, production and scientific research. They aim to teach students to have high political consciousness, good health, and good technical training. They have graduate students, in school for 2 to 4 years. The undergraduate curriculum is for 4 years. They take students from all over the country. Their students must serve the people, so they must learn political consciousness and, during the study, must go to the factory for training. About 80% of students' time is spent on study, especially scientific courses. They must train students to understand fundamental theories. Their students must also have high ability to tackle practical problems. Training in good health is important so that students can carry on their studies; therefore, they spend one hour a day in physical activities. This follows from Chairman Mao's teaching.

Wang then tells us something about the Department of Chemical Engineering. It was established in 1958, after their petroleum department was transformed to the Petroleum Engineering Department. The first two areas of emphasis were nuclear engineering and high polymer technology. They have students in nuclear technology, nuclear processing, inorganic materials technology. The undergraduate students spend a whole year in practical design. There used to be too many specialized courses to the detriment of fundamental work.

From 1966-1969 they enrolled no new students. In 1970 they enrolled new students under the regime of the "Gang of Four," but they provided not much better than a middle school education. Due to the action of the "Gang of Four" their laboratories were dismantled and have not yet been reestablished. They enrolled 170 freshmen in March, following years of shutdown, and expect 15 graduate students this fall.

They have 2 full professors, 5 associate professors, and 67 lecturers.

In answer to a question from Jim Wei, Wang says he cannot tell us what the chemical engineering curriculum is because it has not yet been reestablished. Activities are being reestablished as a consequence of the National Science Conference.

The new class of 170 students is taking classes in mathematics, English, physics, inorganic chemistry.

Wei inquires as to whom he should deliver a letter from the president of the American Institute of Chemical Engineers and learns the Chinese Society of Chemical Engineers has been dormant for 10 years. He is advised to deliver the letter to a government official — Ms. Tao Tao, Vice Minister, Ministry of Chemical Industry.

Baldeschwieler asks about their connection with chemical industry. They reply the connection is through research. Their graduates are placed according to a national plan as part of which students are trained. Tsinghua University functions under the direction of the Ministry of Education. The Ministry allocates the number of students to each university according to the national plan. The university selects the students but the graduates are distributed to jobs by the government. The Commission of Planning coordinates the actions of the various ministries in this regard.

The briefing concludes at about 3:30 p.m. We take pictures of the combined group in front of the Main Building.

We then walk to the East Wing of the Main Building to have a look at an electron scanning microscope shown us by Wang Shu-liang. In a nearby room we see a mass spectrometer (German M86), used for gas analysis and isotopic analysis, shown us by Liu Mi-chin.

We then drive to a nearby chemical engineering laboratory where we see an operating fluidized bed apparatus. This is a students' laboratory. We see a cylindrical column working for gas-solid exchange (air and silica gel). In another apparatus they use cesium-137 gamma-rays to measure the density of silica gel in motion. This is explained by Jim Yun.

We conclude our laboratory visits at about 4:15 p.m. I then present an HP-21 calculator and battery charger to Wang Chia-ting.

We have a tour of the campus in our cars, Wang riding with Yuan Lee and me. We see the dormitories — all the students and faculty live on the campus. (This is also true at other Chinese universities.) We drive by the athletic fields and see students exercising. We see the library, many class rooms, the huge statue of Chairman Mao at a circle in the center of the campus.

We drive back to the Main Building and say goodbye to our hosts and then drive directly to the U.S. Liaison Office Residence to attend the reception in our honor. Yuan Lee and Ms. Ts'ao Hsuan-hsuan are in the car with me. She tells us about the difficulties during the time when the "Gang of Four" was in power and how much better spirit prevails in China among all the people today.

At the Liaison Office Residence we are greeted by Sharon Woodcock and Bill Thomas and learn that Chief of Mission, Leonard Woodcock, left for Tokyo this morning to meet Zbigniew Brzezinski and his group, due in Peking tomorrow. About 30 of our Chinese



U.S. Liaison Office Residence, Peking, May 19, 1978.
From left to right: Lee, Bill Thomas (U.S. Liaison Office),
Baldeschwieler, Schriesheim, Suttmeier, and Breslow in
back; Ibers, Bigeleisen, and Wei in front with Mao caps.

friends are present at the reception, including many of those we have met yesterday and today. We meet David Dean, Deputy Chief of Mission, and his son Tom (just home from the University of Virginia).

I have a long talk with Sharon about her experiences since she arrived in China, about 6 months ago, in the role of a nurse. She married Leonard Woodcock 5 weeks ago today. She tells me that her husband hopes for normalization of U.S.-P.R.C. relations before the end of the year and thinks this may very well happen.

I meet Liu Ping, leader of the eleven-member delegation of Fertilizer Chemists due to leave next week for a visit to the U.S. under the auspices of the CSCPRC. Liu is the Director of the Chemical Industry Research Institute in Shanghai. I also have a chance to have good talks with Liu Ta-kang and with Li Su, who is Vice Minister of Chemical Industry as well as Deputy Secretary General and Director of the Chemistry Division of the Chinese Academy of Sciences.

I meet Mrs. Lovechak who is a member of the Dixie Mission, which is a reunion of the American specialists who were helping Mao Tse-tung at Yen-an at the end of the Long March.

The reception, starting precisely at 5 p.m., ends at precisely 6 p.m.

We return to the Peking Hotel. I learn that Ed and Joyce Kallgren are in the Mintsu Hotel, Jack and Marilyn Service in the Peking Hotel; and, when I reach them by phone, I learn that Clark and Kay Kerr left Peking last Sunday.

Our delegation members (except Wei, who again is visiting his sister) have dinner at our table in the hotel restaurant. I meet Jack and Marilyn Service in the dining room. After dinner our delegation has a meeting to go over plans for the next few days and to assess the results of our visits so far. Some members of our delegation feel that our visits are too heavily programmed so that it is not possible to get the information we would like to get. We watch on TV, for a little while, the soccer game between the British and People's Republic of China teams.

I retire at 10 p.m. because tomorrow I will have an early start.

Saturday, May 20, 1978 - Peking

I arise at 6 a.m. Looking out over the city to the south, where I have an excellent view from my 8th floor room, I note many tall buildings a few blocks away that I do not believe were all there in 1973. There are many red flags flying on the top of the large buildings just across Ch'ang An Boulevard — this houses the International Service and the Friendship Organizations.

I meet in our 8th floor lobby some members of the British soccer team who tell me with elation that they won last night with a score of 2 - 0.

I meet in the lobby Rod Benson, Stewart Bryn (of Richmond, Virginia), Tams Bixly (of Oklahoma), members of the UPI delegation. They tell me they met with Vice Premier Teng Hsiao-p'ing yesterday and had a very frank question and answer session. Teng was very critical of the Soviet Union and also criticized Vice President Mondale's recent foray into Southeast Asia and called for "normalization" of relations with the United States, the latter as a preparation for Brzezinski's forthcoming visit.

We have breakfast at our table — except for Wei, Breslow and Ibers, who eat a little later. I meet at a neighboring table, Frances Diaz of Berkeley (2217 California Avenue), a member of the Civil Defense Delegation. She is the Regional Director of the Defense Civil Preparedness Agency (DCPA), with headquarters in Santa Rosa. They are making an investigation and tour of civil defense activities in China.

As we are about to depart I meet Mr. and Mrs. Sidney Zlotnick, friends from Washington, D.C., who are here for a personal visit.

Today Bigeleisen and I are scheduled to visit the Institute of Atomic Energy. Leaving a little after 7:30 a.m., I ride in a car alone with Ms. Chang Hsiao-hsiao, who is attractive and vivacious, 1.58 meters tall, weighs 95 pounds, has twin pigtailed in her hair and is anxious to practice her English. After graduation from Middle School she made her practical contribution to her country by working as a sheep herder in Inner Mongolia, then returned to Peking to attend the Foreign Language Institute which prepared her for her present position as interpreter and guide.

Jake Bigeleisen and his friend Lee Kuan-hwa (who received his Ph.D. degree with H. C. Urey at the University of Chicago in 1950) from Inner Mongolia follow in the car behind. John Balde-schwieler, Bob Geyer, Alan Schriesheim and Richard Suttmeier follow in cars behind on their way along a similar route to the Peking General Petroleum Chemical Works. Off in different directions are Ron Breslow, to the Institute of Materia Medica, Jim Wei to the Institute of Petrochemical Engineering, Ibers to Peking University,

Thurston Larson to the Institute of Environmental Chemistry (where he will present a gift from Helen to Jenny Liu).

Today Ch'ang An Boulevard is decorated with hundreds of 30-inch by 14-inch colored banners overhead in honor of the visit of President Ceausescu of Romania.

We stop for passport control at the bridge over the Ever Peace River, with a view of the Marco Polo Bridge. The views of the fields, animal-drawn wagons, trucks, houses enroute to the Institute of Atomic Energy, which is about 45 kilometers southwest of our hotel, bring back memories of the visit of Helen and me here in 1973.

We arrive at the Institute of Atomic Energy at about 9 a.m., about a half an hour late due to traffic. We are greeted by Wang Te-hsi (Deputy Director, who got his degree about 1944 with W. K. Lewis at M.I.T.), Li Shen-nan (Deputy Director, whom I met in 1973), Wang Shih-hsiu (Secretary, Administration Office), Yang Ming-chang (head of the Director's Office), Cho Yi-chung (Deputy Head of the Theoretical Division and who will attend the Gordon Conference on Nuclear Chemistry as a member of the Delegation of Chinese Nuclear Physicists to the United States next month).

We go to the reception room on the second floor of the administration building, seat ourselves on the sofas and are served our green tea. Here we see pictures of Mao and Hua on the wall as well as Marx, Engels, Lenin and Stalin.

Wang, a leader in Chinese chemical technology used for isotope separation, greets us and calls on Li to give us some information on the Institute. He says the Institute is part of the Chinese Academy of Sciences and that the high energy physics has been split off as a new Institute since my last visit. There is a total of about 1,500 people working at the Institute, including 600 university graduates. The chemistry division has about 350 people, including 175 university graduates. They have started a program of basic work on chemical reprocessing since I was last here and also work on materials for nuclear power. They are continuing work on nuclear reactions, neutron physics, accelerators, nuclear physics, theoretical work on heavy ion reactions, high spin states, nuclear structure, experimental work on intermediate states, nuclear fission and neutron diffraction, and on reactor material testing and nuclear fuel reprocessing. Their facilities are rather "backwards so they can do only limited work."

They have a 1.2-meter cyclotron (for protons, deuterons and alpha particles), a 2.5-MeV van de Graaf (protons and deuterons) and a 600-keV Cockcroft-Walton (for D-T reactions to produce 14 MeV neutrons). With the cyclotron they have four parameter on-line analyzers. They also have a 7 MW heavy water reactor (fueled with 2% uranium-235), built by the USSR, and a light water swimming pool



Marco Polo Bridge, near Peking, May 20, 1978.



Institute of Atomic Energy, near Peking, May 20, 1978.
From left to right: Cho Yi-chung (Deputy Head, Theoretical
Division), Lee Kuan-hwa (Inner Mongolia Teacher's College),
Wang Te-hsi (Deputy Director), Bigeleisen, Seaborg, Li
Shen-nan (Deputy Director), Yang Ming-chang (Head,
Director's Office).

reactor (fueled by 3% uranium-235), built by themselves and put into operation in 1964.

In the chemistry division they have radiochemistry, analytical chemistry and waste water treatment laboratories. In the radiochemistry laboratory they do basic studies of reprocessing, including reprocessing for transplutonium elements. In analytical chemistry they do neutron, charged particle and fast neutron activation analysis. They also use proton-induced x-ray fluorescence for analysis. They are doing meteorite analysis, with neutron activation for rare earths. The main part of nuclear power reactor research has been put under the management of the Ministry of Nuclear Energy. Their light water swimming pool reactor is used for material testing purposes and the heavy water reactor is for nuclear physics research and radioisotope research. (They provide most of the radioisotopes for the country.)

They have three electromagnetic isotope separators. They are also working on high pressure ion exchange, which we can see.

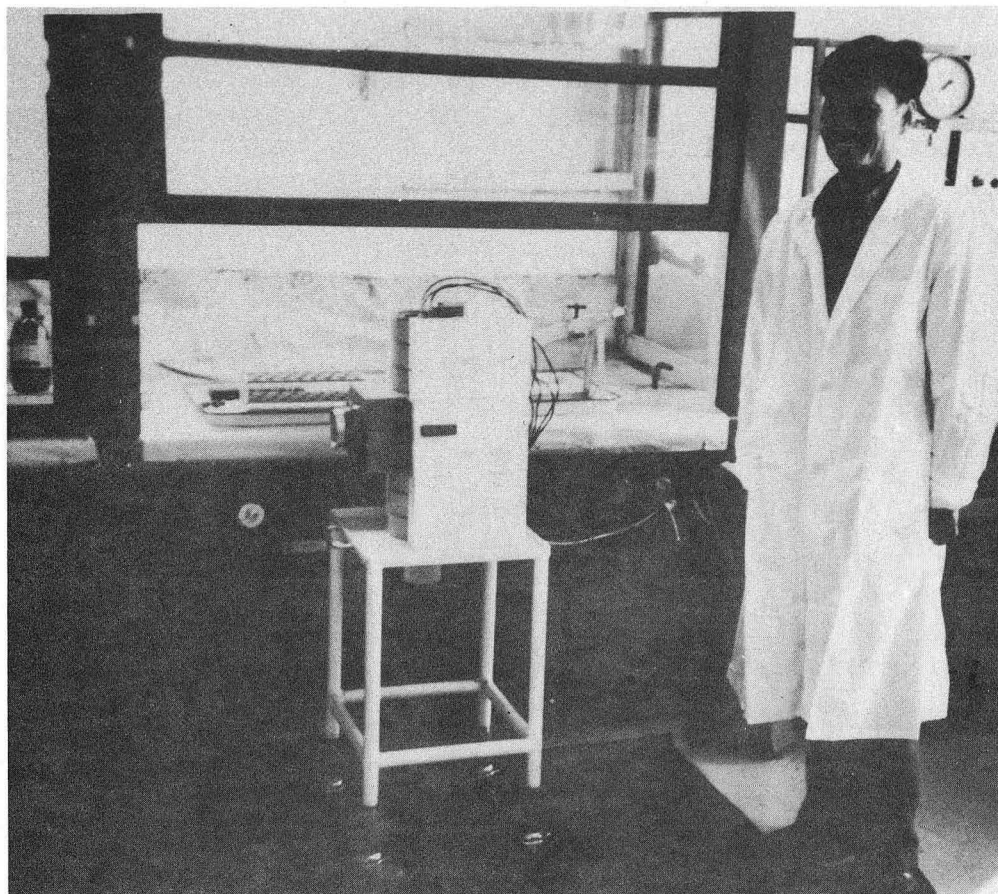
I ask to receive information on the national nuclear power reactor program. They are making comparisons of various types of power reactors; we may talk to these people if time allows.

I ask to give priority to our seeing the work on actinide chemistry and chemical reprocessing, high pressure ion exchange, radioisotopes in medicine, activation analysis of meteorites, nuclear power planning, waste water treatment and electromagnetic isotope separators.

The briefing ends at 10 a.m.

I ride with Cho and Li to the laboratory housing two of their three magnetic isotope separators, where Bigeleisen also visits. The building of these two machines was started by Soviet scientists but they were not finished when the Soviets withdrew so the Chinese had to put them in operation themselves. The separators were in bad shape when the Soviets left and much work had to be done before they could be put into operation in 1965 and 1970. The one that went into operation in 1970 delivers hundreds of milliamperes of ion currents (200-300 milliamperes). Chang Wei-ming shows us these machines and samples of enriched ^{25}Mg , ^{26}Mg , ^{42}Ca , ^{44}Ca , ^{58}Ni , ^{62}Ni , ^{63}Cu , ^{65}Cu , ^{112}Sn , ^{116}Sn , ^{50}Cr , ^{53}Cr , ^{87}Sr , ^{84}Sr , ^{168}Yb , ^{171}Yb (heaviest separated), ^{142}Ce , ^{138}Ce . The purity of the ^{168}Yb is 12.5% and of the ^{171}Yb , 92.8%. They have separated a few mg of ^{48}Ca (about 30-40% isotopic purity). A third separator, which we did not see, was built entirely in the People's Republic of China.

We go upstairs to a chemical laboratory where they are investigating the separation of transplutonium elements — americium and curium — using a cation exchange resin (sulfonic acid type, made in China) and elutions with alphahydroxyisobutyric acid. Here we put on white laboratory coats. They have samples in the multi-



Actinide Chemistry Laboratory, Institute of Atomic Energy, near Peking, May 20, 1978. Ho Chang-yu, Deputy Director, Radiochemistry Laboratory.

microcurie range. They have problems with resin breakdown, the prevention of which is helped by accelerating the separation process by use of high pressure apparatus. They operate at 20 kg/cm² (about 20 atmospheres). They show us separation plots using gamma ray spectra for detection. They also show us alpha spectra plots. The separations are very crude. They have been working on this for about two years. They tell us that they do not know where the americium-241 is produced; this is procured by a procurement department somewhere. The curium-242 is produced on site by irradiating the americium-241. The gamma rays are measured on-line with home-made NaI crystals, using a 800 multichannel analyzer (procured from Intertechnique in France). Data are recorded on a paper tape printer (also made in France). They have Ge-Li detectors but do not use them here. The column is 45 cm x 2 mm stainless steel, is operated at an angle (about 30° above the horizontal). The resin particles are about 150 microns in diameter. The velocity of eluants is about 0.075 cc per minutes. The apparatus operates well. They detect the alpha particles (Au-Si) and gamma rays (NaI) as the solutions flow past the detectors; the solution is only 8 microns thick. This is explained by Ho Chang-yu (Deputy Director, Radio-chemistry Laboratory).

Next, we visit the hot cell laboratory (Soviet built), where work on chemical reprocessing goes on. We don white coats and shoe covers. Ho tells us they are working to modify the Purex process, used by the Chinese in their plutonium production, for use in nuclear power fuel reprocessing. He says 30 volume percent TBP in inert hydrocarbon diluent is used in the plutonium production process. Uranium-plutonium-fission-product separation takes place in the first cycle, then is improved in second and third cycles — these are standard Purex cycles. The plutonium is finally precipitated as the oxalate then calcined to the dioxide. In the plutonium-uranium separation, they use ferrous sulfamide, $\text{Fe}(\text{NH}_2\text{SO}_3)_2$, as the reductant. The sulfamide reduces the nitric acid. They are working on electro-reduction of plutonium as a substitute for the use of ferrous ions. The Chinese process uses a battery of mixer settlers.

Here at the Institute their work is for the development of chemical reprocessing for a nuclear power program. The apparatus they have in the hot cells includes centrifuges, in order to test replacement of mixer settlers with centrifuges for use in reprocessing of nuclear power fuel. They plan to make use of centrifuges in their nuclear power program because of larger burn-up in nuclear power fuel than in plutonium production reactors, where they use the mixer-settlers.

They use U slugs (2% enriched) from their heavy water reactor as the source of material for these investigations. The enriched uranium and heavy water are produced in China. They are also working on the concentration of fission products for waste disposal. They temporarily store radioactive waste in tanks, are working on a waste disposal method. They plan to use incorporation

in asphalt for medium level waste, are considering solidification of high level waste but haven't started work yet. They wonder why we in the U.S. take so long and do nothing about coming up with a process for high level waste disposal.

We are asked to wash our hands as we leave, after taking off the white coats and shoe covers.

We drive to a nearby building where I view the asphalt process of incorporating medium level radioactive waste, while Bigeleisen goes to see the radiopharmaceutical laboratory. They are working on a process they call "bituminization" which involves incorporation (solidification) in asphalt-like material. They show me a Japanese-made apparatus for measuring weight changes and temperature changes as asphalt is heated in air. They haven't put radioactive material in the asphalt yet. They get the asphalt from various places in China and are experimenting with various kinds. They test asphalt behavior with sodium nitrate to predict how fission-product nitrates (from Purex process) will behave. This is described to me by Lo Shang-kan (Research Associate), with the help of You Cheg-tse (head of the Center for Waste Treatment), Chen Pai-son (Research Assistant) and Hsu Yuan-chao (Research Assistant).

We return to the reception room where I have a talk with Wang Te-hsi about nuclear reprocessing, waste disposal, etc. He tells me that the solution to the waste disposal problem is the key to successful use of nuclear energy in China. He believes they will go to geological storage in view of the optimistic data from the Oklo formation in Gabon. I ask him where the chemical reprocessing for plutonium production takes place in China, but he replies he is not free to disclose this to me. He feels the production of electricity from solar energy is very distant in the future.

We then drive to the Institute restaurant, where we have lunch in a small special room. Present are Wang Te-hsi, Deputy Director; Li Shen-nan, Deputy Director; Cho Yi-chung; Yang Ming-chang; Lee Kuan-hwa; Wang Shih-hsiu; Ms. Chang Hsiao-hsiao; Jake Bigeleisen and I.

At lunch, Jake and I propose increased exchange of scientists under auspices of nongovernmental organizations such as the U.S. Academy of Sciences (NAS) and the Chinese Academy of Sciences (CAS), cooperation with the ACS Chemical Abstracts in the information field, etc. They describe for us the difficulties they had with the apparatus left by the Russians when they pulled out in 1958-1960. They believe this malfunction was contrived on purpose. They hope to buy a Tandem van de Graaf in the U.S. (energy 2×10 MeV), either an Emperor from High Voltage Engineering or a Pellatron from National Electrostatic Corporation, but don't know if U.S. government will permit this; Jake and I promise to help. They tell us Tsien San-tsiang is still the Director of the Institute of Atomic Energy, but spends little time here. Li agrees that there

should be more exchanges between NAS and CAS but says it may have to depend on "normalization" of relations, to which Jake and I respond we should make attempts before this happens. Li agrees that this possibility should be pursued.

After lunch, Jake visits the nearby site of Peking Man with Ms. Chang Hsiao-hsiao before his scheduled talk this afternoon. I go back to the reception room to put my slides in order. I then walk with Li Shen-nan and Cho Yi-chung to the Library Building, a distance of about 100 yards along a straight tree-lined walk. In front of the Library I meet my old friend, Yang Fu-chia (whom Helen and I met in Shanghai during our 1973 visit); he is here from Shanghai for a couple of weeks to supervise the research work of about 18 of his undergraduate students who have come to spend a couple of months doing research at the Institute of Atomic Energy).

We go to the Conference Room in the Library Building which is packed full, about 400 people, a third from other places, such as Peking University, Tsinghua University, the Institute of High Energy Physics.

I am introduced by Li Shen-nan for my talk on "Mechanisms of Heavy Ion Reactions," which is translated by Chang Hsi-chen, paragraph by paragraph, as I proceed. I use 34 slides. Speaking under huge front wall pictures of Chairmen Mao and Hua. I talk for about an hour, followed by an half-hour of questions. I am served green tea during my talk.

Li Shen-nan and I return to the reception room to wait for Bigeleisen to finish his talk in the conference room at the Administration Building.

Li and I talk about plans for nuclear power in China. Li tells me they have no nuclear power; it has been delayed. They hope to learn from foreign countries because it is related to the industrial base. The type of reactor for the first power station has not yet been decided, whether heavy water or light water. It has not been decided where to build it. He has not heard about the delegation from the American Nuclear Society, that Suttmeier told me will visit China. Li also describes in detail difficulties caused by the "Gang of Four," which also affected the Institute of Atomic Energy, although not so much as the universities.

After Bigeleisen finishes his talk, he and I assemble in the reception room. I present Wang Te-hsi with a Hewlett Packard HP-21 calculator and battery charger and some of my reprints and present Wang and Li, ACS and Priestley Centennial first day stamp covers and ACS Centennial neckties. Bigeleisen presents Wang with some of his reprints and NAS publications.

As we are about to leave, at about 5 p.m., I notice my slides haven't been returned; but they are now locked up, so they must be returned to me in my hotel room tomorrow.

I ride back to the Peking Hotel with Ms. Chang Hsiao-hsiao and Yang Fu-chia, with Bigeleisen and Lee following in their car. Yang tells me something about the research program of his 18 undergraduate students working at the Institute of Atomic Energy.

We arrive at the Peking Hotel at 6:10 p.m. Bigeleisen and I go immediately to Baldeschwieler's room where the scheduled meeting of our delegation is underway to plan our report. We go over the outline, item by item, with each person responsible for a section, commenting on his observations and plans to this date for writing. At a little before 8 p.m., we stop our meeting and ride to the Szechuan Restaurant where we have an excellent dinner. The duck course is especially good. The dinner costs about \$17 per person. We decide to walk back. It is a balmy night and we see many people outside the shops and homes along the way. We go up to the reception room on the eighth floor, resume our meeting for our report-writing plans. Our meeting ends at about 11:15 p.m. and I retire about midnight.

Sunday, May 21, 1978 - Peking

I awaken at 6:30 a.m. and soon go down to the restaurant where I stop at the table of the UPI delegation to chat with Rod Benson, the Jack Howards, H. T. Stevenson, E. W. Estlow. Stevenson reminds me that he was one of the escorts for the journalism students that interviewed me for the Hearst Journalism Scholarship competition (May 9, 1977).

Today we visit the Great Wall and Ming Tombs, leaving in our caravan of cars at 8:15 a.m. I ride in the lead car with Feng Yin-fu, Vice Director of Foreign Affairs Bureau, Chinese Academy of Sciences, and Ms. Chang Hsiao-hsiao.

I ask Ms. Chang if she is married. She replies she is not. She is twenty-five years old. The average age of marriage for women is twenty-five years, for men, twenty-eight years. By Chinese law, the minimum age for marriage is a combined age of fifty for the man and woman. Divorce is possible.

Our accompanying host group today includes Hu Ya-tung, Lee Kung-hwa, Ms. Ts'ao Hsuan-hsuan, Ch'iu Ping-chun, Shih Wei-ming, Ch'en Kuan-wen.

We drive along the same general route we followed five years ago. My driver, as usual, is Ma Hung-ping, who drives aggressively but competently. The traffic is heavy in town. We see enroute many PLA members, wearing their green uniforms with red stripes on the collar, on bicycles and in trucks. There are many carts pulled by mules or horses, numerous trucks, a few Shanghai cars. Near the outskirts of Peking, we pass a bicycle race — they race along the traffic-laden paved road, dodging traffic, with huge crowds of people standing along the sides of the road at the starting point and at various spots along the route. The course runs to the Ming Tombs and back, a total of 60 kilometers.

The traffic thins out as we leave the outer northern limits of Peking to head north (and west) toward the Great Wall. As we begin the climb on the narrow road into the mountains, the traffic congestion increases and we hear incessant blowing of horns. The weather when we left Peking was somewhat cloudy (there were a few rain sprinkles early this morning) but it becomes increasingly sunny as we ascend into the mountains.

On a steep part of the narrow, essentially one-way, paved road, we come to a complete stop due to the blockage ahead by trucks, buses and cars. The traffic jam keeps us immobilized for about 10 minutes. When we resume driving, we soon see a train full of people. This train route, from Peking to the Great Wall, went into operation within the last year. We arrive at the Great Wall at about 10 a.m. We climb first the wall in the easterly direction. We go individually and in twos and threes. I am accompanied by Ms. Chang who



Traffic on the road to the Great Wall, near Peking,
May 21, 1978.

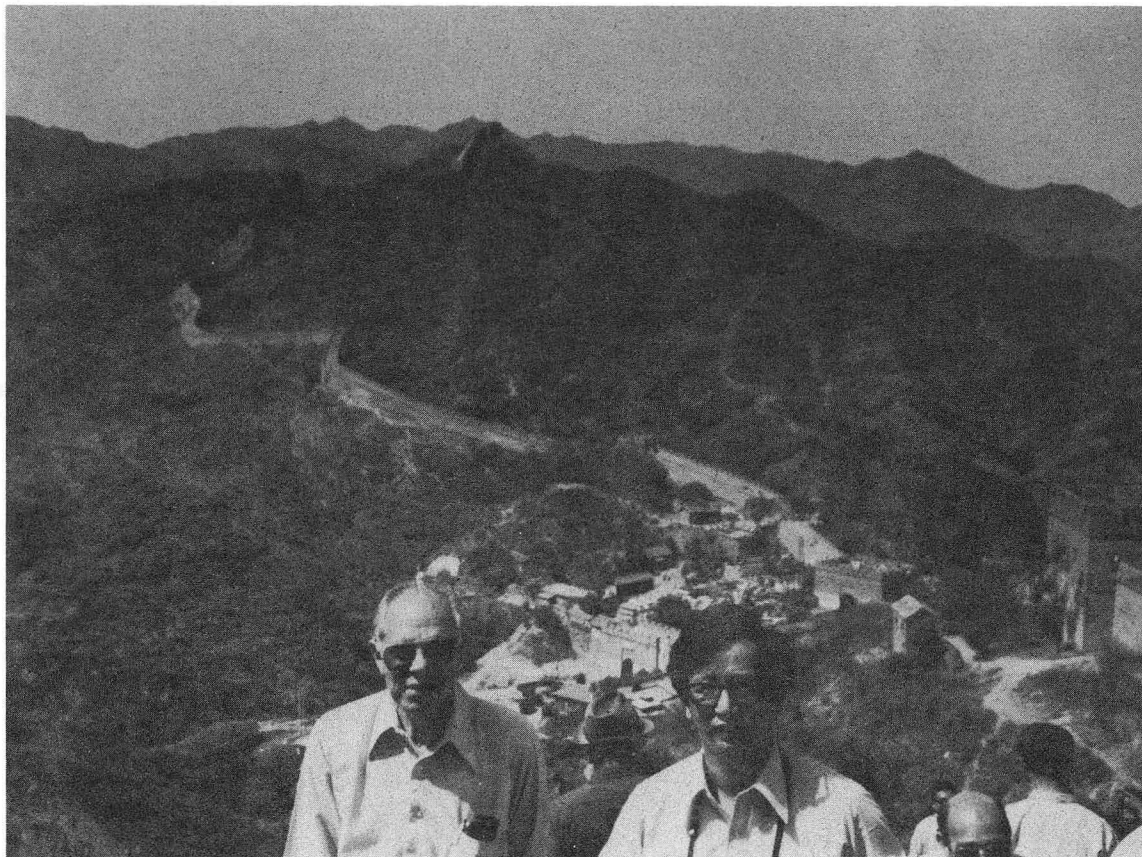
has trouble keeping up with me. I take pictures and movies along the way. We go all the way to the top tower — the end of the renovated part. I find the going somewhat precarious at times, wearing shoes with leather soles, because of the slippery flat rocks on the 45° slope.

The weather is sunny, not too hot, very pleasant. The view in all directions is magnificent — up and down the wall, to the north with the picturesque mountains (beyond the far range lies Inner Mongolia), to the south looking back toward Peking. As we walk back down, I suggest to Ms. Chang that she needn't accompany me to the west side, which offer she accepts with obvious pleasure. However, Ch'iu Ping-chun offers to accompany me and I agree. Yuan Lee, who climbs the east side in nearly the same time sequence through the various towers, etc, as I, also climbs the west side but somewhat behind me. Ch'iu, Suttmeier and I go about a hundred yards beyond the last western tower (the end of the renovated part).

We walk back down to the central pavilion (starting area), then to our parked cars, arriving about 11:40 a.m. and finding the rest of our party there. We each have a soft drink out of the trunk of one of the cars, which also holds our picnic lunches. At about 11:45 a.m. we start off for the Ming Tombs in our caravan of cars. Except for the beginning of the ride down the mountain, we encounter very little traffic on the way. (We have a total of six cars. One has proceeded ahead to the Ming Tombs to make arrangements for our party.) As we approach the area of the Ming Tombs, we see the Dragon Mountains on the right and the Tiger Mountains on the left. Ancient legend had these mountains guarding the entrance to the palaces. We drive along the Avenue of the Animals. As we converse along the way, Ms. Chang tells me she likes to read American books. Ernest Hemingway, Jack London and John O'Hara are her favorites. She read "Tom Sawyer" and "Life on the Mississippi," in Chinese, when she was a girl.

We arrive at the Ming Tombs at 12:30 p.m. We go to a nearby building, where in a private room our twelve member delegation and seven of our hosts partake of excellent box lunches, augmented by soft drinks (a sort of cream soda), beer and tea, brought with us from Peking. After lunch we walk through the crowded grounds to the museum where we see many objects produced for and used by the emperors and empresses of the Ming Dynasty (1368 to 1644 AD), such as gold crowns, bowls, plates, beautiful well preserved vases, empresses' crowns with large numbers of precious stones, etc.

We then go to the Ding Ling (Stability) Tomb area, past the Ding Ling Tower to the Ding Ling Tomb. This we tour individually and in groups, Bigeleisen and I with Ms. Ts'ao Hsuan-hsuan and Ch'iu Ping-chun. It was built by Emperor Wan Li (born 1563, emperor 1573-1620) starting when he was 22 years old, extending over a period of eight years. We descend to the main level, five stories down, visit the Far Hall with its three coffins, reconstructed



Yuan Lee and Seaborg at Great Wall, near Peking,
May 21, 1978.

hardwood boxes, built to hold the remains of Emperor Wan Li, his Empress and secondary wife. We go next to each of the Side Halls, with the places for the Emperor's concubines.

At the conclusion of this tour, we go up into the Ding Ling Tower. Following this we join our group in the garden area. We then drive back toward the Avenue of Animals. I still ride with Ms. Chang Hsiao-hsiao. As we pass the Ming Tomb Reservoir, Ms. Chang tells me that Chairman Mao and Premier Chou each spent a day during its construction (which started in 1958) working as common laborers. We stop at the Avenue of Animals for a closer look and picture taking.

At about 3 p.m. we start our ride back to the Peking Hotel, where we arrive at about 4 p.m. This gives us time to go shopping. While some of our group goes to an antique store, I join those (Baldeschwieler, Lee, Ibers) going to the Friendship Store about a mile east of our hotel. Here, under the guidance of Ms. Chang, I purchase a number of small typical Chinese items suitable for gifts back home. Our group (except Wei, who is having a last visit with his sister) has dinner in the Peking Hotel Restaurant at our regular table.

After dinner, a number of us (Baldeschwieler, Bigeleisen, Suttmeier, Breslow, Lee and I) have a discussion on science policy, priorities, administration, etc., in the reception room on the sixth floor of our hotel. The Chinese representatives are my old friend Dr. Tsien San-tsiang (whom I met in 1973 as Director of the Institute of Atomic Energy, but who now holds, as well, the important position of Vice President of the Chinese Academy of Sciences, which occupies all of his time), Dr. Li Su (Director of the Chemistry Section and Deputy Secretary General of the Chinese Academy of Sciences), Liu Ta-kang (Director of the Institute of Chemistry), Ch'ien Jen-yuan (Deputy Director of the Institute of Chemistry), Feng Yin-fu (Vice Director of the Foreign Affairs Bureau of the Chinese Academy of Sciences), Li Ming-te, Shih Wei-ming, Ms. Ts'ao Hsuan-hsuan.

Tsien San-tsiang is the chief spokesman for the Chinese, beginning the meeting at 7:30 p.m. (Li Ming-te serves as interpreter and Shih and Ms. Ts'ao take notes throughout the discussion.)

Tsien states, when I greet him, that he meets me this time under better circumstances than those of five years ago, when he met me at the Peking Airport and served as my host at the Institute of Atomic Energy at some risk to his personal standing.

As the discussion begins, he says that Fang Yi is out of town so we shall not have a chance to meet him, as we might have. He then extends to Helen and me an invitation to visit the People's Republic of China at any time we wish as guests of the Chinese Academy of Sciences.

Tsien begins by describing the history of the Chinese



Seaborg on stone horse, Avenue of the Animals, Ming Tombs, May 21, 1978.

Academy of Sciences and its functions. At the time of Liberation there were established 17 Research Institutes under the Academy of Sciences with a total of about 200 people working in them. The number of Institutes had grown to about 100 by the start of the Cultural Revolution in 1966. By the end of the Cultural Revolution there were about 36 Institutes left and now the number is back up to about 90. Most of these are located in Peking and Shanghai, but some are distributed throughout the country.

During the past year the Academy of Sciences has assumed increased stature. Both Chairman Hua and Vice Premier Fang Yi have visited the Academy; Fang Yi has "come" to the Academy, now serves as Vice President of the Academy, as well as head of the newly established State Science and Technology Commission.

Tsien tells us that in March a National Science Conference, covering all fields of science, was held in Peking with 5,000 participants. The Congress clarified what is right and what is wrong with Chinese science policy; and it resulted in the preparation of a National Science Policy, with a program for a short period, 1978-1985, and a long period, 1985-2000. The Congress recognized outstanding work done by scientists in Institutes, the army, industry, and agriculture; approximately 1,000 awards went to personnel in the Academy of Sciences.

The administration of science in The People's Republic of China has been reorganized and the Academy of Sciences has been given the main responsibility for research in the natural sciences. A parallel organization has been set up for research in the social sciences. Responsibility for research in the natural sciences resides in, besides the National Academy of Sciences (the leading organization), (1) universities and colleges, (2) industrial, medical and agricultural organizations, (3) research laboratories of national defense institutes, and (4) local authorities (including broad masses of peasants engaged in agricultural research). This is all coordinated by the State Committee, which is also above the Science and Technology Association.

The Academy of Sciences is organized into five units: (1) Mathematics, Physics and Astronomy, (2) Chemistry, (3) Biological Sciences, (4) Earth Sciences, (5) New Technology (including computer science, semiconductors, etc.).

Applied research prevailed during the Cultural Revolution and the period of the reign of the "Gang of Four." Tsien stresses that criticism resulting from the scientist exchange program of the CSCPRC-STAPRC under the terms of the Shanghai Communique of 1972 helped to change this policy. They are now stressing basic research in the Academy of Sciences, while the Ministry of Industry is now doing a great deal of applied research. Applied research in chemistry is going on under the auspices of the Ministry of Chemical Industry, with good liaison with the Academy of Sciences.

Tsien emphasizes that The People's Republic of China is now in a transition period in their philosophy of carrying on research. He notes that I visited China five years ago, then invites me to come back in five years to see if his predicted changes have taken place. He points out that, although chemistry emphasizes the experimental approach, theoretical chemistry is also important and they intend to give this a great deal of attention in the future. They will, however, still give priority to applied areas (i.e. production, agriculture and national defense), and therefore plan chemical research according to the applied needs and profit in their planning by keeping in touch with the development of chemistry on the international scene. He goes on to describe Fang Yi's recent National Science Policy statement (about which I assure him we are familiar), and names the eight priority areas (agriculture, materials science, energy resources (including nuclear, fossil, solar, etc.), computer science, space science, laser science, high energy physics, genetic engineering) — listed in order of priority. He goes on to describe the rationale behind this order of priority. First come the applied programs designed to meet the most immediate needs — agriculture, materials science, energy resources. Next come the three areas designed to place Chinese science and technology abreast of that of the advanced countries — computer science, space science and laser science. The final two areas — high energy physics and genetic engineering — are selected as prestige areas in which Chinese science should catch up with the advanced countries by about the year 2000.

We question the inclusion of high energy physics — it is not in the same category as agriculture, materials research, energy resources. He defends this inclusion on the basis of high emphasis on it in Europe and the United States, its intellectual status, and the fact Chairman Mao foresaw, in January 1955, the discovery of the anti-proton on the basis of his prediction of the infinite nature of matter, thus also emphasizing the importance of the fundamental study of matter.

I again question the high priority given high energy physics, pointing out that such expensive financial support will detract from China's ability to support other fundamental scientific work. Tsien reiterates his argument that China must give priority to high energy physics because the United States and Europe do but says he will take my advice to heart and bring it to the attention of Chinese authorities. He can understand my point of view because, like the members of our group, he is basically a chemist.

Bigeleisen supports my point of view and points out in the future individual countries in Europe and even the United States and the Soviet Union will find it necessary to build machines even in cooperative projects because of the high cost.

Breslow asks why the Chinese did not include typical areas where the Chinese are already preeminent — such as soil science and native medicine — among the eight priority items. Tsien says this

is a good idea, that they were considered and nearly made it to the list of eight. I take this opportunity to ask Tsien how the list of eight priority items was chosen. He counters with the question — how are priorities decided in the United States? Tsien then speaks in answer to my question and essentially says the process of deciding priorities is complicated.

Baldeschwieler asks how the eight priority areas will be implemented, and Tsien replies it will be done in different agencies in different ways and describes the method for agriculture as an example.

I then suggest that Baldeschwieler describe how science policy is made and how science priorities are established in the United States. He describes the operation of the Office of Science and Technology Policy, Office of Management and Budget and the Congress in this process and summarizes both the distribution of funds and effort for basic research.

Breslow then describes the peer review system in the U.S. He asks how a scientist in The People's Republic of China who has a good idea for research can get funding to do research on it. Tsien says it would be reviewed by the local Institute Director and Scientific Committee, who would make the recommendations to the Chinese Academy of Sciences, who would then make a recommendation to the State Science and Technology Commission or appropriate ministry based upon advice from one of the Advisory Committees of the Chinese Academy of Sciences. The scientist can appeal an adverse decision to any of the bodies above the local Director or Scientific Committee.

Bigeleisen next describes the role of the United States Academy of Sciences and National Research Council in giving advice on the national problems that have a scientific basis. He uses as an example the question of banning the use of saccharin, the halo-carbon study, the building of an expensive telescope for use in space orbit, the building of accelerators to be used as sources of synchrotron radiation for research, and the geophysical problems of adverse environmental effects of energy generation (which led to an identification of the serious effect of the production of carbon dioxide by the burning of fossil fuels that may make it necessary to modify President Carter's energy policy).

Suttmeier asks about the distribution of funding among various ministries, etc., to which Tsien replies that national policy forbids revelation of budget figures. Suttmeier then asks about methods of determining distribution of effort between basic and applied research. In reply Tsien traces the whole history of support of scientific research since Liberation (1949). First the emphasis was on applied research for obvious reasons; then, in 1956 Chairman Mao directed a turn toward basic research. The withdrawal of Soviet support, however, in 1960 forced China to become self-sufficient in applied areas and made it possible to develop the atomic bomb in 1964 and their space satellite by 1970.

The Cultural Revolution and the "Gang of Four" delayed giving attention to basic research until now.

By now it is 10:45 p.m. and we have met for over 3 hours; so I suggest we bring the meeting to an end. Tsien again extends the invitation to Helen and me to visit China as guests of the Chinese Academy of Sciences any time we wish.

When we return to the 8th floor our group agrees that our meeting has been very useful. When I return to my room, I find the slides I used for my talk at the Institute for Atomic Energy have been returned.

It is midnight by the time I retire.

Monday, May 22, 1978 - Peking

This morning I am awakened by a prearranged phone call from Ms. Chang, who has a room in the old part of the Peking Hotel, the old French Grand Hotel where Helen and I stayed in 1973. (The wing beyond that, i.e., the Soviet-built wing, is closed for renovation.) She tells me "it is time to get up."

I put my slides in order for today's talk at the Institute for Atomic Energy and go down to the restaurant for breakfast with our group at our table. This morning Schriesheim, Suttmeier and Wei will visit the Petrochemical Institute; Stein and Geyer the Vinylon Institute; Ibers, Breslow and Baldeschwieler the Institute of Biophysics; and Lee the Institute of Chemistry.

I ride with Ms. Chang to the Institute of Atomic Energy after a 15-minute delay because my car is blocked by another car whose driver has disappeared. My resourceful driver manages to open the locked car and push it out of the way. I present Ms. Chang with a Kennedy half-dollar and a deck of ACS Centennial playing cards as compensation for my wake-up call and Ma an ACS T-shirt as compensation for his success in moving the blocking car.

We leave at about 8 a.m. and arrive at the Institute of Atomic Energy at about 9:15 a.m., 15 minutes late, for my scheduled talk. I am met by Deputy Director Li Shen-nan, Cho Yi-chung and Hsiao Yi-chung (head of the radioisotope group, whom I met in 1973 and who did his Ph.D. work with Bob Duffield at the University of Illinois, 1947-50). After going momentarily to the reception room in the Administration Building, we walk across to the Library Building and to the lecture hall where I am scheduled to give my lecture on "Transuranium Elements and Superheavy Elements." The lecture hall is packed again - 400 to 500 people. I speak, with Cho serving as translator, and am served the welcome green tea continuously as I talk (welcome because the room is warm). My talk is illustrated with 42 slides, which the projectionist has some trouble producing on schedule, but I fill in during the waiting periods. I talk for about an hour and a half, followed by an hour of questions. The questions are quite sophisticated - on the status of Ghiorso's "Sassy device," the application of the criteria for discovery of chemical elements spelled out in our *Science* article, experiments to distinguish between compound nucleus and deep inelastic reactions on basis of time scale, why I believe spontaneous fission detection is not an adequate criterion for discovery of chemical elements, best method of detecting SHE in nature, and status of detection of SHE in nature.

After my talk we go back to the reception room in the Administration Building to hold a discussion with Lien Pei-shang (Deputy Director for Reactors), Lin Chen-guo (Vice Chief, Engineering Reactor Laboratory), Li, Cho and Hsiao.



Audience at Seaborg lecture in Library Building, Institute of Atomic Energy, May 22, 1978.

Lien (who has been here since 1956) says his research team (now about 40 engineers and reactor physicists) started to work on planning for a Chinese national nuclear power program here at the Institute in 1974. They have the primary responsibility for making proposals to the Chinese government, although some planning is also done at the Shanghai Institute for Nuclear Physics. They are studying pressurized water reactors and heavy water reactors. The People's Republic of China plans to build a PWR prototype, date and site not yet determined, then a regular power reactor. Lien and Lin met with the American Nuclear Society group when they were in Peking recently (Joseph Dietrich, C. H. Wang, Harry Lawroski, Corwin Rickard, William Kimel, Ersel Evans, Octave Du Temple). Their discussions were apparently solely on a technical level (discussing PWR reactors) without going into the scheduling of plans for building power reactors. China will build the prototype reactor with Chinese engineers and also the PWR power reactor, which will be constructed and operated by the Ministry of Water Conservation and Electric Power.

The Chinese may also purchase a PWR (900 MWe or higher power) from France — the Westinghouse design. Lien states that the activities of environmentalists in the United States do exert some influence on the attitude of the Chinese government toward nuclear power. He inquires if President Carter intends to have the United States change to the heavy water reactor and why he favors this type. I reply that such a change is unlikely; President Carter may think the heavy water has less potential for proliferation of nuclear weapons. Lien inquires if we plan to aid nuclear waste disposal by irradiating the waste with neutrons and I reply this is not very practical.

Lien asks me to compare Westinghouse, Combustion Engineering and Babcock as sources of PWR reactors (I say they each have their special attributes), compare the BWR and PWR (I say they are both OK, the fact there are more PWR's than BWR's in the United States should not be a basis for making a choice in China).

The view is expressed that the development and use of the breeder reactor in The People's Republic of China is "inevitable."

We then go to lunch in the restaurant as on Saturday — Li, Cho, Hsiao, Lien, Lin, Ms. Chang and I. We continue our discussion of nuclear power and I also answer a number of questions posed by Hsiao on behalf of his staff. I learn that China uses its own facilities to produce its americium-241.

I ride back to the Peking Hotel and arrive at about 2:30 p.m., after our people have dispersed in various directions. We were scheduled to visit the Forbidden City this afternoon but our hosts made a mistake; it is closed on Mondays. Alternatively, Lee and Stein will go to the Institute of Chemistry; Ibers and Breslow will forego Institute visits; Larson will visit the Institute of Environmental Chemistry. I ride with Ms. Chang to join Baldeschwieler,

Bigeleisen, Wei, Geyer, Suttmeier and Schriesheim for a visit to the Temple of Heaven. They are finishing their visit by the time we arrive.

Ms. Chang and I go first to the Hall of Pray for Harvest, built in 1420 during the Ming Dynasty, burned down (due to lightning) in 1889 and reconstructed after Liberation.

We then walk along the long wide walkway to the Echo Hall, a circular wall of about 50 yards diameter, with ornate buildings within, including the Imperial Heavenly Hall, built in 1538, repaired in 1752. Here Ms. Chang and I stand at opposite parts of the Wall and hear each other's voices easily as we talk into the wall. We then walk some distance to the Center Stage where I stand at the center and hear echoes of my voice from a surrounding wall as I speak softly.

We then drive to the Front Gate of old Peking City and beyond to a subway station. The subway runs under a street about a block south of Ch'ang An Boulevard and is more than 20 kilometers long. It runs every 15 minutes from 6 a.m. to 10 p.m.

Ms. Chang and I go down into the subway and board an east-bound train. The underground is rather austere, with large imitation marble columns and no wall decorations. Our train has all seats filled, a number of people standing and numerous PLA members of both sexes. A young PLA member tries to give me his seat, but I, with great difficulty, persuade Ms. Chang to take it. Music emanates from the loud speaker, with a woman's voice overriding it on occasion to announce upcoming stations. We pass rooms with beds in them at each station, places for employees to rest during working hours.

We ride past about 3 stations to the eastern terminus of the subway line and emerge into a huge square with the Peking Railroad Station bordering it on one side. Here we find our driver, Ma, waiting for us and ride with him back to the Peking Hotel, arriving a few minutes before 5 p.m.

I then go to Baldeschieler's room for a meeting to recapitulate our discussion on science policy last night with Tsien Santsiang and his colleagues. All except Wei and Larson are present for this discussion.

I go back to my room to change clothes for this evening's dinner that we are giving for our Chinese hosts. I read in the Hsinhua News Agency Bulletin, which is delivered to our rooms every evening at about 5 p.m., about Brzezinski's talk with Chinese Vice Premier Teng Hsiao-p'ing yesterday in the presence of U.S. Chief of Mission, Leonard Woodcock. They had "a serious and frank exchange of views on international issues of common concern to China and the United States and those of bilateral relations."



Whispering Wall, Imperial Heavenly Hall, Temple of Heaven,
Peking, May 22, 1978.

At 6 p.m. Bigeleisen and Breslow meet with Chu Yung-hang, Deputy Director, Foreign Relations Bureau, Chinese Academy of Sciences, to discuss increased methods of Chinese-U.S. cooperation in chemistry.

At a little before 7 p.m. we ride in our cars to the nearby Peking Duck Restaurant on Wang Fu-ching Street and arrive before our guests. We greet them as they arrive. Our guests tonight are Chou Pei-yuan, Chinese Academy of Sciences and Peking University; Li Su, Chinese Academy of Sciences; Feng Yin-fu; Li Ming-te; Ms. Chang Hsiao-hsiao and Ch'iu Ping-chun, of the Foreign Affairs Bureau of the Chinese Academy of Sciences; Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Kuo Ch'u, Shih Liang-ho, Ch'en Kuan-wen, Hsu Mao, Wang Pao-jen, Teng Shao-lin and Shih Wei-ming of the Institute of Chemistry; Chang Ch'ing-lian, Peking University; Wu Chin-ch'eng, Chief Engineer, Institute of Petrochemical Engineering; Wang Te-hsi, Institute of Atomic Energy; Huang Liang, Institute of Materia Medica; Hu Feng-hsien, Foreign Ministry; Shen Pao-ch'eng, Ts'ao Hsuan-hsuan, Institute of Environmental Chemistry, and Lee Kuan-hwa, Inner Mongolia Teachers' College.

During the pre-dinner reception Hu Ya-tung (Scientific Secretary of the Institute of Chemistry and Secretary of the Chinese Chemical Society) presents several of our group with pieces of rare porcelain from his personal collection. He gives me a wine cup with an exquisitely painted picture of a tree and other decorations; this dates from the Ching Dynasty (1665). It comes in an artistic box.

I sit at a table with Chou Pei-yuan, Wu Ching-ch'eng, Wang Te-hsi, Li Su, Liu Ta-kang, Li Ming-te, Alan Schreisheim, and Yuan Lee.

Near the beginning of the meal I make the customary remarks welcoming our guests (with translation by Yuan Lee). I express satisfaction that Chou Pei-yuan has chosen to attend our dinner rather than one being hosted tonight by Brzezinski, to which he has also been invited. I review our many activities in Peking the last 5 days, our future schedule in China, suggest there be increased cooperation in chemistry, starting with conferences in each country on specialized topics, leading later to exchanges of graduate students and post-doctoral fellows.

In my conversation with Chou Pei-yuan he explains to me the 8 priorities in the national Chinese plan fall in 3 categories — (1) practical, agriculture, energy sources, material science; (2) applied science, computer science, laser science, space science, and (3) basic science, genetic engineering and high energy physics. I warn him that high energy physics shouldn't be allowed to starve financial support for other important basic sciences. He explains to me the four ways in which research is carried out in China — (1) research institutes, (2) universities, (3) research arms of ministries, and (4) research institutes under auspices of various provinces. Defense research is in a separate category. He also

describes for me some of the activities of the "Gang of Four" and the problems this created for scientists.

Toward the end of the meal, Chou Pei-yuan makes his response (with translation by Li Ming-te) including some Chinese history and a call for continuing friendship and cooperation between our two countries. He presents a gift to each of us — including two vases in two large boxes to Baldeschwieler and to me.

We have an excellent meal, consisting of seven assorted cold plates, wooden ear bird nest soup, braised shark fin, pineapple chicken, braised abalone, sliced chicken, fried fresh kidney bamboo shoots, roasted duck (Peking Duck), duck bone soup, sweet white wooden ear soup, fruit.

After dinner we say goodbye to our guests and then go down to the kitchen, as we did in 1973, to see where and how the Peking Duck is cooked.

I walk back to our hotel, along Wang Fu-ching Street with Yuan Lee.

Our group holds a little meeting in Baldeschwieler's room to discuss our travel and other plans for tomorrow. We shall divide into two groups. Group A (Baldeschwieler, Breslow, Schriesheim, Wei, Suttmeier and Ibers) departs Peking at 8:15 a.m. for Harbin to go on to Tach'ing, while Group B (Larson, Stein, Bigeleisen, Lee, Geyer and I) remain in Peking until 7 p.m. when we are scheduled to depart for Talien.

I retire at about 11:30 p.m.

Tuesday, May 23, 1978 — Peking; Talien

I arise at 7 a.m. The red banners on the roof of the building across the street are gone. These apparently go up when distinguished visitors come to Peking.

I have breakfast at our table with Bigeleisen, Larson, Stein, Lee and Geyer. They will visit the Forbidden City; but, because I visited there in 1973, I plan to visit the Museum of Chinese History in T'ien An Men Square (reopened in 1975 after being closed during the Cultural Revolution).

Ms. Chang calls my room at 8:30 a.m. to say "it's time to go now," and we ride to the Museum in my regular car, despite the fact it is only a couple of blocks away. At the Museum we meet, by prearrangement by Ms. Chang, our guide, Chien Su-chiang.

The exhibition covers the period from primitive man to the May Fourth Movement of 1919. There are thousands of objects in hundreds of cases; so we must ration our time in the 3 hours available. I decide to emphasize the earliest periods and look at these exhibits in more detail.

First we see (in the entry room) a model of a huge astronomical instrument of the Sung Dynasty (11th century). The original was made of copper. This is in a large room where a class of school children sits on the floor to hear an orientation lecture. Next we see a model of a globe showing the location of stars as determined by the previous instrument.

We see a huge wall calendar listing the dates of 38 dynasties for which there are collections in this museum — 476 BC to 1919.

We enter the first hall with items from primitive society, including teeth from an ape 1.7 million years ago — Yunan Province. There is also a reproduction of a skull and bones of Peking man and also stone instruments made by him. This corresponds to the paleolithic age. Next we see fossils of ashes (showing man knew how to use fire), bones of animals in the ashes he presumably ate and also bones of bigger animals of this age.

We see a topographical model of the Peking man site, bringing back memories to me of our 1973 visit there.

Next we see a piece of bone and teeth of Chang yang man of 100,000 years ago from Hupei Province. We see stone tools of this period.

Then we see a six-foot antler from the age of Ding chun man, 100,000 years ago, Shensi Province.

Next we see models of skulls of upper cave men of 10,000 years ago, stone tools, a model of long needles made of bone, wild sheep antlers and mule teeth (jaw with teeth), all upper cave man age, picture of burial site and model of material buried with them.

Next we see a model of a bow and arrow of 10,000 years ago.

Then we see a panorama of women working at agriculture, which women invented 6,000 - 7,000 years ago, millet seeds — actually from that era at Sian — bone fishhooks and spear points of that era from Sian.

Now we come to pottery of 6,000 - 7,000 years ago from Sian, Chinese writing characters of this age — 6,000 - 7,000 years ago — forerunners of today's Chinese writing, agricultural tools and animal bones (husbandry) of 4,000 - 5,000 years ago, pottery and bronze of this age, money made of shells and jade decorations of that time. Family life begins as shown by pottery, tools, animal bones found in graves — a model of grave with family and its possessions — evidence of patriarchy, Tsinghai Province.

Next is shown pottery from Shantung Province of 4,000 - 5,000 years ago, showing evidence of division into rich and poor people. There is a panorama of tribal battles, showing enslavement of the vanquished.

Next we see early writing characters of 4,000 - 5,000 years ago. There is an exhibition of the beginning of slavery, 2100 BC; a picture of the wall of a city of the Shang Dynasty (1766-1122 BC) during the age of slavery; huge bronze weapons — spears, axes, etc., and remains of silk of the Shang Dynasty. There is a huge bronze piece (tub on legs) of the Shang Dynasty — used for cooking on a large scale — it weighs 875 Kg, the largest of the Shang Dynasty; and a huge ornate bronze wine container of late Shang Dynasty. Many other sophisticated items are shown indicating the beginning of real civilization during the Shang Dynasty. There are turtle back bones containing writing and a picture of graves containing a rich man and skulls of 80 of his slaves, buried with him.

Slaves rebelled and overthrew the Shang Dynasty, which led to the start of the Western Chou Dynasty (1122-770 BC). The emperors of Chou divided the country into more than 80 kingdoms.

We see reproductions of books of early poems in China, pictures and panoramas of various slave uprisings, and the start of China as a feudal society, 475 BC, near the end of the Spring and Autumn Annals period (770-476 BC).

There are relics (180) from a grave in the early Warring States period (476-221 BC) from Hunan Province — original bronzes and models. We see a huge model of a multi-bell instrument (original now on exhibition in Japan) of early Warring States period (476-221 BC), a model of a sophisticated water reservoir and conservation

system, of Warring States period, in Szechuan Province, which is still used today.

There are two life-size clay figures of the Ch'in Dynasty (221-206 BC) found in the emperor's grave, a couple of dozen clay figures (individuals) of Western Han Dynasty (206 BC - 24 AD), from among 2,015 found in a grave, and a model of a water-wheel-powered iron works of the same dynasty.

We take the traditional rest, with green tea served in the white cups, in a reception room at 10:30 a.m. Ms. Chang tells me we are two-fifths of the way through the Museum.

We continue after our stop and first see the clay statue of Chang Hung, famous Chinese scientist (astronomer and mathematician) and writer of the Eastern Han Dynasty (25-220 AD). Then there is a half-size model of an earthquake detector — a huge bowl-like figure with dragons on the side from the Eastern Han Dynasty — made by Chang Hung. This pre-dates European earthquake detectors by 1,000 years.

Next, there is an exhibit about two doctors of the Eastern Han Dynasty. One, the surgeon, Hua Tuo, was the originator of herb anaesthesia.

We see a silk painting of the Western Han Dynasty found in a grave. There is a model of the famous flying horse standing on one foot on a swallow (Western Han Dynasty), a model of a mill for grinding grain of the Western Han Dynasty (265-316 AD) and a model of a horse drawn chariot with a complicated odometer to measure the distance travelled.

Now we have finished half the exhibition — the ground floor — and we go to the second floor.

First we see a model of the famous bridge built by Li Chun during the Sui Dynasty (589-618 AD) in Hupei province; this has a 54 meter length with an arch span length of 37.2 meters.

Then we see a picture of Empress Wu Tsan-ten (head of state) of the T'ang Dynasty (618-907 AD) — the only woman head of state in the history of China.

We see samples of "three color glaze" pottery of the T'ang Dynasty, a map of Chung An (Sian), laid out in regular rectangular blocks (also of T'ang Dynasty) and porous bricks of city streets and samples of cotton sandals and pottery from Sinkiang (Uighur) Province of the same time.

We see Roman and Arabic coins found in Sian — Roman, 6th century, Arabic, 8th century — and reprints of excellent paintings of animals of the T'ang Dynasty, coins, with holes in the center, of the Northern Sung Dynasty (960-1127 AD) and sophisticated porcelain

of the same dynasty. There is a reprint of a 5-meter long painting of the capital of the Sung Dynasty — homes, boats on rivers, etc.

We next enter the section on Chinese inventions. We see gun powder of later T'ang Dynasty, a model of a little cannon (1351 AD), found in 1959, a printing template of the Sung Dynasty, a compass of the Sung Dynasty, a full-scale human figure (original) showing about 100 acupuncture points (also of Sung Dynasty) and a model of a large astronomical instrument. There is a series of four metallic tanks to keep time by the water drip method, of the Yuan Dynasty (1280-1368 AD). There is a large weaving loom and a model of a water wheel for grinding grain, and jewelled crown, jewelled hair pins, etc., from the Ming Dynasty (1368-1644 AD). We see gold plates, tied together on hinges to form a sort of a book, with messages written on them for the leader of Tibet.

Now we see exhibits of the Ch'ing Dynasty (1644-1911 AD) — ornate colored robes, a large curved knife, Mongolian writing on a stone tablet, beautiful large porcelains, books of many kinds, huge elephant tusks (from Vietnam), Chinese herbs for medicine and perfume, silk thread and silk cloth, a statue of Li She-jiu (famous Chinese medical expert on herbs), paintings by Chun Peu-cha (famous painter), huge cannon, small cannon, huge bust of Hun Shiao-shen (leader of peasant uprising, working out of Nanking), huge wall pictures of the Boxer Rebellion, large bust of Sun Yat-sen, last flag of the Ch'ing Dynasty (bringing us to the end of the Ch'ing Dynasty).

In the last room we see the huge painting depicting the students of Peking University leading the May 4, 1919 movement. On the way out we see a huge wall painting, in color, with snowy neighboring mountains, of the Great Wall. We finish our tour at 12:15 p.m. and say goodbye to Chien Su-chieng and ride back to the Peking Hotel. I present Ms. Chang with gifts at this time, a Dashiell Hammett book, "The Thin Man," an ACS necktie for her brother and a number of other gifts including some for Ms. Ts'ao Hsuan-hsuan, Ms. Hu Feng-hsien, Ch'iu Ping-chun and Shih Wei-ming.

I manage to write a letter to Helen to bring her up to date on my visit, inform her of Tsien San-tsiang's invitation to us to visit The People's Republic of China.

Since the other members of our group have already returned from their visit to the Forbidden City and have had their lunch, I eat alone, at a new table, in the dining room. I choose to have a "western style lunch."

While the others of our group do some sightseeing, reading, etc., I take a leisurely 2½ hour walk through the streets of Peking with Ms. Chang as my guide. We walk down Wang Fu-ching Street, by the Peking Duck Restaurant, along interesting narrow side streets with small homes, by boys playing marbles at the street side, the Capital Theatre, a Palace of Youth, the Art Gallery, back along Wang Fu-ching



Popsicle vendor and crowd, Wang Fu-ching Street, Peking,
May 23, 1978.

Street to the Peking Hotel. I take a number of pictures. We stop at the large department store (largest in Peking) on Wang Fu-ching Street, a street with shops of all kinds, where I buy some Chinese handkerchieves and scarves for gifts.

I return to my room, pack my bags and go down to the restaurant to have my last meal (all of us eat western style this time) at table 2 with Bigeleisen, Larson, Stein, Lee and Geyer. We then ride to the Peking Airport along with our guides Ms. Ts'ao Hsuan-hsuan, Ms. Chang Hsiao-hsiao, Shih Wei-ming and also Teng Shao-lin (Librarian, Institute of Chemistry). I ride in my car with Yuan Lee and Ms. Chang. Soon after our arrival at the Airport we learn that China Airlines flight no. 163 to Talien (Liaoning Province), due to depart at 7 p.m., is long delayed.

During the long wait I write a postcard to Pat Johnson et al at Lawrence Berkeley Laboratory.

Shih and Teng are scheduled to travel with us, but Ms. Ts'ao and Ms. Chang stay with us during our wait.

Bill Thomas joins us, having just seen the Chinese Fertilizer Chemistry Delegation off to the United States.

We finally board China Airlines flight no. 163 and it leaves at 9 p.m., 2 hours late.

We arrive at Talien Airport, in a slight drizzle (Talien, also known as Dalien and Darien, is the former Port Arthur and is situated on the tip of the Liaotung Peninsula) at about 10:30 p.m., 2 hours late.

We are met by K'ou Ken-sheng, Deputy Chairman, Scientific and Technology Committee, Talien; Chiang Ping-nan, Deputy Director, Research Division, Institute of Chemical Physics, Talien, and whom I met as a member of the Chinese Chemistry Delegation to the United States last year; Ku Yi-chian, Chief, Scientific and Technical Department, Institute of Chemical Physics, Talien; Meng K'uan-wu staff member, Scientific and Technology Committee; Sun Yun, Foreign Affairs Bureau, Talien City; Swei Da-yung, staff member, Scientific and Technology Committee.

I ride in a car with K'ou and Teng, the others in a bus, to nearby Talien, a city surrounded by hills, with our luggage in a truck, to the Eastern Mountain (Dongshan) Guest House (about 17 km) in Talien (population 1,200,000), where I am assigned to room 432 in the six story hotel, the others in neighboring rooms also on the fourth floor. My room has twin beds, simpler than in the Peking Hotel, with a simple bath and an adjoining living room which has the familiar white-covered sofas and chairs, white-covered cups on two tables and a thermos bottle of hot water. I notice in the halls there are spittoons on the floor. We receive no keys for our rooms.

After a little conversation with our hosts, I retire at about midnight.



Peking Hotel, including center and west wings (old section) and traffic on Ch'ang An Boulevard, Peking, May 23, 1978. Delegation stayed in new, tall, east wing.

Wednesday, May 24, 1978 - Talien

I arise at 6:30 a.m. to meet our schedule. I have trouble getting hot water for shaving but solve my problem by using water from the thermos bottle.

Looking out the window, I see a slight wetness (there has been a light rain). Our hotel is on a hill. There is a view of the sea, a hill nearby, a huge rock hill in the sea and small mountains across the sea in the distance. There are some nearby apartment buildings.

I walk down to a room on the second floor which has a table set with six places for our breakfast but there is no one here to serve us at the appointed time (7 a.m.). On the way down I see a girl at the reception desk on our floor, none on the third and second floors - perhaps the hotel is not too full.

We are served, a few minutes later, by a girl, 2 eggs, bread, butter and jam, fried rice patties filled with jam, cafe au lait and tea.

Our group rides, in the same manner as we came last night, to the Institute of Chemical Physics accompanied by our guides - K'ou (with me), Meng, Sun and Suei.

We drive through the center (downtown area) of Talien, passing a park, on the way to the Institute of Chemical Physics, which we passed as we drove to the hotel last night. There is a slight drizzle as we arrive at the Institute (Zhong Shan Street), at about 8 a.m.

We are greeted by Fan Ta-yin, Director of the Institute of Chemical Physics, Chang Lo-feng (Deputy Head, Division of Analytical Chemistry and Deputy Director of the Research Division, and a member of the 1977 Chinese Delegation to the U.S.), Ku Yi-chian, Chiang Ping-nan, Liang Tung-pai (Assistant Researcher) and Sung Yan-k'uei (staff member).

We go up to the reception room on the second floor of the Main Building which has the familiar setup of tea cups, etc., where we see on the blackboard, in Chinese and English, the words "Warmly Welcome the American Delegation of Pure and Applied Chemistry" and are welcomed in a prepared speech by Fan Ta-yin.

The Institute was originally a Polytechnic Institute, set up under the Japanese in 1908. It was expanded under the leadership of Chairman Mao. It soon specialized in catalysis, chromatography, chemical engineering. In 1950 it became a part of the Academy of Sciences and was named the Petroleum Research and Engineering Institute. It began to specialize in catalysis, chromatography, chemical engineering, synthetic liquid fuels, modern



Delegation (Group B) and hosts, Institute of Chemical Physics, Talien, May 24, 1978. From left to right: Meng K'uan-wu (Talien Science and Technology Committee), Sun Yun (Talien City Foreign Affairs Bureau), Sung Yan-k'uei (staff), Larson, Stein, Chiang Ping-nan (Deputy Director, Research Division), Lee, Ku Yi-chien (Responsible Person, Scientific Administration), Chang Lo-feng (Deputy Director, Research Division, Seaborg, Bigeleisen, Fan Ta-yin (Director), Liang Tung-pai (Assistant Researcher), K'ou Ken-sheng (Deputy Chairman, Talien Science and Technology Committee), unidentified, Chiang Jen-chien (staff).

analytical chemistry. The Academy of Sciences decided to turn it into the Institute of Chemical Physics in 1962. There are 800 employees, 500 of them scientific workers.

There are nine departments, five at this site. These five are: 1) Basic and applied catalysis (with work on physical chemical properties of catalysts, studies of the adsorbed state, petroleum reformation and nitrogen fixation); 2) Chromatography and general analytical chemistry (work on high efficiency columns and the theory of gas chromatography); 3) Molecular reaction dynamics (planned work on energy transfer processes and theoretical analysis of scattering dynamics); 4) Chemical engineering (planned work on reverse osmosis for desalination and chemical reaction engineering); 5) Scientific instrumentation (work on scientific instrumentation, computerization, automation, etc.). The other four departments are located at another site near the sea. The program, including work at this other site, includes investigations of chemical simulation of nitrogen fixation, new reactions of transition metal catalysts, olefin polymerization, trace analysis of organic materials, ultra analysis for other elements, high pressure chromatography.

We will visit and be briefed on 1) chemistry of nitrogen fixation; 2) olefin polymerization; 3) reactions of transition metal complexes; 4) catalysts; 5) chemistry of hydrocarbon reactions; 6) study of adsorption states; 7) trace analysis; 8) high pressure liquid chromatography; 9) investigation of macro-cyclic ethers.

Fan describes their setback due to the "Gang of Four" and subsequent recovery. I respond with a description of the ways we have acquired knowledge about the Institute, from the two members of the Chinese Chemistry Delegation that visited the United States last year and during our visits in Peking and the consequent favorable impression we have. I express delight that we are going to see the work in 9 departments, a heavy schedule which we like. I then introduce the members of our group.

Fan introduces his senior people (including those who greeted us upon arrival).

Bigeleisen suggests we divide responsibility in order to cover better what we are about to see, so I make suggestions as to division of responsibility among our group members.

We now start our tour of laboratories, at about 8:30 a.m. Fan, Chiang, K'ou, Chang, Ku accompany us on our tour.

We go to the first laboratory on the first floor where we meet a number of technicians and listen to Wang Shie-tau as he describes work on trace analysis. They determine trace quantities of nitrogen, chlorine, sulphur and phosphorus by gas chromatographic methods. They use flame ionization and electron capture detectors to great advantage and can selectively detect nitrogen and phosphorus in organic compounds. Their detectors have a sensitivity of the

order of a picogram per second and they can detect as little as 10^{-13} grams of DDT per second. In terms of concentration the sensitivity is a nanogram per milliliter of solution, and since they can make an analysis with 10^{-3} ml they can detect on the order of a picogram. They hope to make these detectors in mass production quantities. The system uses British Unicam chromatographic equipment. Wang shows us a number of chromatograms to illustrate results obtained in this program.

Next we go to another laboratory on the first floor (of the rather large building) to be briefed on other work on chromatography by Lu P'ei-chang. Again a number of technicians are present. They started their work in 1954 and they work on the dynamic theory of chromatography. He describes work on capillary gas chromatography and shows us examples of capillaries. They have studied cuts from various petroleum fractions, are able to elute 9 peaks in 9 seconds and can make a complete analysis in 2 minutes. Lu shows us the output from a flame ionization detector displayed on an oscillograph, which can be photographed. They also separate noble gases and detect impurities in neon, krypton and xenon in the range 1 to 100 ppm. They use as a support polytrifluorochloroethylene in a number of their experiments. We look at their gas chromatography apparatus in detail. They use apiezon wax for seals, make their own stopcocks. They also work on high performance liquid chromatography, measure small concentrations of impurities in wines.

We walk across the grounds to another building. There are a dozen or more good-sized buildings on the site, nearly all made of brick. The building we enter has a kind of stucco-type construction. Here in a room on the first floor we are briefed on chemical simulation of biological fixation of nitrogen. The basic reaction is $N_2 + 8H^+ + 8e^- \rightarrow 2NH_3 + H_2$. The energetics in terms of energy needed to break nitrogen-nitrogen and carbon-carbon bonds is described. They use electron donor-acceptor complexes in this work and conduct experiments at $350^\circ C$. They use ferric chloride plus potassium as reducing agent, mounted on graphite (or other bases such as alumina or activated carbon) in their catalytic matrix. They conclude the potassium component acts as a catalyst and not as a reductant. They find the potassium reduces the iron to the zero-valent form. They have compared the use of ferrocene with ferric chloride, found the ferrocene to be more active but lacking in stability. These catalysts have greater activity than commercial synthetic ammonia catalysts but the stability leaves something to be desired.

In the future they plan to study the use of various iron complexes, using large ligands as the complexing agents. They will study the interaction of the support with the active agents.

We see the vacuum line setup where such research is conducted. They can obtain a vacuum of 10^{-4} - 10^{-5} mm, measured with a Pirani gauge and an Ionization gauge.

We now go to a neighboring laboratory where Liao Shih-t sien describes their work on olefin polymerization. Technicians are present as in the other rooms. With propylene they work at 30 atmospheres pressure and have highly efficient titanium catalysts — yields of 45,000 - 50,000 grams polymer per gram titanium, and can reach 100,000 grams of polymer per gram titanium with a catalyst support. They have developed an equation to describe their yields of product. They have conducted experiments on the copolymerization of long chain polymers, including the use of ethylene as well as propylene. There are ample resources of rare earths in China, and therefore they plan to investigate rare earth complexes as catalysts. They ask our opinion about using f orbitals as complexing means. They have also studied the copolymerization of long chain olefins, show us a sample of a copolymer, from a C-10 to C-16 raw material. They measure molecular weights by conventional viscosity methods. They use Silicone High Vacuum Grease imported from England.

We go to a laboratory on the second floor where Tsung Sian-mow briefs us on their work on organometallic compounds, again in the presence of a number of laboratory workers. He describes the rationale for and reactions of organometallic complexes containing pyridine. Although pyridine does not react with alkyl halides to produce alkyl pyridine (reaction carried out in diethylether), they find organometallic complexes (with first row transition elements) of pyridines do react with alkyl halides (Cl, Br, I) to produce alkyl pyridines, in agreement with their theory and their calculations (Hückel molecular orbital calculations). They do their calculations on their computer (103, built in China).

We walk back to the Main Building.

We then travel by cars (I with K'ou) and bus to the other site of the Institute of Chemical Physics, in a valley near the bay. Liang Dong-bei, Assistant Research Fellow working on catalysis, rides with me to serve as interpreter.

We arrive at the site, go to an engineering-type laboratory on the second floor to be briefed on their work on heterogeneous catalysis. (For each of the briefings in the various laboratories we are furnished chairs to sit on.) They are studying the dehydrogenation of long chain paraffins using platinum combined with other elements. They are attempting to develop better catalysts. They study the influence of uranium, iridium, germanium, lead, zinc, etc. on the activity of the platinum-containing catalyst, which is supported on gamma alumina. They use x-ray diffraction apparatus (made in Japan), an electron microscope (made in China) and hydrogen chemisorption to characterize these catalysts. They measure surface area of their catalysts. The large panel for controlling the apparatus (built in the Institute with some components built in Shanghai) for the production of catalysts to study reforming reactions is described to us. They have developed a reforming catalyst, not described to us, that produces 55% aromatics from T'aching oil as compared with 45% produced with conventional catalysts.

We go to a neighboring room where Tao Lung-jan briefs us on reaction chemistry of micro-catalytic conversion processes. They study the mechanism of reforming reactions using mixed component catalysts. They are studying the reaction mechanism of hydrogenolysis and isomerization, postulate the involvement of the cyclopropyl radical as an intermediate in such reactions. They have studied the theory of molecular orbitals of cyclopropane; there is bonding with the d orbitals of platinum. Tao shows us a micro-reactor connected to a chromatographic apparatus for analysis.

We go to a neighboring room. Here Hsin Chin briefs us on their work on chemisorption as applied to the surface of catalysts. Using chemisorption techniques they have studied the mechanism of the oxidation of ethylene to ethylene oxide. They are studying, under reaction conditions, adsorption, desorption and the structure of the adsorbed state and the correlation of this structure with reaction mechanism. Carbon monoxide is used as a molecular probe for the adsorbed state. Here again they use bimetallic catalysts such as Pt-Au and Pt-Ag. They show us apparatus including their platinum catalyst and instruments for detection of products, based on a vacuum line; this apparatus includes Kovar to glass seals and flexible bellows (made in China) and can be rated as first class. The apparatus includes an omegatron mass spectrometer and a Perkin Elmer No. 577IR spectrometer. They are not yet using ESCA apparatus, plan to use this technique (which is already used elsewhere in China). Also included in their apparatus are high quality high vacuum valves and flanges, purchased from Varian in Canada.

We then walk to a nearby building. We go to a third floor laboratory where Sun Yan-k'uei briefs us on their work on high molecular weight polycyclic compounds (macro-cyclic ethers). He describes the synthesis of crown ethers, with molecular weights as high as 100,000. We see the refluxing solution, leading to synthesis of di-benzene-18 crown ether.

Thus we come to the end of our tour and briefings at 11:45 a.m. We go outside and take pictures of the combined group. We then ride back to the hotel (I with K'ou and Teng) for our lunch. Our ride reveals an attractive city, with many multi-family dwellings, an extensive town section, a number of factories, etc. As we begin to climb the hill to our hotel, we see many smaller dwellings, most of them built of stone, presumably multi-family type. We meet hundreds of school children on their way home from school. We also see many dwellings made of brick. Our hotel is higher up in the hills than I had realized as we approached it last night.

We arrive at the hotel about 12:10 p.m., go to our rooms which we find were locked during our absence, have them opened by the girl at the fourth floor reception desk and then go down to our second floor room for lunch (leaving our rooms unlocked meanwhile). We have a Chinese and western style lunch, according to our wishes.

All of us except Yuan Lee (who will lecture at the Institute of Chemical Physics this afternoon) leave at about 12:50 p.m. I ride in my car (with K'ou and Teng), with the others following in the bus, to the Oil Harbor. We drive back down the hill, through downtown Talien, pass Stalin Square in the center of the city which is flanked by the huge building of the Talien Revolutionary Committee; this building houses the offices of the Talien Science and Technology Committee. We see old fashioned electric trolley cars on tracks as we did last night; this, apparently, is an extensive network for transportation in Talien. We see many people walking along the sides of the streets and riding bicycles, many trucks, almost no passenger cars, a few mule and horse driven carts. I have the impression Talien is quite free of pollution. We proceed in the general direction of the Airport, turn off about 2 kilometers short of the Airport and continue along a road that has very heavy truck traffic. As we approach Oil Harbor there is open country, fields with occasional clusters of stone dwellings, with diminishing traffic.

We pass a huge limestone digging on the side of a hill on the left. We pass the northern tip of the bay on our right as we proceed generally northeast. The ground, containing many rocks, has been cleared of rocks to make agriculture possible and the rocks are piled to build wall fences, terraces, or just piled up.

We finally travel along a road where there is very little motor vehicle traffic, bordered by stone dwellings on each side. Women are working in the stone-cleared fields. There are more mule, horse and some oxen drawn carts. The road is paved all the way.

We arrive at the near (or west) side of the harbor at about 2:10 p.m. and head south. Soon we reach an area where the road is under repair — here about a hundred laborers, men and women, are building a rock wall along the hill side of the road.

We reach the Oil Harbor at about 2:20 p.m. Here the oil is handled that comes down from the Tach'ing Oil Field. To reach the Oil Harbor we pass along a street lined with apartment buildings; this is the town built for the people who work here.

We drive up to the Administration Building and are greeted by Meng Yi, Manager of Shing Harbor (New Harbor), or Oil Harbor, and Shang Chun-yim, staff member, and others. We go up to the third floor to the reception room where we sit down for the traditional tea and briefing.

Meng tells us we are the first Americans to visit Shing Harbor, which is operated under the administration of Talien Harbor. The facility here was built to load into tankers, for export, oil that comes here by underground pipeline from Tach'ing. Construction was started on May 1, 1976 and was completed in 18 months. Premier Chou En-lai had the idea for this and it was built according to

Chairman Mao's instructions. It was designed and built by the Chinese and includes a bridge 1,400 meters long to convey the 4 oil pipelines and one line for waste water to the dock, where a 100,000-ton tanker can be loaded on one side and a 50,000-ton tanker on the other. The loading speed is 10,000 tons per hour and they have storage space for 300,000 tons. This is the first oil harbor to be built in China. They wish to export oil abroad. Romania is one of their best customers, as well as Japan and south Asian countries. They have also built a club and hotel for use by foreign visitors.

At the conclusion of the briefing we go outside to our car and bus. I ride in our car with Meng, K'ou and Teng. We drive by the building housing the club and Friendship Store. I see a picturesque little wooden boat at the water's edge.

We drive out on the bridge to the dock, see the 5 pipelines on the bridge. We get out of our vehicles and walk on out to the end of the dock. A tanker is at the dock; we are told it is pumping water through the waste water pipeline at this time. We take a number of pictures.

We drive back on the bridge to land and take a picture of our combined group and say goodbye to our hosts.

We leave at about 3:15 p.m. and drive back as we came. We pass a group of about 100 middle-school students returning home from school. We stop at the Institute of Chemical Physics to check on Yuan Lee, find he hasn't finished his lecture yet; so we continue on to our hotel. We drive along tree-lined streets, upon which many people walk in preference to the sidewalks. There are many bicycles.

We return to our hotel at about 4:30 p.m. and go to our (unlocked) rooms for a few minutes to change clothes before our hosts are to come to take us to dinner in the hotel at 5 p.m.

At 5 p.m. we go to the reception room on the fourth floor to meet our host for this evening's dinner, Tsao Lin, Chairman of the Science and Technology Committee of Talien. Here we sit at the little tables with the tea service as Tsao greets us and gives us some history on Talien. Talien came under Russian domination in 1894, then Japanese domination in 1904 as a result of the Russo-Japanese War. It went back in Russian hands in 1945 and the Russians left in 1955. There were no research institutes during Russian or Japanese dominance up to 1904; the number of research institutes, universities, middle schools (there are now 80) increased dramatically after Liberation in 1949. Now the main industries in Talien are machine, chemical, textile, electronic and ship industries. The Talien area has a population of about 4,000,000. He also tells us of the adverse impact of the "Gang of Four." I respond to his remarks by expressing appreciation for their hospitality, describing our activities today, suggesting our cooperation in chemistry should increase in the future.



Tanker, Oil Harbor, near Talien, May 24, 1978.

Tsao tells me he was locked in a school room for 7 months during the Cultural Revolution (1968-69), which he blames on the "Gang of Four."

We go down to a second floor dining room for our Chinese dinner. Present at the reception and dinner are, besides the 8 members of our traveling group, Tsao, Fan, K'ou, Ku, Chiang Ping-nan, Chang, Men, Sun and Suei.

Tsao gives a brief welcoming toast near the beginning of our dinner, followed soon by another by Fan. I respond with a toast, translated by Yuan Lee, near the end of dinner — a brief one expressing appreciation for hospitality shown us, delight at many new friends we have found in Talien and our new acquaintance with the city of Talien and I then propose increased friendship between the scientists and peoples of our two countries.

Chiang Ping-nan and Chang Lo-feng thank me for the photos I sent them taken during their visit to Berkeley last year as members of the Chinese Chemistry Delegation.

We then ride to the People's Cultural Club in Talien, I with Tsao and Teng in our car, the others in the bus and other cars. Here we see the performance by the singing and dancing ensemble of the city of Talien. The huge theatre is full of people. Members of a soccer team from the Soviet Union sit in front of us, identified for me by the young man who sits next to me.

We enter the theatre after the show has begun (the starting time was 6:30 p.m.). We hear a 15-piece ensemble of Chinese musical instruments, see a dozen girls dancing with fans to enhance the artistic quality of their movements, another group of girl dancers, hear a male singer, a male quartet with accordion accompaniment, the music ensemble again, see 15 girls dancing with beautiful green costumes, a male dancer who twirls a long piece of cloth with his head to give a loop effect, hear a group of 12 girl singers featuring a very popular soloist who wins the affection of the audience, then see a finale including most of the performers.

The performance ends about 8:40 p.m., Tsao bids us adieu and I ride back to the hotel with K'ou and Teng with the others coming in the bus.

I retire at about 10 p.m.

Thursday, May 25, 1978 - Talien

I arise at 6:30 a.m., have breakfast with Bigeleisen, Stein, Lee and Geyer in our restaurant room on the second floor. Larson has decided to sleep longer this morning.

At 7:30 a.m. we leave with our hosts in our car and bus — K'ou and Teng with me in the car, Meng, Sun and Suei with the others in the bus. We drive down to the nearby beach at the area of the rock-hill island (Bangehui Islet) visible from my room in the hotel, where there is an operation for planting, growing, and harvesting sea weed (kelp), a source of food. We see piles of sea weed on the beach and a work force of women in the process of harvesting more.

We then ride to the Institute of Chemical Physics. I am impressed by the many trees lining the sides of the streets. K'ou tells me that Zhu De, Chairman of the National Committee (who passed away in July 1976), during a visit to Talien in 1962 noted the lack of trees, suggested a tree planting program to beautify the city.

When we arrive at the Institute we are met by Fan, Chiang Ping-nan, Chang, Ku, Liang and others. We have our picture taken on the front steps of the main building of the Institute by a host photographer.

Ku tells me that he worked with Wm. H. Hamill at Notre Dame University from 1948 to 1950, stopped his work at the Master's Degree because he felt he should return to China following the Liberation movement in 1949. After assuring Fan we do not need a rest, we go to the already full lecture room, take our seats in the front rows with our tea cups at about 8:15 a.m. Ku makes the introductory remarks, introduces Lu P'ei-chang for his lecture on "Some Basic Principles of Chromatography." Lu speaks in Chinese with translation by Chang. Lu begins by saying he will skip the theoretical aspects, and will cover four aspects: (1) resolution criteria; (2) peak widths; (3) peak capacity vs. column length; and (4) prediction of separation. He discusses both gaseous and liquid chromatography, describes the use of silica gel as one of the absorbents they use. He concludes his lecture at about 9 a.m. Ku then thanks the speaker and calls for questions. Bigeleisen asks about the effect of pressure on compressing the constituents, Lee about the possible separation of CH_4 and CD_4 and I about separation of aqueous inorganic ions.

After the lecture by Lu, Yuan Lee is asked to continue his lecture of yesterday, while Bigeleisen, Stein, Geyer and I and our escorts (K'ou, Meng, Sun, Suei) are scheduled to visit the computer center and library. We walk with K'ou, Fan, and others to a nearby building, go to a room on the second floor where Shih Hsi-yan shows us their DTS-130 computer, made in China, which

operates with sixteen bit words, 5,000 operations per second, 16K core memory, uses a paper tape recorder manufactured in Tientsin. Their computer uses basic programming, not Fortran. They have used this to solve a number of problems in molecular structure. Their computation group was set up recently, so their efforts are rather limited. They have a new and larger computer with a capability of one to two million operations per second, with automatic retrieval of information, and remote access terminals, being manufactured in Shanghai. Provision for computer-to-computer connection will come somewhat further in the future.

We walk back to the main building, go to the library on the second floor where we are briefed by the librarian, Lee Hai. The library has about 30,000 volumes, mostly periodicals, about 10,000 books, many of them 17th, 18th and 19th century, left by the Japanese. They have 250 Western periodicals, including 50 Russian, 405 total. They have *Chemical Abstracts* from 1907. Current issues of American journals are received by the Academy of Sciences and reproduced in a central library and distributed on a delayed basis throughout the country. We see original issues of some journals, such as *Chemical and Engineering News*, indicating someone in the Institute is a member of the American Chemical Society and putting the journal in the library. They have *Nature* starting with Vol. 22, *Journal of Chemical Physics* from the beginning, the *Journal of the American Chemical Society* from the beginning, now all currently reproduced as the issues arrive in China.

We conclude these visits at about 9:45 a.m. Yuan Lee is still lecturing to a "standing room only" crowd. We say good-bye to our hosts on the front steps of the main building of the Institute, which is situated quite close to the street (Zhong Shan Street). I present a Hewlett Packard HP-21 calculator and battery charger to Fan and Bigeleisen presents him with the National Academy of Sciences publication "Halocarbons."

We (Bigeleisen, Stein, Geyer, Teng, Shih, K'ou, Meng, Sun, Suei and I) ride, without Lee, to the nearby locomotive factory where we are greeted by Chu Zhong-cheng, who shows us first the huge machine shop, with Chinese-made lathes, and much other sophisticated equipment. The machinists seem to be working without eye protection.

We then go to the "number one" workshop. Here we see machines that drill six holes in a block simultaneously, and much other sophisticated equipment. Tolerances of 0.001 - 0.002 mm are achieved with some of the equipment. Here some workers wear mouth and nose masks to protect against dust, etc. Women operate some of the machines. Many of the workers are young. All these machines are made in China, some in this factory.

We next visit the "number two" workshop. These workshops are huge, perhaps 150 yards long, 50 yards wide, in the case of workshop number two. Here we see basic locomotive engine blocks,

each containing 578 holes — it used to take eight days to drill these holes, now it takes three hours using a machine made in this factory, programmed by a computer. We see a computer-controlled finishing machine.

Premier Chou En-lai visited here before the Cultural Revolution, and asked them to build the machines themselves.

In an adjoining portion of number two workshop, we see assembled locomotives of the diesel type. They produce 150 locomotives a year, make all the parts except the bearings.

We make a tour of a finished 4,000 horsepower diesel locomotive (serial No. 0225), then take a short ride in it. This is well designed, easy to start and operate with the controls well laid out on the control panel.

Then we go to an administration building, upstairs to a large reception room, where we sit in traditional white-covered sofas and chairs and are briefed by Chu. He says the name of the factory is "Talien Locomotive Factory of Ministry of Railway." The two main products are 4,000 horsepower locomotives and motors for cargo. The factory started in 1901 (period of Russian occupation). In 1905, the Japanese took it over, until 1945. There are now 9,000 workers and staff members, including 2,000 women. After Liberation, there were three modifications — first, in 1954, to transform from a repair to manufacturing factory; second, in 1958, conversion from production of steam locomotives to 2,000 horsepower diesel locomotives. Russians gave them trouble in this conversion. In 1960, Soviets withdrew after delivering only a small part of the equipment, took design drawings and data with them back home. They wanted to give oppression politically and technically. These actions of the Soviet "revisionists" angered the workers in the factory. They decided to do things according to Chairman Mao's instructions and make locomotives themselves. Other sources in China produced machines for them immediately, and engineers and technicians came here from other parts of China to help. In 1964, the first locomotive was produced by 100% Chinese effort, and in 1965 they went into production themselves. The Russian withdrawal, therefore, turned out to be a good thing.

Going back to his three points, Chu says the third is the performance after the Cultural Revolution. In 1969, they started towards production of 4,000 horsepower locomotives. They have built up 60 automatic production lines, some of which we have seen this morning. The production of 4,000 horsepower locomotives started in 1974, when production of 2,000 horsepower locomotives ceased.

Despite all this, Chu tells us, there are some shortcomings. The total degree of mechanization is not high, there still is much hard labor. So they are responding to a call of Chairman Hua to improve and sweep out the influence of the "Gang of Four." With

the help of large posters, meetings, etc., they can stamp out the continuing influence of the "Gang of Four." The posters we saw on our tour are meant to criticize some cadres who still do not wish to criticize themselves and reform.

The workers are trying to work for the four "modernizations" (1) agriculture; (2) industry; (3) science and technology; and (4) national defense. During the period of the "Gang of Four" many scientists and engineers were afraid to study, because they would be accused of taking the "white" road as opposed to the "red." There was a "hero" because he turned in a blank paper in his examination. His name is Chang Tie-shang and he is from Hsin Chen county here in Liaoning Province.

We finish our meeting at about 11:30 a.m. As we leave the building, we see cadres reading the bulletins on the wall which are meant to convince them they should reform.

We ride back to our hotel in our car and bus. As we start up the hill, we meet a large group of middle school students on their way home to have lunch. We arrive back at our Eastern Hill (Dongshan) Guest House at a little before noon. I find my rooms locked so I find the girl at the reception desk to get them opened. We soon go down to our room on the second floor to have our lunch. We have our lunch — Bigeleisen, Larson and I, western style, Stein, Lee and Geyer, Chinese style.

We reassemble in front of the hotel at 1 p.m. We ride in our car and bus, as usual, to the Petroleum Refinery Plant No. 7. Now we have our entire group, including Yuan Lee and Larson. We drive along Zhong Shan Street (a wide street and one of the two main streets of Talien — the other is Yellow River Street). Just beyond Stalin Square, we turn right, continue on other wide streets, some with trolley lines, some with bordering cement sidewalks and some with no sidewalks, all with trees, through a factory district of more narrow streets. We see civil defense shelters built into the hills, particularly in the rock areas. We finally drive up a hill to arrive at the Petroleum Refining Plant No. 7, which is situated at the edge of bay, at about 1:40 p.m.

We are greeted by Jin Hsi-gao, the General Manager, who leads us to a reception room on the ground floor of the main building, to sit down for the familiar briefing with tea served in the usual manner. He briefs us on the plant, reading from prepared text. It was started in 1934, soon reached a production of 50,000 tons a year (this old plant is still operating), and was liberated from the Japanese in 1945, prospered for awhile, but had difficulties with the Soviets who were ostensibly here to help. Chairman Mao exhorted them to be self-sufficient. After Tach'ing field was discovered in 1959, a new plant was built and Tach'ing petroleum began to flow into the plant. They now process 5,000,000 tons of crude oil per year and produce 1,200,000 tons of gasoline per year. They have 80 kinds of products produced using equipment

built by themselves. Since 1969, they have fulfilled quotas designated by the government with an average annual increase of about 20%. The "Gang of Four" interfered with production, the Communist Central Party smashed the "Gang of Four" and subsequently great improvements have taken place in their plant. Although they have made some achievements, there are still disrupting activities by the "Gang of Four;" so these must be criticized, and the level of plant management must be improved.

At the conclusion of the briefing, I ride with Jin, K'ou and Teng, with the others in our bus, to the distillation towers and the control room.

We then ride to the area of the reforming equipment. We see towers 30 meters high and 2.6 meters in diameter designed and built in The People's Republic of China. Here they have a capacity of 150,000 tons of aromatics (benzene, toluene, xylene, etc.) per year.

We then walk to the nearby catalytic cracking unit, which has a capacity of 600,000 tons per year (gasoline, diesel oil, etc.) and we see its control room. This unit started operating in 1975.

We finish our visit at 2:30 p.m., then drive in our car and bus to Tiger Beach, using the same route as that over which we came. At Tiger Beach Park, a rocky hill area at the edge of the sea, we all walk along the beach, up the hill, and over various paths, taking some pictures.

We then ride back to our hotel, arriving at about 3:40 p.m. We spend the time in our rooms, then assemble in the lobby preparatory to leaving for the railroad station. Our hosts K'ou, Ku, Chiang, Chang, Liang, Meng, Sun, and Suei meet us here. Then all of us, our eight hosts and group of eight (Bigeleisen, Lee, Stein, Larson, Geyer, Shih, Teng and I) ride to the railroad station in cars and bus, leaving about 4:30 p.m. During my ride with K'ou and Teng, K'ou tells me of his correspondence with Zhu Dau-chung of the Finigan Company of San Francisco from which they have purchased analytical instruments such as a quadrupole mass spectrometer for use at some unidentified site (not the Institute for Chemical Physics).

We arrive at the station a little before 5 p.m., are helped on the train with our luggage by our hosts, then say good-bye to them.

We find that we have two good-sized compartments, so we distribute ourselves four in each. The train leaves on time at 5:05 p.m. As the train rolls out through the countryside, we see large fields under cultivation, interspersed with rolling hills.

Bigeleisen and I work on the "Nuclear Chemistry" section of the report our Delegation is going to produce for publication upon our return.

At about 7:30 p.m. we go into the neighboring diner to have our dinner. This is a diner like we used to have in the United States, capable of serving a wide variety of dinners. There are some ten waitresses and waiters to serve this one car — perhaps not all on duty. Our group occupies three tables. There are flowers in pebble-filled clay pots at each table. As we leave I see about seven people in the galley.

After dinner, back in our compartment, Bigeleisen and I complete the first draft of our section "Nuclear Chemistry," working with a tape recorder. Most of us manage a little nap before the train arrives at Shenyang (the former Mukden) Railway Station at 11:30 p.m. We are met by Tsou Te-ch'en, staff member, Science and Technology Committee, Liaoning Province.

We are transported by a small bus to the very nearby Oversea Hotel. I have a bedroom (room 301) and living room (with sofa, chairs and tea cups) on the third floor, the others have rooms on the second floor; all of the accommodations are rather primitive. I retire immediately upon arrival.

Friday, May 26, 1978 — Shenyang; Changchun

I arise at 5 a.m. We assemble in front of the hotel, walk to the very nearby railroad station while our luggage goes there in the bus. We note a greater interest in foreigners here in Shenyang than in the other places we have visited.

At the railroad station, we wait in a reception room equipped with sofas, chairs, tables and tea cups, learn the train isn't due to leave until 6:13 a.m. We finally board the train with the help of Tsou Te-ch'en and others with our luggage. The train leaves at 6:13 a.m., on time. We have two compartments, as we had yesterday, each with a small table at the window containing a bonsai plant in a clay pot, a lamp and four covered tea cups.

As we leave Shenyang, we see evidences of small industries near the train tracks with piles of coal, sand, wood, etc.

At about 7:30 a.m. we go to breakfast in the neighboring dining car. We sit at two tables, Bigeleisen, Larson, Stein and I sit together to have a so-called western breakfast — a sort of Spanish omelet, a kind of fried bread, and plain bread. All of us decline the glass of hot milk. I am told there is no tea available, manage to get a cup, using hot water and Yuan's supply of green tea.

The train passes through a flat landscape of large fields under cultivation, dotted with little villages and some individual dwellings — the famed plains of Manchuria. People, including many women, are working in the fields. We pass through regions where there is a drizzle of rain. A radio blares forth quite loudly with Chinese music, but we manage to find a volume control to cut down the volume in our compartment.

We arrive at Changchun (the former Hsinking) Railway Station at 10:06 a.m., on schedule. We are met by T'ang Ao-ch'ing (President, Kirin University, and well known quantum chemist, who was the leader of the Delegation of Chinese Chemists to the U.S. last year and who obtained his Ph.D. with Ralph Halford at Columbia University, 1946-49), Woo Hsueh-chou (Director of the Institute of Applied Chemistry and who worked at Caltech from 1928-1932, from 1928-1930 with A. A. Noyes and from 1930-1932 with Badger, obtained his Ph.D. in 1931, visited Berkeley in 1931, and worked with Gerhard Herzberg at Darmstadt, Germany from 1932-1933, and whose student, T. C. Chu worked with me at Berkeley in the late 1940's), Wang Erh-k'ang (Institute of Applied Chemistry and member of the Delegation of Chinese Chemists to the U.S. last year), Huang Pao-t'ung (Director, Research Division, Institute of Applied Chemistry and a polymer chemist who got his Ph.D. with Charley Overberger, 1948-1952, at Brooklyn Polytechnic Institute, worked at Princeton University, 1952-1955), Ms. Chang Chih-min (staff member, Science and Technology Committee, Kirin Province).

I ride with T'ang and Woo to the South Lake Nanhu Guest House, in the lead car, the others following in their cars. On the way I renew acquaintance with T'ang, learn of Woo's graduate work at Caltech and am reminded he sent his student, T. C. Chu, to work with me in the late 1940's. Chu and his wife still reside in southern California, keep in touch with us by exchange of Christmas cards.

When we arrive at the hotel, we are led to our second floor suites — each with a large bedroom (with a single and a double bed), bath (with overhead shower, the first we've had in China) and a large living room. My suite has the number 229. My living room has a large writing desk with a complete tray of writing equipment of all kinds.

We learn the broad outline of our schedule in Changchun from our hosts. I meet briefly with our group to discuss our schedule, after which we all rest until lunch time.

The hotel is large and ornate, built by the Chinese in 1958. There is ornate wood carving in the halls of our second floor looking down on the large lobby from four sides

We go down to lunch at 12:30 p.m., are led to our assigned table in the dining room. A delegation of Japanese physicians is eating at neighboring tables. The dining room, with its parquet floor, is large, about half the size of the huge dining room in the Peking Hotel, with tables and chairs covered with the usual white cloth. We are served a western style lunch, with choice of beer or soft drink, topped off with beer for dessert.

Having a few minutes to spare after lunch, I take a walk on the hotel grounds. The hotel is in three parts — the center part is three stories high, four stories high in the lobby area, and at each side there are connected two-story buildings, each with an auditorium in front. The grounds are very extensive with an entrance gate as though this might be a somewhat restricted area. A PLA stands at this gate, and there are many PLA on the grounds. South Lake is situated in front of the hotel and we pass over it on a bridge in going to and from our hotel to Kirin University, the Institute of Applied Chemistry, etc.

We gather in front of the hotel at 2 p.m., ride to Kirin University on Stalin Street, I in my car with Huang Pao-t'ung and Shih Wei-ming, the others following in their cars.

We are met by T'ang, Chiang F'u-k'ang (Vice Chairman, Chemistry Department), Sun Chia-chung, Chiang Yuan-sheng (Professors in the Chemistry Department), T'ang Hsin-yi, Shen Chia-ts'ung, Hsu Ju-je, Lo Hsiu-chin, Chin Ch'ing-han (Lecturers in the Chemistry Department), Wu Pei-tzu (President's Office), and Liu Yun-tso (nuclear physicist).



Delegation (Group B) and hosts, Kirin University, Changchun, May 26, 1978. Picture includes T'ang Ao'ching (President), to right of Seaborg, front row; Chiang Yuan-sheng (Professor, Department of Chemistry), to left of Seaborg, middle row; Huang Pao-t'ung (Director, Research Division, Kirin Institute of Applied Chemistry), extreme left, front row; Wang Erh-k'ang (Associate Research Fellow), third from left, last row; Shih Wei-ming (Institute of Chemistry, Peking), extreme left, last row.

We are led to a reception room on the second floor of the Science building (housing the Chemistry, Physics and Semiconductor departments), with the regular setup for tea. Liu Jih-ch'ing (Foreign Affairs Bureau, Kirin Province) introduces the room full of staff members and I introduce the members of our group, as an Institute photographer takes movies.

T'ang then briefs us on Kirin University. It was founded in 1946 in Harbin with only social sciences, moved to Changchun in 1950 and became Northeast People's University with added emphasis on literature and the humanities, then added the natural science departments in 1952 to become a comprehensive university, assumed the name Kirin University in 1956. It has eleven departments, five in the sciences (mathematics, physics, chemistry, electronic computers, semi-conductors), and six in the other areas (history, Chinese, economics, law, foreign languages, philosophy), including a total of 31 specialities under these departments (21 in science and 10 in the other areas). There are 3,400 students, and 1,500 will be admitted in the fall (250 in chemistry). In chemistry they have six specialities (inorganic, organic, analytical, physical, polymer science, biochemistry) with a total of 520 students. They are just now changing back from a three-year (for the 3,400 students) to a four-year (for the entering 1,500 students) curriculum. There are 1,200 teaching staff, 220 in chemistry, of which 17 have the rank equivalent to full or associate professor, 28 the rank of lecturer and the remainder are teaching assistants. This unusual distribution of ranks is a result of the Cultural Revolution; it is expected that many lecturers and teaching assistants will soon be promoted. They are just getting started in graduate work following the set-back by the "Gang of Four." They will admit about 100 graduate students in chemistry this fall. Thus the total number of chemistry students in the fall will be about 870. In response to questions we learn that there is some choice of graduate school for those who pass the entrance examination (the one given nationally last week) and that the graduate course curriculum here, in physical chemistry, for example, is different from that in other Chinese universities.

We now go through an artistic wooden arch to an adjoining room to be briefed on the work in the Chemistry Department. Movies and still pictures are taken at the beginning of the briefings. After introductory remarks by Chiang F'u-k'ang, we are briefed by the following people, all speaking English and all using prepared charts — Sun Chia-chung on "Molecular Shell Model and Ligand Field Theory," Chiang Yuan-sheng on "Graph Theory of Molecular Orbitals," T'ang Hsin-yi, on "The Problem of Sol-gel Distribution During Chemical Cross-linking" (the first theory of this was made by Paul Flory in 1941), Shen Chia-ts'ung on "The Molecular Weight Distribution and Kinetics of Living Polymers," Hsu Ju- jen on the "Use of Molecular Sieve Zeolites" and on the Re^{+3} - Na^{+} exchange reaction (including a description of the kinetics of zeolitization of pumice in an alkaline environment), Chin Ch'ing-han on "Determination of Trace Total Mercury in Foods, Soils and Sediments," and

finally, Lo Hsiu-chin on "A Study on Catalysts in Heterogeneous Oxidation of Ethylene to Acetaldehyde."

The briefings are concluded at about 4 p.m. Chiang F'u-k'ang then expresses the regrets of Tsai Lu-sun, the 76-year old Chairman of the Chemistry Department, who is absent due to illness, as we prepare to visit the laboratories. He apologizes for their poor state due to the actions of the "Gang of Four." T'ang gives each member of our Delegation a book of reprints of papers presented by Kirin University people at the recent National Science Conference in Peking.

We begin our tour of laboratories, with Chiang and T'ang, by going to an undergraduate analytical laboratory (with absorption and emission spectrometers) on the fourth floor, shown to us by Chin Ch'ing-han, lecturer in analytical chemistry. This department has the responsibility of organizing a course in analytical chemistry for use in other universities in The People's Republic of China.

We go to a fifth floor laboratory to see student and research polymer chemistry laboratories with Chinese-made equipment, shown to us by Chang Hong-an. Undergraduate research work is done here — all undergraduate students must do thesis problems.

We next go to the sixth floor to the molecular sieve (zeolite) laboratory. They use gaseous chromatography for analysis purposes. The research is also done here with undergraduate (two third-year) students; one of these took the graduate exam last week. This is described by Hsu Ju-jen. He also shows us a neighboring laboratory for measuring the absorption properties of zeolites (done by two undergraduate students). In the next laboratory, they synthesize zeolite from clay, done by three undergraduate students.

In another room on the sixth floor we see reflux experiments on catalytic synthesis. They are synthesizing one of "Iber's Compounds" $-\text{Fe}_4\text{S}_4(\text{SPh})_4^{2-}$. Two undergraduates synthesized this compound in two months. This is explained to us by Lo Hsiu-chin.

Next we visit, on the fifth floor, a workshop in the Semiconductor Department, which trains some 20-30 students per year. Liu Shi-yang is our guide. In the next room we see (with Liu continuing as guide) an apparatus for testing the "chips" produced in the workshop. We see a 300 component silicon chip under a microscope. In the next room he shows us the apparatus for boron and phosphorus diffusion to form p-n junctions. In the next room, the best chips are chosen, then welded with an ultrasonic welding device. Then he shows us the photo-etching room. In the next room they oxidize the silicon to form the protective coating. In a neighboring room we see the apparatus for the evaporation of aluminum to form connections in the chips (done in 10^{-5} mm vacuum) with equipment made in China. In the next room we see the projections of line drawings of the circuits that are reduced 200-fold

in the final product. In the final room, Liu shows us the equipment for reducing the line drawings to the size of the final chips.

We conclude our tour at about 5:15 p.m., say good-bye to our hosts on the front steps of the University. I ride back to the South Lake Guest House with Huang Pao-t'ung and Shih Wei-ming, the others in the following cars.

We find that the members of our Group A have returned from their visit to Harbin and the Tach'ing oil fields — Baldeschwieler, Breslow, Ibers, Schriesheim, Wei, Suttmeier, Ms. Hu Fenghsien and Shih Liang-ho (Associate Research Fellow, Polymer Physicist, Institute of Chemistry, Peking). They have rooms on the third floor.

The twelve members of our Delegation hold a meeting in the living room of my suite to compare notes of our visits and to review our schedules for our stay in Changchun and our next stops, Shenyang and Fushun.

We go to our rooms to change clothes. Then at 6:40 p.m. we go to the reception room on the third floor for the meeting with our hosts before tonight's dinner — Ho Hsun (Vice Chairman of the Science and Technology Committee of Kirin Province) and our other hosts: T'ang, Woo Hsueh-chou, Wang Erh-k'ang, Wu Yueh (Institute of Applied Chemistry and member of the Delegation of Chinese chemists to the U.S. last year), Huang Pao-t'ung, Chiang F'u-k'ang, Ch'ien Pao-kung (Deputy Director, Institute of Applied Chemistry, who did graduate work with Charlie Overberger, 1946-49, at Brooklyn Polytechnic Institute), Ms. Chou En-lo (Institute of Applied Chemistry and member of the Delegation of Chinese chemists to the U.S. last year), Chang Wei-kang (Associate Research Fellow, Institute of Applied Chemistry), Chiang Yuan-sheng (Professor of Chemistry, Kirin University), Huang Ch'ang-ch'ang (Institute of Applied Chemistry), and Liu Jih-ch'ing, Han Sheng-sh'ian, Ms. Chang Chih-min, Hsin Lien-ti (staff members, Science and Technology Committee, Kirin Province), and our traveling escorts (Teng, Ms. Hu, Shih Liang-ho, Shih Wei-ming).

I give my slides for my talk at Kirin University to T'ang to give to Liu Yun-tso (nuclear physicist, Kirin University, who worked at the Niels Bohr Institute, 1965-69), who will be the translator for my talk tomorrow on "Transuranium and Superheavy Elements."

We sit down to our traditional green tea, while Liu Jih ch'ing introduces all of our hosts and I then introduce the eleven members of our Delegation.

Ho greets us somewhat hesitantly, emphasizing friendship between the chemists and peoples of our two countries. He doesn't even give me a chance to respond, but gets up and leads us downstairs to the dining room. Here we sit at three round tables, some 30 of us in all. I sit at a table with Ho, T'ang, Woo, Ch'ien,

Baldeschwieler, Breslow, Lee, Shih Liang-ho. Near the end of the meal Ho offers a short toast of health and friendship and I respond almost immediately, expressing wishes for health of our hosts, commenting on the fact that four of last year's Chinese chemistry delegation to the U.S. came from Changchun. I present an ACS Centennial year necktie to Ho as a remembrance, then propose a toast for increasing cooperation between the chemists and the peoples of our two countries. T'ang then also proposes a toast of cooperation and friendship.

The dinner ends at about 8:40 p.m. As we linger to say good-bye in the dining room, Liu Jih-ch'ing ushers us out in the lobby rather brusquely. We spend a few minutes with our hosts talking in the lobby, say good-bye, and soon retire to our rooms.

I retire at about 10 p.m.

Saturday, May 27, 1978 - Changchun

I arise at 6:30 a.m. Looking out my second floor window I see many PLA walking around on the large paved parking area in front of the hotel.

All twelve members of our delegation have breakfast at our two tables in the dining room. Baldeschwieler, Bigeleisen, Stein, Larson and I have a western style breakfast at our table, the others a Chinese style breakfast at theirs. Our western style breakfast of omelette, hot rolls with butter and jam is the best we have had during our present visit to the People's Republic of China.

Our delegation of twelve, plus our four guides on tour with us, gather in front of the hotel at 8 a.m. for the ride in a caravan of cars to the very nearby Institute of Applied Chemistry on Stalin Street for our visit this morning.

I ride in the first car with Huang Pao-t'ung and Teng.

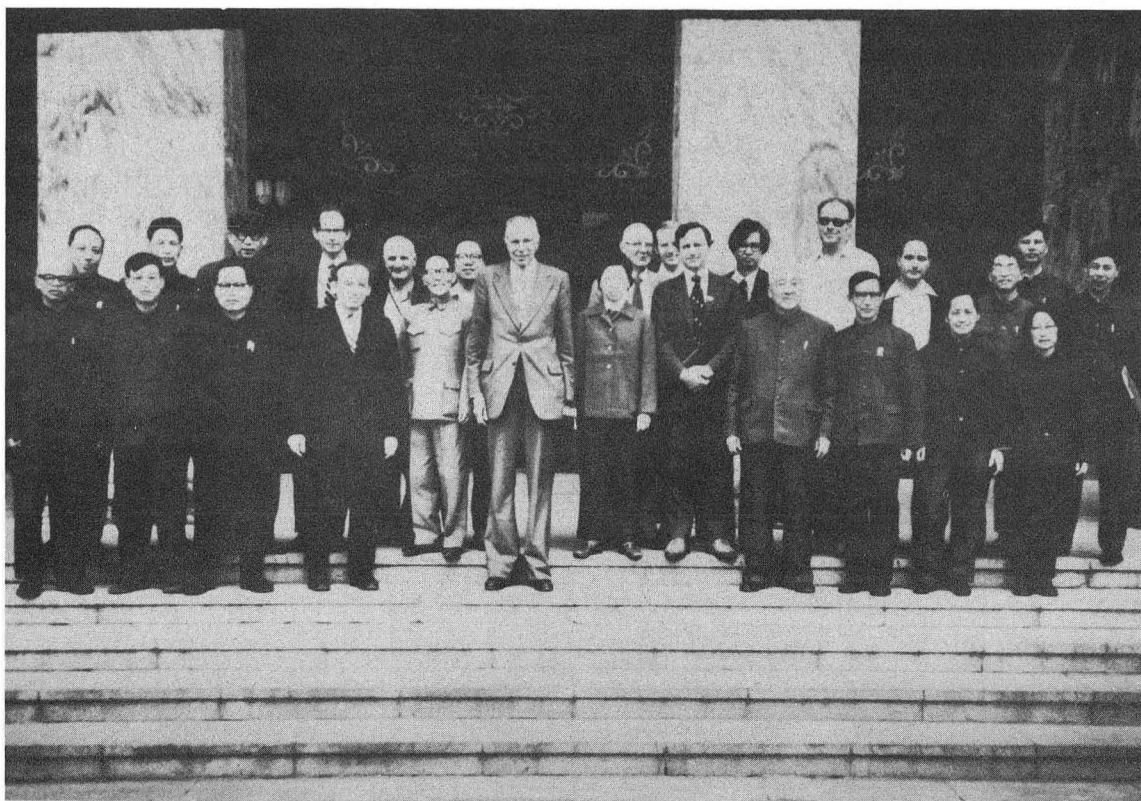
When we arrive at the Institute of Applied Chemistry at about 8:15 a.m. we are met by Woo Hsueh-chou, Ch'ien Pao-kung, Wu Yueh (head, catalysis section), Wang Erh-k'ang, Chang Wei-kang (Associate Research Fellow), Ms. Chou En-lo, and others.

We see huge welcoming signs for "the American Delegation of Pure and Applied Chemistry" in front of the building and in the halls.

We go to the reception room of the main building with its typical chairs, tables and tea cups. Woo welcomes us, makes a special introduction of Ms. Chou En-lo and then goes on to describe the Institute, with translation by Chang Wei-kang.

The Institute of Applied Chemistry was established in 1948; after the liberation of China it became a multi-disciplinary Institute. Part of the Institute of Physical Chemistry was moved from Shanghai in 1953 and combined with other groups to form the Institute of Applied Chemistry. It was organized into the present form later. During the last twenty years the work here has steadily developed. Unfortunately, during the last ten years the "Gang of Four" has impeded research work. The scientists here were very depressed then. When the "Gang of Four" was repressed the scientists were "reborn." Now they are trying to catch up with foreign science through the "long march" of modernization.

The research is roughly divided into three large areas. The first is high polymer chemistry and physics with four parts. Polymerization of olefins and diolefins is carried out with transition metals and rare earth metals as catalysts. The second part is in heterocyclic polymerization. The third part is radiation



Institute of Applied Chemistry, Changchun, May 27, 1978.
From left to right: Wu Ch'ing-yi (Associate Research Fellow), Chang Wei-kang (Associate Research Fellow), unidentified, unidentified, Shih Liang-ho (Institute of Chemistry, Peking), Huang Pao-t'ung (Director, Research Division), Baldeschwieler, Bigeleisen, Stein, Woo Hsueh-chou (Director), Wei, Seaborg, Ms. Chou En-lo (Assistant Research Fellow), Larson, Suttmeier, Breslow, Lee, Ch'ien Pao-kung (Deputy Director), Schriesheim, Wu Yueh (Associate Research Fellow), Ibers, unidentified, Shen Lien-fang (Assistant Research Fellow), unidentified, Ms. Wang Wen-yun (Assistant Research Fellow), Wang Erh-k'ang (Associate Research Fellow).

chemistry of high polymers — for example, radiation cross linking. The fourth part is research work in high polymer physics, including determination of structures and mechanical, electrical and solution properties, under the leadership of Huang.

The second large area is physical chemistry, including structural chemistry. Several techniques have been established, including molecular, x-ray, NMR, ESR and mass spectrometry. They have worked on high polymer materials to meet national material needs. They have worked on the structure of the sex pheromones of insects and chemical illuminating materials. They have turned more toward basic research in recent years. The second part of physical chemistry research is in the catalysis field — heterogeneous and homogeneous. The third part of physical chemistry is electrochemistry and corrosion. The fourth part is laser chemistry and spectroscopy. They have built their own laser equipment.

The third large area of research work is inorganic chemistry and inorganic analysis. In inorganic chemistry they are chiefly working on rare earth chemistry, including the synthesis of rare earth compounds, because China has extensive deposits of earth ores. They are also working on photoelectric semi-conductors and gas-sensitive semi-conductors. In inorganic analysis, they have worked on analysis of complex ores, then analysis of rare earths, now work on trace analysis. They have established methods for emission spectroscopy, x-ray spectroscopy, atomic absorption spectroscopy and polarography.

During the last thirty years they have achieved some success, but need to do better to keep up with the requirements of their socialistic country.

I then make a response, refer to Woo Hsueh-chou as a graduate of Baldeschwieler's department at Caltech, refer to the three Institute members of the Chinese Delegation of Chemists that visited the U.S. last year, express our appreciation for Woo's briefing.

We then divide into groups A and B for tours, beginning at about 9 a.m. Groups A and B make the same tour but in opposite directions.

Group B (Bigeleisen, Geyer, Larson, Lee, Stein and I) is under the guidance of Woo and Huang. Our first visit is to a first floor laboratory where work on electron spectroscopy and structural chemistry is done in connection with insect control. Shen Lien-fang (Deputy Chief, Structural Analysis, and whom I met in San Francisco as a member of the Insect Hormone Delegation in 1973) introduces Ms. Chu Yu-fang, who briefs us, speaking English, on their work on insect control.

Next, in the same room (in order to save time) Wu Ch'ing-yi (Associate Research Fellow), with translation by Shen, describes

their work on NMR spectroscopy. There are three aspects of this work: (1) application to basic research, (2) as a structural analysis instrument, and (3) application of the electronic computer to structural chemistry and the NMR application. He uses diagrams to describe in detail the NMR spectrometer that they plan to build.

We go to the room next door to see the NMR equipment under construction. We then go down the hall to a laser laboratory, where we are greeted by about six investigators (each of the laboratories has a number of workers present), and are briefed by Ms. Wang Wen-yun (Assistant Research Fellow) in English. She demonstrates the argon-ion-dye laser combination (7 watts output) in operation before us as she speaks. This is done without any eye protection and precautions and Lee warns them about the dangers of such operations. They use homemade rhodamine 6-G as dye and report a conversion efficiency of 10-15%. The spectra are analyzed by the use of a double grating monochromator using photomultiplier detection (procured from Zeiss Company in Jena, East Germany). They plan to investigate two-photon absorption, multiphoton absorption, opto-acoustic detection and laser Raman spectroscopy. We go to the laboratory next door to see a several-millijoule pulsed carbon dioxide Transfer Excitation Atmospheric-pressure (TEA) laser (repetition rate once or twice a second) in operation. This has been used for the multiphoton dissociation of CF_3I in a process to produce enriched ^{13}C .

We then go to a neighboring laboratory where Shen introduces Ling Hung (Group Leader, X-ray Research Division), who briefs us on their work on x-ray diffraction determination of molecular structure. He shows us results on lead niobate (PbNb_2O_6) and 3,3,3-nitrilotrispropionamide (useful in oil field work). To save time, we hear a briefing on chemiluminescence in the same room by Yang Chen-hua, also speaking Chinese with translation by Shen. They investigate oxalate diesters which have reacted with fluorescing components such as substituted anthracenes. We are shown samples of the materials in solution in dimethyl phthalate, fluorescing in brilliant green color — this emission lasts about three hours. Such materials show promise as substitutes for batteries and for use in civil defense. This research program is based on previous work done at such places as West Germany and Columbia University.

Woo and Huang guide us, during our entire tour, from laboratory to laboratory. Group A is still taking the tour in an opposite order from our group B.

We then go down the hall to see an apparatus based on an inductively coupled emission plasma (ICP) source, used for emission spectroscopy. Wang Erh-k'ang shows us the Hilger spectrograph utilizing this source for the determination of rare earth elements and also shows us diagrams illustrating spectral emission.

We now leave the first floor to go to the second floor to a laboratory where polymer research is conducted. Here Ch'ien Pao-

kung gives us a reprint ["Characterization of Cis 1, 4-Polybutadiene," published in *Huaxue Tongbao* (Chemistry) No. 5, pp. 12-23 (1977)], makes introductory remarks, then asks Yu Fu-sheng (Associate Research Fellow) to make a presentation. He speaks in Chinese. He describes the methods used for characterization of polymers — molecular chain structure, morphology, gel content, intrinsic viscosity, average molecular weight, density, Mooney viscosity, cold flow index, stress-strain curve, stress relaxation. He describes in some detail their work on polybutadienes, a source of synthetic rubber.

Next, Chiang Ping-cheng (Assistant Research Fellow), speaking in English, describes work on the structure of copolymers using light scattering.

Woo Hsueh-chou tells me there are no students working at the Institute. Graduate students will start this fall, perhaps about 20.

At about 10:45 a.m., Bigeleisen, Geyer, and I leave Stein, Larson and Lee, who go on to the catalysis and polarography laboratories, to return to the first floor reception room to meet with inorganic chemists. Woo accompanies us. Here, Ni Chia-tsan describes his work on basic research on the extraction, separation, and purification of rare earth compounds. They synthesize rare earth compounds for use as semi-conductors, such as Se-Gd compounds, in 1 to 1 and 1 to 2 ratios.

Next Su Chiang describes his work on fluorescent rare earth-containing materials, including laser materials. They synthesize yttrium-aluminum doped neodymium (Nd-YAG) for lasers, show us a 3-inch-long rod in the form of a single piece; they investigate the properties of the color centers in this substance.

Next Li Shao-tsung (husband of Ms. Chou En-lo) briefs us on his work on semi-conductor and photo-conductive materials. They have been working on the technology of solar cells, investigating the use of gold-plated Cu_2S -CdS mixtures. They want to lower the cost of photocells, are also studying polycrystalline silicon cells. They are seeking photovoltaic material using rare earth compounds. Besides the investigation on photocells, they investigate gas-sensitive semi-conductors, are studying materials for making these devices (to detect combustible gases at ppm levels). The sensitivity is adequate but the selectivity is poor.

Also present are Ms. Tung Shao-chun (Wang Erh-k'ang's wife), Wang Yu-liang (works on lasers), Ms. Tu Yu-ju (works on solar energy), Cho Hsin-kung (interpreting) and Huang Ch'ang-ch'ang (staff member).

Woo tells us the research staff is composed of 40% women. There are 1000 people in the Institute, of which 600 work in laboratories. They have six research fellows (professors), 31 associate

research fellows (associate professors), 68 assistant research fellows (assistant professors), about 300 total with the equivalent of B.S. degrees. These do not have adequate scientific training, a result of the low level of training in universities during the reign of the "Gang of Four."

They show us a gas-sensitive semi-conductor element for use in a mine to detect combustible gases. They also show us a 50-square-centimeter square gold plated Cu_2S -CdS solar cell grid (CdS thickness 30-60 micrometers). The CdS is dipped in a cuprous chloride solution to give a covering of Cu_2S 3,000-4,000 Angstroms thick. The single cell gives about 450 millivolts.

They use solvent extractions to separate rare earths from each other using carboxylic acids, compounds of phosphorus and compounds of amines as the complexing agents; this was worked out in the 1950's. They use this for separation into the light and heavy groups. The solvent extraction is satisfactory for further separation of the light rare earths, but ion exchange methods are necessary for heavy rare earths. They use polystyrene cation exchange resins, with sulfonic acid groups, made in China. For elution they now use ammonium acetate (formerly used EDTA). Use of ammonium acetate is simpler and cheaper. They use alpha-hydroxy-isobutyric acid for analysis; it is too expensive to use for separations.

In the solvent extraction separation they use kerosene, not aromatic solvents, because of their adverse health effects. They use mixer-settler equipment. They ask me a number of questions about how we separate actinide elements using ion exchange in the United States.

As Bigeleisen and I are finishing our meeting with Woo and the inorganic chemists, Stein, Larson and Lee return upon the completion of their visits to the catalysis and polarography laboratories, and the members of our group A (Baldeschwieler, Breslow, Ibers, Wei, Schriesheim, Suttmeier) return, upon completion of their tour of all the laboratories that our group B has seen. It is now a few minutes before noon.

With all of our group of twelve, our four escorts, many of our hosts in the reception room, I present to Woo Hsueh-chou a Hewlett-Packard HP-21 calculator and battery charger and also a number of NRC-NAS publications relevant to the work they are doing at the Institute. We then go outside on the front steps, have a picture of the combined group taken by an Institute photographer.

We say good-bye, ride in our caravan of cars back to the South Lake Guest House. I again ride with Huang and Teng.

We have lunch at our two tables in the restaurant. This afternoon, Ibers and Schriesheim will meet with Wu Yueh at the Guest House to discuss further work at the Institute of Applied

Chemistry on polymers. Baldeschwieler, Breslow, Schriesshiem and Wei will make the tour of Kirin University we made yesterday; Bigeleisen and Stein will give talks at the Institute of Applied Chemistry; Larson will lead a discussion at the Institute of Applied Chemistry; I will give a talk at Kirin University; and Lee will be free to have a well earned rest.

At about 2:10 p.m. T'ang, with Teng, comes up to my suite, presents me with a large box of Ginseng Drops. He tells me this is a kind of medication candy that is supposed to make people strong and have a long life. I use this occasion to present him with a Hewlett Packard HP-21 calculator and battery charger and some NAS publications.

I then ride with T'ang and Teng to Kirin University. We go directly to the lecture hall of the Science building on the fourth floor, walking up at my request. It is full, with about 200 people, many from the Kirin Institute of Applied Chemistry as well as Kirin University, and some from as far away as Shenyang and other distant parts.

I am introduced by T'ang. After introductory remarks about being glad to visit Changchun, Kirin University, etc., and stating this is my second visit to The People's Republic of China, I give my lecture on the "Transuranium and Superheavy Elements" illustrated with 42 slides. I speak for about an hour and a half and am served tea during my talk, but do not drink so much because the weather is pleasantly cool. Liu Yun-tso does the translating and does an excellent job.

After my talk T'ang expresses appreciation. The audience is enthusiastic in its response.

I then go with T'ang and Teng down to the first floor reception room where we met yesterday. T'ang tells me he became President of Kirin University three months ago. Before that he served as second in command as a Vice Chairman of the Revolutionary Committee of Kirin University, a title that has now been abolished. He works three days a week as President, the other three days teaching research students and doing research. He tells me he will send me a copy of the report of the visit of his Chemistry Delegation to the U.S. last year when it is issued; he says it will be a very simple report.

We are soon joined by about 15 members of the Chemistry and Physics faculty for a question and answer session on my talk. Present for this session are Wu Shih-shu and Kou Ch'ing-chuan, Professors in the Department of Physics, Ting Te-tseng, Deputy Director, Division of Theoretical Chemistry, Yueh Kuei-ch'un and Yu Lien-sheng, Lecturers in the Department of Chemistry, and Yang Shan-te, Wu Ts'un-sung, Chou Chieh-wen, Wang Ai-lien, Shu Wen-huei, all Lecturers in the Department of Physics.

The questions are on such subjects as the methods for determining the chemical properties of element 104, the feasibility of establishing the discovery of element 106 with only a few atoms, the energy of ^{48}Ca ions used in our ^{48}Ca plus ^{248}Cm bombardment, our plans for repeating our ^{248}Ca plus ^{248}Cm bombardment, to see if we can confirm our 215 MeV spontaneous fission event.

At a little before 5 p.m. we bring this session to a close. The whole group accompanies me to the front steps of the Science building to say good-bye.

I ask about the students that I see on the campus. T'ang tells me that students take some three hours of political classes every Saturday afternoon; their regular academic classes are held $5\frac{1}{2}$ days a week — Monday through Saturday morning.

I ride back to the South Lake Guest House with Teng, go up to my suite for awhile before dinner. I then join our group for dinner at our tables in the dining room. At 7 p.m. we attend a movie in one of the two theatres (auditoria) adjoining the South Lake Guest House. A number of our hosts: Liu Jih-ch'ing, Woo Hsueh-chou, Wang Erh-k'ang, Huang Pao-t'ung, Ch'ien Pao-kung, and others, accompany us. Wei misses most of the movie because he is leading a discussion at the Automobile Research Institute this evening. (Schriesheim decides to forego the movie in order to make a phone call home to his wife.)

As we enter the theatre, Liu Jih-ch'ing directs us all to our seats in the front part, a section reminiscent of the "loge" section in U.S. movie houses in days past. The other attendees, staff members from the Institute of Applied Chemistry and Kirin University, clap as we enter.

The program begins with a short film on the botany of China. The main feature is the 1964 movie "Girl Diver." This concerns a girl in her teens who trains to become a champion diver, does well at first, then develops a psychological block in which she is unable to perform the "5-3-1-1" dive. An act of heroism on her part — she saves a little boy from drowning — enables her to overcome this mental block. She then goes on to qualify as a member of the national diving team.

After this movie, we say good-bye to our hosts and soon return to our suites. I retire at about 10:30 p.m.

Sunday, May 28, 1978 - Changchun; Shenyang

This morning I get up at about 7:30 a.m. I soon go down to the restaurant to have breakfast, find only a few of our people are eating at this time.

This morning, Lee and Baldeschwieler are scheduled to give talks at the Institute of Applied Chemistry and Wei at Kirin University. Larson, Suttmeier, Schriesheim, Geyer and I are scheduled to visit the Tsinghua (New China) Printing Factory. I ride in the first car with T'ang and Teng, the others and Ms. Chang Chih-min (Science and Technology Committee, Kirin Province) in the two other cars. I present a Kennedy half-dollar to Fang Shu-he, who has served as my driver during our stay in Changchun.

We pass a number of dwellings made of brick or clay, or combinations of brick and clay. T'ang tells me that the clay is used for protection against injuries in earthquakes. Turning our conversation toward Kirin University, he tells me there are about ten large classroom buildings there, the largest of which is the Science Building (34,000 square meters).

When we arrive at the Tsinghua Printing Factory, at about 8:40 a.m., we are greeted by Ma Hung-lu, Deputy Manager, Wei Kuo-sheng, Chief administrator, Li Chih-p'ing, Head, Planning Division, and Liu Chin-fu, Administrative Office.

We go up to the second floor to the reception room where we take our places in the white covered chairs, at the traditional table with covered tea cups. Ma offers me a cigarette, a common gesture at these briefings, and two girls fill our cups with tea.

Ma starts his briefing. He tells us the factory was built up in 1948. The back of the Factory was built earlier, in the Japanese era. In 1943, during the Japanese era it was put into production. The reactionary faction took control in 1945. During 1945-48, the reactionary period, the factory was damaged severely. The date 1948 represents the time it came back into the people's hands. There were only 200 workers here in 1948; there are now 1,600 workers here. Since the Cultural Revolution production has increased and they can now process 6,000 tons of paper per year. Since the smashing of the "Gang of Four," the production has doubled. A main task is to print works of Marx, Lenin, and Chairman Mao. They print Red Flag material and dozens of journals as well as textbooks for students. They print propaganda, pictures, portraits of their leaders, etc. Printing textbooks for students is presently their main task.

There are four workshops in the Factory: (1) typesetting, (2) printing, (3) color printing, (4) binding. They also have some clinics, nurseries, other welfare departments.

The automation level of the People's Republic of China is not too high; so operations like this can be improved. Suttmeier asks how the Factory is run. We learn it is now run by the Manager. It was run by the Revolutionary Committee until the Fifth National Congress. In response to another question by Suttmeier we learn the pay scale varies from 33 yuan per month for the first grade to 99 yuan for the eighth grade. There are no engineers. They rely on their experienced workers. Suttmeier asks about methods of innovation. Ma replies the Chinese printing industry is quite backward compared with the level elsewhere. Hence, according to the precepts of Chairman Mao, they made improvements in their equipment. In 1948, only 40% of the work was mechanical. Now about 80% is done by machinery in an automatic manner. Binding of books was originally done by hand, but now they use a machine developed by the workers. The workers also developed other machines to do the finishing steps of the binding process, turning the pages in the binding process, etc. The workers are inventing a new machine that will be able to perform the overall binding process. They have developed other machines for assembly line operations. They can only make small innovations consistent with their process.

As we start our tour at about 9:10 a.m., we note the plant is in full operation. Today is Sunday — their day off is Friday (the day off for Chinese workers varies by district). We first visit the typesetting room, still on the second floor. They are busy setting Chinese characters made of lead-tin matrices. We watch a woman setting type for a textbook which includes Japanese phrases. Each worker has several thousand basic characters to work with.

Next, we see a girl picking characters out of a file of 3,000 to deliver them to the places where they are needed by neighboring typesetters. She is seated at her task now but used to work standing up.

In the next room we see the workers (men and women) at the small individual machines for assembling the blocks of individual characters.

Next we go downstairs to see the printing presses, for books, in operation. In the next room we see more presses at work printing mathematical books, etc., with men and women operators. These presses were made in Shanghai.

In the next room we see presses (some made in England, some in China) printing with colored ink. Next, still on the first floor, we see the latest automatic machine for binding, designed by a dozen workers in the factory. We see in this room many other automatic machines for binding, designed by workers. We are each given a copy of an attractive children's booklet as it comes off the production line.

We go back to the latest automatic book binding machine,

see it put into operation for us. Next we go to another printing press room with presses printing colored posters, postcards, etc. The workers stand by as the automatic machines operate.

Next we go back upstairs to a room where we see a brand new typesetting machine (much like a Chinese typewriter), which uses a photo-reproduction method. This is operated by a girl, a very skilled worker.

In the next room we see artists at work modifying pictures. Next we visit a room where pages are folded together with automatic machines, then a room where they are put in order by such machines.

We end our tour at about 10:15 a.m., go outside to say our good-bye. Ma presents each of us (Larson, Schriesheim, Suttmeier, Geyer, and me) with a lead-tin printing piece with our name on it. He presents me with a stack of color pictures of Chairman Mao with Chairman Hua and a stack of large (2 x 3 feet) color posters (three varieties) being used in the Spring Festival.

We ride back to the South Lake Guest House. I pack my bags, bring them to the lobby. I meet Woo Hsueh-chou, who presents me with a picture album covering yesterday's visit to the Institute of Applied Chemistry; he presents such an album to each member of our delegation.

I join our group in the restaurant for an early lunch of fried (Colonel Sanders type) chicken.

I meet T'ang after lunch, present him with American Chemical Society and Joseph Priestley Centennial first day covers.

We then meet a number of our hosts who have come to accompany us to the railroad station. Besides T'ang Ao-Ching, there are Woo Hsueh-chou, Wang Erh-k'ang, Wu Yueh, Huang Pao t'ung, Ch'ien Pao-kung, Chang Wei-kang, Liu Jih-ch'ing, Ms. Chang Chih-min, Hsin Lien-ti, Han Shen-ch'ian.

We ride to the Railway Station in a caravan of eight Shanghai cars, I in the first car with T'ang Ao-ching and Woo Hsueh-chou; our group of eleven, traveling guides (Teng, Ms. Hu, Shih and Shih) and hosts following in the other cars. Enroute, I ask T'ang a number of questions. He tells me the Spring Festival is usually held in February, at the time of the New Year as it was celebrated in China before Liberation (1949); now their New Year is the same as ours, January 1. In a discussion on the age of retirement of university and institute scientists, I learn they retire at whatever age they individually choose. Woo is 76, Tsai Lu-sun (Chairman, Department of Chemistry, Kirin University) is 76, and two other members of the Department of Chemistry are over 80. They receive 80% of their salary upon their retirement. There are 3,400 students at Kirin University. The quality has improved greatly since entrance examinations have been re-instituted. The

only student unrest they have concerns criticism of the teaching performance of faculty members.

As we drive through the streets of Changchun, I note there are no passenger automobiles other than those transporting the members of our Chemistry Delegation and our hosts, and those transporting the members of the visiting delegation of Japanese physicians, who are apparently taking the same train as we. There are only buses, trucks, horse and mule drawn carts and, of course, multitudinous bicycles.

When we arrive at the Changchun Railway Station, I present American Chemical Society and Joseph Priestley Centennial first day covers to Woo and an American Chemical Society Centennial T-shirt to Liu Jih-ch'ing.

We board the train, visit with our hosts awhile. The train leaves for Shenyang, on schedule at 12:10 p.m. Our group of twelve and four traveling guides are distributed in three compartments. I share space with Baldeschwieler, Geyer, Larson, Suttmeier and Teng Shao-lin.

After awhile I join Schriesheim, Breslow, Ibers, Wei, Lee in their compartment. We have a discussion about what we have learned about academic salaries in The People's Republic of China. In Peking, the graduating student (after finishing three years of university work) starts his first position at 56 yuan per month (1.75 yuan = \$1). Assistant professors start at 130 yuan per month, professors receive about 320 yuan per month. The two highest paid professors in Peking receive 336 yuan per month. Top professors are furnished apartments of 60 to 70 square meters area, Directors of Research Institutes have apartments with 100 square meters area.

We ride over the plains of Manchuria, see the large fields under cultivation, many areas flooded with water, as we saw on our ride in the other direction on Friday morning. As we reach Kaijuan at about 3 p.m., there is a slight drizzle of rain.

I join Bigeleisen, Stein, Ms. Hu Feng-hsien, Shih Wei-ming and Shih Liang-ho in their compartment for awhile. Ms. Hu tells me that when we reach Shenyang our hosts plan to have a dinner for us this evening.

By the time we reach Shenyang Railway Station at 4:20 p.m., on time, the drizzle of rain has stopped.

We are met by Chi Wan-fu, Shenyang, Head of Office of the Science and Technology Committee of Liaoning Province; Tsou Te-ch'en, Shenyang (who met us Thursday night and helped us to the Oversea Hotel and to the train early Friday morning); Ku Ching-hsin, Fushun, Chairman, Board of Directors, Chemical and Chemical Engineering Society (CCES), Liaoning Province; Teng Hsiao-hui, staff, Science and Technology Committee, Liaoning Province; Wu Ming-tsun, member,

Board of Directors, CCES of Liaoning Province; Li Wan-hou, Fushun, member, Board of Directors, Coal Societies, Liaoning Province; Ma Chen-kuo, staff, Science and Technology Committee, Liaoning Province.

A large crowd of people is at the Railway Station to watch us (and the Japanese Delegation who traveled on the same train, in the same car, with us from Changchun) as we emerge into the street.

I ride with Chi Wan-fu and Shih Liang-ho in the first car, the others following in their cars. We pass the Oversea Hotel where we stayed on Thursday night. We travel north on Yellow River Boulevard, past Red Flag Square which has a huge statue of Chairman Mao in the center. I see many apartment buildings lining both sides of Yellow River Boulevard. Shenyang is the largest city of the three provinces (Liaoning, Kirin and Heilungkian) making up the former Manchuria; its population exceeds 3,000,000. We pass the huge building and grounds of the Bureau of Education, other large official buildings, a large middle school on our way to our hotel — the Hotel of Friendship.

When we reach our hotel, we are ushered to our rooms on the second floor. These are large rooms. Baldeschwieler and I share a kind of a suite (number 233) — a large living room with sofa, chairs and tea table is situated between our two large bedrooms (each with large twin beds, writing table, dresser, chairs flanking a tea table with cups and thermos bottle, radio and connecting bath with overhead shower). However, with all this, there is no clothes closet.

Our luggage is picked up at the train and is delivered to our rooms. We are told that Ts'ai Li, Deputy Chairman of the Science and Technology Committee of Liaoning Province, will host the dinner for us in the Hotel of Friendship this evening at 6:30 p.m. The delegation of Japanese physicians, who traveled to Shenyang in the same railway car as we, are also staying at the Hotel of Friendship.

It begins to rain soon after we get settled in our rooms.

I change suits for our dinner; our group of sixteen meet our hosts for dinner at 6:30 p.m. in a huge reception room on the second floor. Here we sit in the chairs at the little tables and tea is served as usual. Present are T'sai Li, Ku Ching-hsin, Teng Hsiao-hui, Chi Wan-fu, Tsou Te-ch'en, Wu Ming-tsun, Li Wan-hou, Ma Chen-kuo.

Our host, Ts'ai Li, briefs us on the history and attributes of Shenyang. He tells us Liaoning Province covers 220,000 square kilometers, has a population of 36,900,000 (of which 11 million live in cities) about 10 million acres under cultivation, has ten cities, three districts, 54 counties. The main agricultural products are corn, maize, rice and they also raise beans, cotton, tobacco.

Shenyang is the largest city in the province with a population within the city itself of 2,000,000 and in the city area of 4,200,000. The main industry is machinery. Talien is the second largest city in the province.

He speaks very softly and gets help from his translator, Teng. He then has one of his colleagues introduce the members of his group. I then introduce the members of our Delegation in an abbreviated manner. I ask Ts'ai to identify the research institutes, universities and colleges in Shenyang. With the help of Ku Ching-hsin, he names: Institute of Chemical Engineering (under the Science and Technology Committee of Liaoning Province), Institute of Metals (under Chinese Academy of Sciences), Institute of Soils (Science and Technology Committee), Institute of Computing Technology (Academy of Sciences), Institute of Automation (Academy of Sciences), Institute of Electronics (Electronic Bureau, City of Shenyang), many institutes in the factories — some of which conduct chemical research), University of Industry of the Northeast, College of Chemical Engineering of Shenyang, Liaoning University, University of Medical Science, University of Machinery and Electronics, College of Architecture, College of Fine Arts. There are 322 institutes in the province (including those in factories), including 194 Research Institutes. There are more than 100 middle schools in Shenyang.

We then go down to the first floor to have dinner in a private room. I sit at a table with Ts'ai Li, Ku Ching-hsin, Baldeschwieler, Larson, Bigeleisen, Shih Wei-ming, Shih Liang-ho. Almost immediately Ts'ai rises to make a welcoming speech and toast. Shih Liang-ho has trouble translating the political phrases so Teng Hsiao-hui takes over the task of translation. Ts'ai reads from a prepared text, mentions the Shanghai Communique of 1972, recommends its expansion, mentions the Chinese Delegation of chemists to the U.S. last year, the activities of the "Gang of Four" and the subsequent political improvement in China.

This is the best dinner we have had so far during our visit to China and the evening is unusually convivial with an endless drinking of toasts. More mai tai than usual is consumed. When I respond to Ts'ai Li's toast, near the end of the meal, I take note of this conviviality, express our Delegation's admiration for the excellent state of industry, research institutes and universities in northeast China, admiration for the fact that six of the ten members of the delegation of Chinese chemists to the U.S. last year came from northeast China, also call for increased exchanges under the Shanghai Communique of 1972, propose a toast to the health of our hosts and to increased friendship between our two countries.

A few minutes later, I rise again, present an ACS Centennial necktie to Ts'ai Li, say he should regard this as a souvenir since Chinese do not wear neckties.

The dinner ends at 8:15 p.m. We say good-bye to Ts'ai, but several of our other hosts linger quite a while in the lobby and porch to talk. This apparently follows the Chinese protocol of having the hosts stay until the guests leave. It is raining rather hard.

Several of our group find this is a convenient time to place phone calls home to the eastern U.S. It is too early in Lafayette for me to place a call to Helen.

I go up to my room, do some writing in my journal, retire a little after 10 p.m. — again, the rooms are left open, without keys during our absences.

Monday, May 29, 1978 — Shenyang; Fushun

I awaken about 6:30 a.m. to find sunny weather outside my room which overlooks the hotel grounds. I leave a bag of laundry for processing. We get one day service at all our stops.

We have breakfast in the hotel dining room at our two tables. The Japanese delegation of physicians occupies four tables, thus accounting for everyone in the dining room.

This morning we gather on the front steps of the hotel preparatory to our departure for Fushun, where we will visit the Petroleum Refinery No. 2, attend another dinner in our honor, spend the night, visit the coal mine tomorrow morning, then return to Shenyang. We take only overnight luggage with us, leave the rest in our Shenyang hotel rooms.

Ibers tells me that during his jogging this morning (which he and Suttmeier do every morning here when they have the opportunity), he saw evidence of a wind storm last night — many branches of trees blown off, etc.

We leave at 8 a.m., ride in a caravan of Shanghai cars. I ride in the second car with Ku Ching-hsin and Shih Liang-ho (some of our hosts are in the first car — no. 0). All of our group of sixteen (twelve members of our Delegation and four traveling host guides), and our local hosts whom we met yesterday, constitute our party.

We drive back down the street upon which we came to our hotel yesterday. We again pass Red Flag Square with its immense statue of Chairman Mao, with figures of workers and soldiers surrounding the base, all made of reinforced plastic.

We drive on tree-lined streets, see no passenger cars other than those we are traveling in, the usual trucks, carts, and myriads of bicycles. We are heading from the northwest part of Shenyang to the southeast part. Shops line the paved streets for miles, giving evidence of a large city. As we proceed, we pass through a factory district, then a huge vegetable farm, a complex of apartments for workers, some individual and multiple dwellings (made of brick and clay). We approach an area with large vegetable fields, see more horse-drawn carts. We pass the large Exhibition Hall for the Province, and the Institute for Agricultural Machinery as we continue along the Shenyang-Fushun Highway. We pass on a bridge over the Whan River. Now we drive by large, wet rice fields with neighboring individual and multiple dwellings.

Ku is a rugged individual who has lived in this area much of his life. He was the chief engineer for the two petroleum refineries, was the chief engineer of the Design Institute, is now the head of the Chemical and Chemical Engineering Society of the

Province. He tells me the Petroleum Refinery No. 2 was originally used, before 1960, to obtain oil from dry distillation of oil shale. After the discovery of oil at Tach'ing, this plant was turned into a petroleum refinery. The oil is transported from Tach'ing by pipeline. Only a very small oil shale operation remains. The previous production from oil shale was about half a million tons annually.

As we enter Fushun at about 8:45 a.m., we pass the Institute of Coal. Children in groups look at us as our cars pass. Here again the street is lined with trees. As we pass a middle school, hundreds of children line the street and wave at us. The street has many apartment houses for the workers.

There are a million people living in Fushun. There is much traffic of trucks and buses as we approach the center of the city, pass the Railway Station for the train to Shenyang.

We arrive at the Hotel of Friendship in Fushun at about 9 a.m., are greeted by Li Ta-chang, chairman of the Science and Technology Committee of Fushun; Lin Yao-sen, Deputy Director, Foreign Affairs Bureau, Fushun; Lo Jung-pen and Tu Cheng-yin, both staff members, Foreign Affairs Bureau, Fushun.

We are ushered to the reception room on the second floor, where we find the usual setup of sofas, chairs, tables with covered tea cups. Li and his colleagues are introduced. Li then gives us a description of Fushun. There are three districts in Fushun. The population in the area is 1,900,000 and in the city itself, 870,000. Fushun is located about 45 kilometers from Shenyang. The main industries are coal, petroleum, machinery, cement, light industries. Coal was discovered here 2,000 years ago and was excavated about 800 years ago. Fushun was occupied by Russian czars, then from 1905 to 1945 it was occupied by the Japanese. The Japanese took away 250 million tons of coal and about 78 million tons of oil shale. In 1945 the industries here were badly damaged. The city was liberated in 1948 and since then it developed very quickly under the precepts of Chairman Mao. Chairman Mao visited Fushun in 1958 which served as an inspiration for subsequent hard work by the people. In recent years, under the leadership of Chairman Mao, the people here have worked hard to expand the production of coal. The production of coal has increased five times that of electricity, fifty times that of oil, 173 times since before Liberation.

At the conclusion of the briefing, I introduce the members of our Delegation. We are shown to our rooms on the third floor. I have suite 314, a living room with the tea setup, desk, dresser, etc., a twin-bedded bedroom and bath. Again the rooms have no keys.

The twelve of us then assemble in the third floor reception room to hold a meeting to compare notes for the preparation of our report. We requested this time for this purpose in lieu of a planned trip to a reservoir this morning. We have trouble convincing the hotel employees not to put white cloth covers on the chairs because

we want to save time and get to work. We start our meeting at about 9:45 a.m., run through the report outline to make our contributions to the writer of each section. Wei reminds us that the five leading comprehensive universities in China are considered to be: Szechwan University (Shangtu), Peking University (Peking), Kirin University (Changchun), Fudan University (Shanghai), Chongshan University (Canton).

We conclude that less than 10% of 5,000,000 applicants pass the national examination for admission to universities and colleges; there are some affirmative action type considerations for the admission of minority nationalities. We have been unable to get a copy of the examination. The prospective students submit the names of five universities of their choice, in priority order. The age limit is 25 years, with some exceptions for those displaced by the Cultural Revolution, for those taking the examination. In addition to the national examination, there may be a second examination given locally. The examination for admission to graduate school is also given as a national examination and the percentage of those who pass and are admitted is small.

In discussing University/Research - Institute/Industry relationships, we note the work on zeolite and rare-earth-based catalysts developed for use in the petroleum industry.

We conclude that, so far, we have seen very little modern research work in the fields of organic and inorganic chemistry. Also, in the field of physical chemistry, we have seen very little work in thermodynamics and statistical mechanics, some good work in gas chromatography, polarography, calorimetry, lasers. There is much work on polymer science, not yet very novel or refined, much catching up work being done. Polymer theory is relatively weak.

In chemical physics the best work is going on at the Institute of Chemical Physics in Talien. The work at the Institute of Applied Chemistry includes some good research with lasers — the argon ion laser equipment there is impressive.

There is some good work going on at the Institute of Biophysics. They are not concerned with the social aspects of work on genetic engineering. There is, in fact, minimal regard for safety in the various laboratories we have visited.

We have seen very little work on chemical engineering so far. Apparently the chemical engineering work is conducted under the auspices of the ministries and we have not visited too many of their institutes.

In analytical chemistry there is work on activation analysis, analysis by gas chromatography, polarography, gas-sensitive semi-conductors, inorganic chromatography, infra-red spectroscopy.

In the catalysis field, there are indications that the Chinese may have made more progress than they have revealed to us—a very natural response since in the United States such information would be considered to be proprietary information and would not be made available to any plant visitors, foreign or domestic.

There is very little use of computers in chemistry that we have seen as yet, except at the Institute of Chemical Physics at Talien. There are obviously advanced computers in use in some practical applications in China.

They are making plans for nuclear power, seem to have more of a national energy plan than we have in the United States.

Other than polymers we have seen very little research work in materials as yet.

We finally discuss in some detail the content of our report section on "Issues". We agree that U.S. scientists should read *Scientia Sinica*, which is published in English and Chinese and now is publishing articles of interest to us. The principal chemical journal in China is *Huaxue Tongbao*, published in Chinese but with an English table of contents.

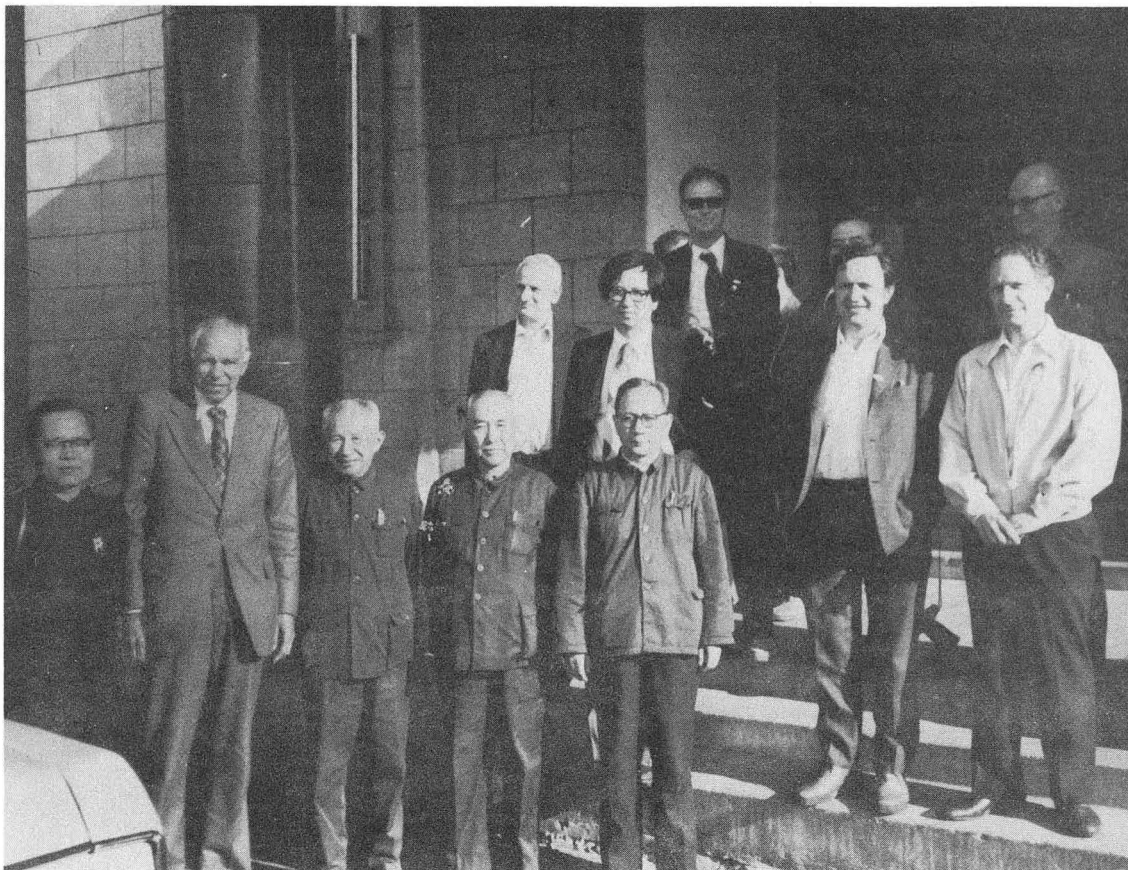
We wind up our brainstorming session at about 12:30 p.m. I return to my room. Immediately a girl knocks on my door, tells me in Chinese (I think) that it is time for lunch, leads me down a long hall where two more girls in relay fashion lead me to a third floor restaurant in a far away part of another wing. Here I join our group for lunch.

After lunch we assemble at 1:30 p.m. for our ride to the Petroleum Refinery No. 2. I ride in the number one car with Ku Ching-hsin and Shih Liang-ho, following number 00 and 0 cars in which some of our hosts, including Li Ta-chang, ride. The other members of our delegation ride in the following cars, numbers two to six. It is about a twenty-minute ride to the eastern part of the city.

As we approach the area of the Refinery we see some rather large industrial plants. We turn into a side street, meet many horse- and mule-drawn carts, pass a village of single and multiple dwellings. We arrive at the Refinery at about 2 p.m.

We are met by Ch'en Yung-shou, Deputy Manager of the Petroleum Refinery No. 2; Li Hung-ts'ai, Technician, Catalysis Workshop; Tai Ch'eng-yuan, Engineer; Yin P'ing, Reforming (Platinum) Workshop Engineer; Ting Chung, Engineer; Wang T'ung-li, Office Director; Yang Chin, Engineer; Ts'ui Chao-yun, Staff, Refinery Office.

We go to a large room, with long tables, on the second floor of the administration building. Our delegation sits at one



Petroleum Refinery Unit No. 2, Fushun, May 29, 1978.
From left to right: front, Shih Liang-ho, Seaborg,
Ku Ching-hsing (Chairman, Board of Directors, Chemical
and Chemical Engineering Society, Liaoning Province),
Li Ta-chang (Chairman, Science and Technology Committee,
Fushun), Ch'en Yung-shou (Deputy Manager); back, Stein,
Lee, Schriesheim, Breslow, Ibers, Larson. Bigeleisen
(behind Breslow).

side of a long table, a dozen hosts at the other side. Others of the host group sit at other tables. Our hosts are introduced and I introduce the members of our Delegation.

Ch'en describes the history and status of the refinery. It first produced crude oil and refined products from shale, but in 1962 changed to refining only oil although continuing to produce crude oil from oil shale. They increased to 8,700 workers, produced fifty products (including gasoline), processed 1,500,000 tons of crude oil from Tach'ing per year.

They have made many innovations following the Cultural Revolution, have increased the processing of crude oil from 1,500,000 to 4,000,000 tons annually.

They started to process oil shale at Petroleum Refinery No. 1 in 1941 under the Japanese. Here at Petroleum Refinery No. 2 there are sixty distillation furnaces for this purpose, which produce 80,000 tons of oil from oil shale per year with a byproduct of 20,000 tons of ammonium sulfate per year. This oil shale unit started operating in 1954. The shale is obtained from the nearby Open Cut Pit coal mine and is mined concurrently with coal. The crude oil obtained from the shale is not refined here but is shipped to local users. The cost is greater than that of oil from the oil fields, perhaps 50% greater, but this source is used because China must use all her resources.

For electric power production, they have a generating plant that can produce 350 tons of steam per hour to yield 100,000 Kw.

We will see (1) dry distillation of oil shale, (2) the distillation of crude oil under normal and reduced pressure, (3) catalytic cracking plant. In response to questions by Schriesheim, we learn the catalytic cracker uses a fluidized bed, uses zeolite as catalyst, processes 900,000 tons of crude oil per year. There is a reforming unit, using platinum as the catalyst, which processes 100,000 tons per year, employing Italian technology. The plant doesn't yet produce ethylene and propylene, but there are plans to do so. The distillation of crude oil accounts for the bulk of the refining, nearly 3,000,000 tons per year. They use some crude oil from other sources, but mainly the source is from Tach'ing. They have coking capability of 400,000 tons per year. They use their own engineers and also some from Peking. Initial design work was done at a research institute in Fushun.

After the briefing we see, in the same room, a model of the entire plant, and in a glass case, samples of oil shale, coke, Tach'ing crude oil, waxes, organic chemicals (not mentioned in briefing).

We drive to the oil shale processing unit of the plant. We go into the control room, have the operation of the plant explained to us. There are 60 cylindrical reactor furnaces

(retorts), each 15 meters tall, 3 meters inside and 4 meters outside diameter, with the intervening space filled with heat-resistant bricks. They are fueled by coal; the crushed oil shale is charged from the top, and air is forced in from the bottom. The oil shale takes 5 to 9 hours to descend from top to bottom and the heated material exits at the bottom through a grid which rotates at a speed of less than one revolution per hour. They operate at atmospheric pressure, with a maximum temperature of 900-1000°C at about one meter above the grid. The heated material is discharged into water to remove the product while the slag is collected in a pile. No cooling water is used in the process. Part of the volatile product is used as fuel for the process and part as fuel gas in other plants.

We request to have Wei stay here for further detailed explanations, while we tour the remainder of the plant, and they consent. We walk into the operating area, see the left-over slag. They dispose of this by using it to fill some of the cavities left after the coal mining. They recover oil at a yield of five weight-percent of the oil shale. Our visit includes a view of 20 distillation furnaces of the total of 60. There is a foul odor at this operation (a source of carcinogens?).

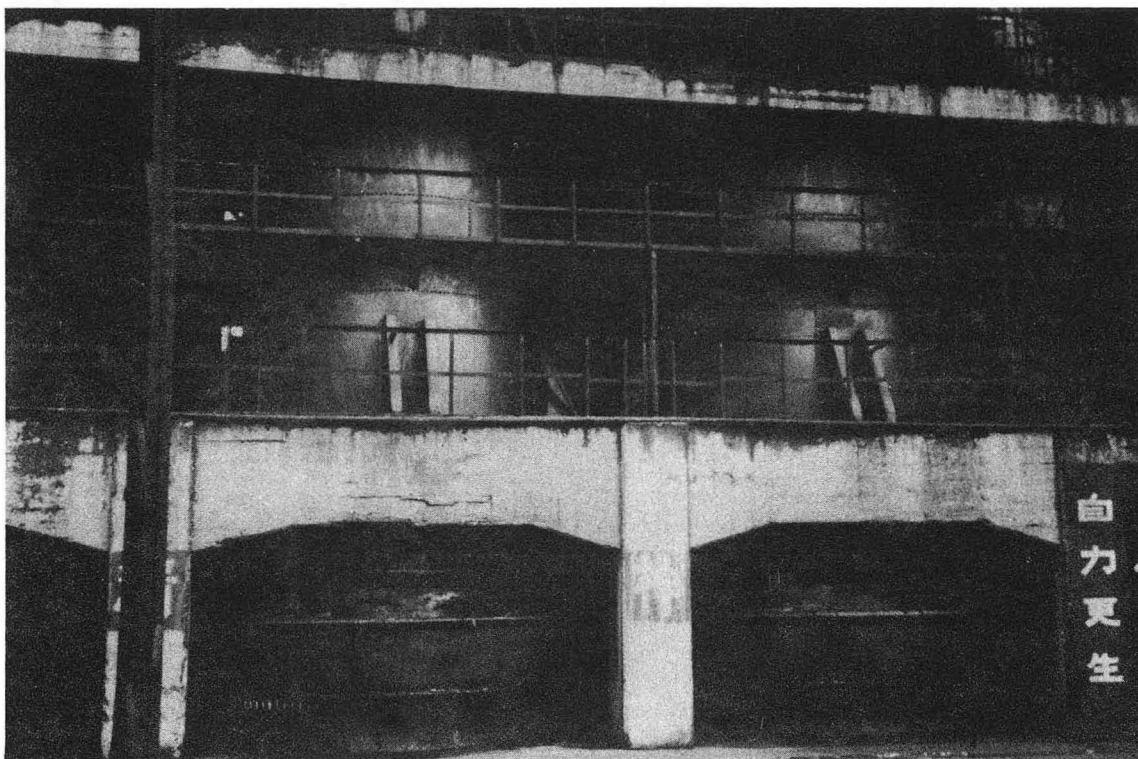
Next we visit a control room for a distillation column. Their atmospheric pressure and vacuum distillation columns handle a total of nearly 3,000,000 tons of crude oil per year.

Finally, we visit the catalytic cracking unit, built in 1965, now operating at 900,000 tons per year using Chinese technology. There are five products: (1) gas, (2) liquefied gas, (3) gasoline, (4) light diesel oil, (5) heavy diesel oil. Here they use a paraffin source (330-550°C boiling range) and zeolite catalyst.

About 5% of the crude oil goes into gasoline; 12-15% goes into diesel fuel; 38-40% goes into fuel oil for industrial fuel and delayed fuel coking use; 3-5% goes into platinum-catalyzed reforming products (benzene, toluene, xylene, etc.). The reforming columns and the platinum catalyst for the reformers were imported from Italy. The Talien, Tach'ing and Peking reformers were, however, built in China.

We ride back to the administration building at 3:45 p.m., return to the same room on the second floor to continue our discussion. I express appreciation for our visit, say we are especially interested in their oil shale operation because we do not have anything like this in the United States.

In response to questions by Schriesheim, we learn that only a very small proportion of crude oil goes to production of chemicals. Breslow inquires about laboratories here, and we learn there is a research institute on the site working on yield and product improvement, production of chemicals, etc. Baldeschwieler asks about control tests and we learn that such simple determinations as the



Oil shale processing unit, Petroleum Refinery Unit No. 2,
Fushun, May 29, 1978.

solidification point, melting point, octane number are made. There are 100 people in their research institute, of which 15% are college graduates. They don't take any special precautions to protect their workers against carcinogens.

James Wei rejoins us, following his closer inspection of the oil shale unit.

They dispose of their shale oil slag as filler in coal mines. The oil shale is mined from the same mine as coal. The slag is also used as raw material for cement and as a part of paving for roads. The waste water is first used to recover the oil, pyridines and phenols. The problem of disposal of the remaining waste water is not completely solved — it flows into canals and is then diluted for use in agriculture. We remark that in the U.S., three to five times as much water as shale is used, creating a serious problem. They use less water in the Chinese process because it is recycled, whereas in the United States, a once-through process is used in our pilot plant. Innovation in their plant comes both from inside the plant and outside.

There are other oil fields than Tach'ing, for example, Victory Oil Field.

I suggest they might now ask us some questions. These are directed mostly to Schriesheim and Wei.

We finish this session at a little before 5 p.m. We all go out to the front of the building, take some pictures, say good-bye to our hosts, then ride back to the Hotel of Friendship in Fushun in cars as we came, arriving about 5:15 p.m.

We go to our rooms for awhile, then reassemble to attend the 6 p.m. dinner tonight to be hosted by Li Ta-chang, Chairman of the Science and Technology Committee of Fushun.

We go to the third floor room, far off in the other wing of the hotel, where we meet our hosts (the room where we had lunch today). There is no briefing session because we already had that with Li this morning. Present at the dinner are our group of 16, plus hosts Li Ta-chang, Ku Ching-hsin, Tsou Te-ch'en, Chi Wan-fu, Lin Yao-sen, Lo Jung-pen, Tu Ch'eng-yin, Wu Ming-tsun, Li Wan-hou, others.

I sit at a table with Li Ta-chang, Ku Ching-hsin, Lo Jung-pen, Baldeschwieler, Schriesheim, Stein, Teng Shao-lin, Shih Liang-ho.

Near the beginning of the meal Li offers the traditional toast with translation by Teng — he has difficulty with Baldeschwieler's name, makes a reference to the Shanghai Communique, suggests increased cooperation, offers friendship of the people of Fushun, then offers his toast proposing increased friendship between our peoples.

We have an interesting conversation on the oil shale developments in China. There are three oil shale plants — at Fushun Petroleum Refinery No. 2 (80,000 tons of oil per year), Fushun Refinery No. 1 (120,000 tons per year), and a plant at Maoming in Canton (80,000 tons per year). The plant No. 1 was built by the Japanese during World War II and went into production then. The plant No. 2 was started by the Japanese but not finished before the end of the war. Both plants were sabotaged by Chiang Kai-shek after the war.

Near the end of the meal, with translation by Teng, I offer my toast. I suggest that we should cooperate with our hosts and have Baldeschwieler change his name to accommodate our hosts with an easier pronunciation, thank our hosts for their hospitality, express admiration for their oil shale work, say the United States hopes to enter this field, invite them to visit the United States under increased cooperation under the Shanghai Communique. I then present Li with an ACS Centennial T-shirt, suggest he might use it as a wall decoration as a souvenir from us; he responds he will do this. I then offer my toast to our hosts' health and increased cooperation between the peoples of our two countries.

The meal ends at 7:20 p.m. and I go to my room for awhile before attending a movie at 7:40 p.m. At 7:38 p.m. a girl knocks on my door to bring me down to the second floor movie theatre on time.

The movie is a special showing for us in a large room set up with tea tables, tea cups and straight-backed chairs. Li and Ku, most of our other dinner hosts and traveling guides attend. Only Lee, Suttmeier, Stein, Larson and I of our Delegation are present at the start. Ibers and Breslow soon join us. Only Lee and I stay until the end. The program has three parts — a short film on Chairman Hua, his Vice Premiers and other officials going to the Me Yung dam site and doing some work as the real workers look on; a cartoon entitled "Goat Go Home"; and a film of free-style gymnastics, acrobatics, balancing acts of various kinds, many magic acts, all involving both men and women. The film program ends at about 9:30 p.m.

I return to my room, retire about 10:30 p.m.

Tuesday, May 30, 1978 - Fushun; Shenyang

I arise at about 6:30 a.m.

At our hotels in the last few cities, hot water in the bathrooms has been available only at certain limited hours, sometimes not at the time I want to shave. I have solved this by using hot water from the thermos bottles always available for tea.

These hotels have also been characterized by rather attractive rugs on the floors and the lobby and halls. These, however, are usually in need of cleaning.

I walk to the room where we have our meals, join the others for breakfast. This morning our group of 16 is scheduled to visit the Open Cut Pit coal mine.

We leave at about 8 a.m. in our caravan of cars, numbers 00, 0, 1, 2, 3, 4, 5, 6. I ride in car number 1 with Ku Ching-hsin and Shih Liang-ho; Li Ta-chang accompanies us in car number 2 with Baldeschwieler and Wei.

On the way we pass Petroleum Refinery No. 1, and next to this the cement plant that uses slag from Petroleum Refinery No. 1. This seems to be a factory district. We are riding toward the west. We soon pass huge piles of slag left by the Japanese from operation of the oil shale unit in Petroleum Refinery No. 1.

We pass many horse- and mule-drawn carts. We drive along the edge of the Kuo Jen Tsi River. As we approach the mine, there is a village of brick one-story multiple dwellings with people outside basking in the morning sun.

We arrive at the Open Cut Pit coal mine at about 8:30 a.m., where we are greeted by Kao Kuo-hsing, Chief Engineer; Lo Ch'ang-fu, Engineer; Li Wen-shan, Engineer; others.

We go into the administration building, seat ourselves at the usual little tables with the tea servings in a reception room. Here we see exquisite objects of many kinds carved out of coal in many cases along the walls.

Our hosts are introduced and I introduce our Delegation. Kao then begins his briefing with translation by Shih Liang-ho. Kao tells us there is an open pit coal mine and shale oil mine operating here with production of 3,600,000 tons of coal and 12,000,000 tons of oil shale annually. The dimensions are 6.6 kilometers long and 2.2 kilometers wide. They have reached a depth of 270 meters with an area of 10 square kilometers. The mine was built in 1914 and has a history of producing coal for 60 years. It is of tertiary and quaternary geological classification. The time of formation of the deposit was one to fifty million years ago.

The upper part is 30 meters of soil that must be removed. Then comes the green rock layer with a depth of 300 meters at places. The shale layer appears next with a depth of 110 meters. The rich shale (more than 4.7% organic material) is orange in color, the poor shale (below 4.7%) is gray. They process only the rich shale. Then comes the coal layer, with a depth of 120 meters. These are, however, in veins, so the geometry is not this simple. Below this is a layer of igneous rock. They are down to a depth of 270 meters, so they are not at the bottom of the coal — the final depth will be 500 meters. (We learn later that these are not vertical distances but are distances measured on an incline angle of some 25°.)

Also on the grounds are an electric plant, refinery plant, and cement factory. These limit the depth they can go for safety reasons. There is coal down to 1,000 meters. The coal below 500 meters will be mined by underground mining methods.

Of the sixty years in operation, thirty years were under the Japanese, and two under the Kuomintang. The Japanese used destructive mining methods, leaving huge amounts of slag. They left 100,000,000 cubic meters of rock, so the mine was heavily damaged. When Fushun was liberated in 1948 they found a very damaged state — smoke and fire, wide scale flooding. After Liberation, the workers became master of the mine under the leadership of Chairman Mao and the Chinese Communist Party. The workers were successful in restoring the mines and have completed ten major reforms. On February 18, 1958, Chairman Mao visited this mine, gave great impetus to the workers, resulting in a great leap forward. After the Cultural Revolution, there was another leap forward. The production had been raised to five times that before the Liberation. After the overthrow of the "Gang of Four," the production increased by another 60% and the profit doubled.

The heat content of the coal is 7,500 kilocalories per kilogram of coal. For the rich portion of the oil shale, the heat content is 1,360 kilocalories per kilogram, with an ash content of 25%, volatile compound content of 15%, water content of 2½%, fixed carbon content of 3.7%, methane content of 12%.

The analytical work for the shale is not performed here. The on-site laboratory only determines whether the shale is rich or not. Analysis at other laboratories determine the content of C, H, O, N, CO₂, ash, etc. The mineral content of the shale includes five to six kinds of inorganic compounds. The rich shale, containing more than 4.7% oil, is used by Petroleum Refineries Nos. 1 and 2. The slag refuse is used to fill mines.

In answer to questions, we learn that there is some sulfur (0.1 to 0.6%) in the coal. The reserves should last 25 to 30 years at present rate of extractions. This is the Western Open Cut Pit mine. There is a similar Eastern coal deposit near Fushun, not yet being exploited.

Kao then leads us outside to view the open pit mine. We ride down part way into the mine in a cable tram car. We walk to an overlook to watch the operations with trucks and machines at the bottom of the open pit, more than a hundred meters below us. The coal occurs in seams that are readily visible. At a level about halfway down, there is a gusher of water that flows to the bottom of the open pit and obviously must be dealt with. Smoke emanates from five places, due to underground fires that have apparently been burning since the time the Japanese were here. We see the orange (rich) shale deposits and gray (poor) shale deposits outlined on the sides of the huge open pit, next to a wide seam of coal. We see the green rock in the area above the water flow.

We then ride back up to the ground level in the tram car. A crowd of workers greet us with hand clapping as we emerge. We return to the administration building, linger awhile outside to talk to our hosts.

We say good-bye to Li Ta-chang, our mine hosts and other Fushun hosts, drive back to Shenyang, in our caravan of cars. I ride in number 1 car with Ku Ching-hsin and Shih Liang-ho. Now there is only one car with hosts, number 0, in front of us. Ku, who was the former Chief Engineer (first class) of Petroleum Works No. 1 and No. 2 in Fushun, and now is the Chairman, Board of Directors, Chemistry and Chemical Engineering Society of Liaoning Province in Shenyang, has served as my personal host during our visit to the Shenyang-Fushun area. He stayed with us at the Hotel of Friendship in Fushun last night.

I present our driver, Tsao Kuang-fon, with a Kennedy half dollar.

When we reach Shenyang we drive through heavy traffic of bicycles. We pass the by now familiar Red Flag Square. We arrive at the Hotel of Friendship in Shenyang at about 11:15 a.m., going through the gate which has a PLA guard on duty.

I go to my old room (number 233, where I left my luggage during our visit to Fushun) for awhile to write in my journal, repack my bags, etc.

At 12:15 p.m. I join the others in the restaurant for our lunch. Members of the Japanese delegation of doctors are eating at neighboring tables, so they have not left yet.

Since we are not scheduled to leave until 1:30 p.m. for our afternoon activities (a visit to the Palace and the Northern Tomb of the Ch'ing Dynasty — Shenyang was the capital of the early Ch'ing Dynasty from 1625-1644), I place a phone call to Helen in Lafayette with the hope it will come through in time. My call to Helen comes through at about 1:10 p.m. (10:10 p.m. yesterday Lafayette time) and I have an excellent connection. She brings



Open Cut Pit Coal Mine, Fushun, May 29, 1978.

me up to date on the family — Lynne and Bill in Iowa City, Eric and Pete in Washington, D.C., Steve in San Diego, Dianne at Davis and Dave in Berkeley. She mentions the letters she and Pat Johnson have sent to China for me. She also tells me that General Motors, as sponsor of the Glenn T. Seaborg Nobel Prize Travel Awards, has invited me to accompany this year's two winners and Dorothy Schriver to Stockholm to attend the Nobel Prize Ceremony in December. I tell her to accept for me and suggest that she accompany me.

We assemble in front of the hotel at 1:30 p.m.; then our group of 16 departs with our local hosts, in the caravan of cars. I again ride with Ku Ching-hsin and Shih Liang-ho in No. 1 car following some of our hosts in No. 0 car. (Tsou Te-ch'en and Chi Wan-fu still serve as sort of coordinators for our local hosts.) Ku tells me he attended a meeting in Philadelphia of the Electrochemical Society (he identifies it as the Faraday Society) at which he met Colin Fink of Columbia University who acted as President of the meeting. He came there from Berlin where he studied at the Technische Hochschule from 1931 to 1937, when he received his Doctor of Engineering degree, under Professor Heinisch Frank.

This time, as we come to Red Flag Square, we stop to take pictures.

We are headed for the Palace of the Ch'ing Dynasty, which is in the old, eastern, part of Shenyang. We drive along Chung (Center) Street, the busiest one in the Old City.

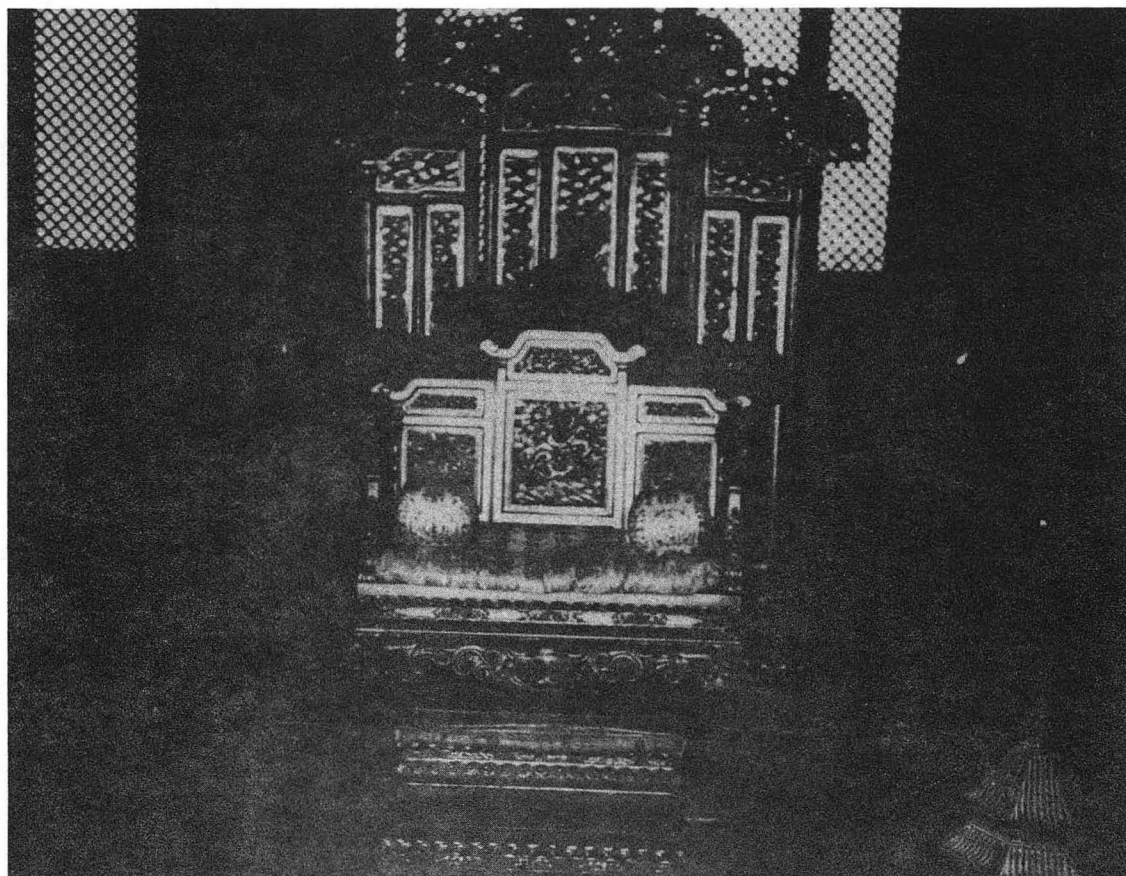
We arrive at the Palace at 2 p.m., find the grounds full of people. Here we meet a guide who starts us out on a tour. She speaks Chinese and Yuan Lee translates. We start at the eastern branch of the palace, which was built 350 years ago during the first two emperors of the Ch'ing Dynasty. This palace is about one-tenth the size of the Palace of the Ming Dynasty (the Forbidden City) in Peking.

First we enter a building showing the emperor's flags and warriors' hats, etc. The next building shows a display of bows and arrows.

Crowds of curious people stop to look at us at each place we stop, and as we walk around, children line up and clap their hands.

In the next building, we see swords and other implements of war. We see a huge cannon made in 1840, in Shenyang. In the next building, we see a cannon made in 1690, and rifles made in 1840, mostly in Shenyang. In the next building we see horse saddles, officers' gowns, etc.

Now we visit a building housing the throne where Shun Chih, first emperor of the Ch'ing Dynasty, was crowned in 1644 at the



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Throne of Shun Chih, first Emperor of Ch'ing Dynasty,
Shenyang, May 30, 1978.

age of six years.

As we walk to a building housing the throne used by Wung Ti-ji, father of Shun Chih, we attract the attention of many children and I take some pictures. Many of these wear the red arm bands of the Red Guard. We enter the building housing the throne of Wung Ti-ji.

We next visit the Phoenix Palace. We then visit a building housing a hall of worship and emperors' living quarters. We visit a building, built in 1748, used by three Ch'ing Dynasty Emperors during their visits to Shenyang; this building is opened especially for our group today.

To recapitulate, Nuer Ha-zu was an emperor in the Hojin Dynasty, a Dynasty in competition here in Manchuria with the Ming Dynasty in Peking. His son was Wung Ti-ji, and his son in turn was Shun Chih, who was the first emperor of the Ch'ing Dynasty. Shun Chih was crowned as emperor at the age of 6 in 1644, using the first throne that we have seen on our tour.

We complete our tour of the palace grounds at about 3 p.m., then head for the Northern Tomb, located in the northern part of Shenyang. The Northern Tomb grounds border the Hotel of Friendship grounds.

We arrive at the Northern Tomb grounds at about 3:20 p.m. These grounds are huge and have been made into a park. There are a number of ornate ceremonial and guard buildings here. This is the tomb of Wung Ti-ji, father of the first emperor of the Ch'ing Dynasty (Shun Chih) and Wung's wife. The tomb has not yet been excavated — we are told it is too recent — only 350 years old.

There are some statues of animals here similar to those at the Ming Tombs. We wander over the grounds to view the various buildings, finally come to a mound of earth, the site of Wung's Tomb.

The Eastern Tomb here in Shenyang is that of Nuer Ha-zu, father of Wung Ti-ji. This also has not yet been excavated. The first emperor of the Ch'ing Dynasty, Shun Chih, is buried somewhere in the Hopei Province.

Because several ten- to twelve-year-old boys have been following me for quite some time, peering intently at my face, I stop to engage them in conversation with Teng serving as my interpreter. I ask them where they are going to school, and they reply "Middle School 180." I ask one boy what his favorite subject in school is; he replies "sports;" another boy gives the same reply. I ask if they are studying English and they say "not yet." I ask if they intend to study English and they say "yes."

We now wander back to the entrance area. Near this point I take a picture of Ku Ching-hsin, Tsou Te-ch'en, Chi Wan-fu, Li Wan-hou and Wu Ming-tsun, who have been serving as our guides.

As we leave the Northern Tomb Park we pass an artificial lake which, Ku tells me, is used for swimming and boat rowing in the summer. We ride back to the adjoining Hotel of Friendship, arriving about 4:30 p.m., say a temporary good-bye to our hosts.

I go up to my room, do some writing in my journal before it is time for dinner. We are scheduled to catch a train to Peking at 7:35 p.m. this evening, due to arrive in Peking at 5:26 a.m. tomorrow. Then after breakfast at Peking Airport, we are due to catch a 10 a.m. flight to Shanghai.

At 6 p.m. I go down to the restaurant to join the members of our Delegation at dinner.

A little before 7 p.m. we gather in front of the hotel, preparatory to going to the Shenyang Railway Station. Present to see us off are Ku Ching-hsin, Tsou Te-ch'en, Chi Wan-fu, Lo Chang-fu, Li Wen-shan, others. I present Tsou with an ACS deck of cards and Chi with a Sunprint Kit as a token of appreciation for all their help.

We ride to the Railway Station in our usual formation of Shanghai cars, I in a car with Ku Ching-hsin and Shih Liang-ho. I present Ku with an ACS Centennial T-shirt, say he might regard this as a kind of souvenir of our visit.

At the Railway Station, our group of 16 boards the train, with the help of our local hosts to bring our luggage aboard. We say good-bye as the train pulls out at 7:35 p.m., on time. Shenyang is its point of origin. We have four compartments with four bunk-like places in each. Our four traveling hosts (Ms. Hu, Teng, Shih and Shih) occupy one compartment and our Delegation the other three. I share a compartment with Lee, Larson, and Geyer. Bigeleisen, Wei, Baldeschwieler, Stein are in one of the other compartments, Suttmeier, Breslow, Ibers, Schriesheim in the other. We retire a little after 9 p.m.

Wednesday, May 31, 1978 - Peking; Shanghai

With the radio coming on and the general activity in our car, I awaken at about 4:30 a.m., can't get back to sleep and soon get up and dress. We arrive at the Peking Railway Station at 5:26, a.m., on time. We are met by Ch'ien Jen-yuan, Deputy Director of the Institute of Chemistry in Peking (and member of the Chinese Delegation to the U.S. in 1972; and who will travel with us to Shanghai, Sian and Lanchow in place of Teng Shao-lin, who will now leave us), Li Ming-te, Ms. Ts'ao Hsuan-hsuan, Ch'iu Ping-chun, Chen Kuan-wen (Office Staff, Institute of Chemistry, Peking).

Our hosts help us with our luggage. We spend some time in front of the station before we enter our cars and bus for the ride to Peking Airport.

I ride in a car with Ch'ien Jen-yuan and Baldeschwieler; the others ride in a bus, to the Peking Airport. There are many people out on the streets, walking and bicycling, at this early hour. We see numerous joggers along side the long straight road to the Airport. We arrive at the Airport at about 6:20 a.m.

Soon after arrival, we all (our traveling group and greeting group) go to the Airport restaurant to have a Chinese breakfast. As usual, it is difficult to get tea, as it has been at most meals.

After breakfast, we go to the reception room for our long wait for the 10 a.m. departure of China Airlines flight No. 151 to Shanghai. I use some of this time to get caught up in writing my journal. Members of our Delegation are running out of Kodachrome film; so I give some of them rolls of 36 Kodachrome-64.

I also have time to write postcards to Helen, Pete and Eric, Dianne, Steve, Dave, Lynne and Bill, and Pat Johnson. I buy a set of Chinese stamps to take home as souvenirs.

We board China Airlines flight No. 151 (a 707) at a little past 10 a.m., take off at 10:20 a.m. Our traveling group still numbers sixteen — our delegation of twelve members and four traveling hosts (Ch'ien Jen-yuan, Ms. Hu Feng-hsien, Shih Wei-ming, and Shih Liang-ho).

We are each given a fan, for use to help keep cool, and which we are told we can retain. We have been assigned the front seats in the tourist section, where I sit with Baldeschwieler and Schriesheim. There is a five-row first class section in a compartment in front. We pass high over the plains containing many rivers, soon rise above the clouds with our view cut off.

I read in the 1978 (3) issue of *China Pictorial*, an article on "College Enrollment Examinations." This describes the Western

District of Peking's annual national college entrance examination held on December 10, 1977 at Middle School 150. This was one of 195 examination centers in Peking municipality. To quote from the article, "Enrollment is by voluntary application, examinations are unified and, after preliminary selection in various regions, admissions to colleges or universities must be approved by enrollment committees in the provinces, municipalities and autonomous regions. Workers, peasants, educated youth who have settled in the countryside, demobilized army men, cadres, and the year's senior middle school graduates, all may apply, provided they meet the requirements. They are allowed to list several alternative institutions and specialities, according to their personal preference. In order to ensure quality, those who do best in the exams are selected, after an all-around appraisal of their moral, intellectual and physical qualification." "The tests in this center took two and a half days. When they were over, the applicants returned to their various jobs. If they passed, they said, they would go to the schools to which they were assigned and study hard. If they didn't, they would continue to study and do their best to contribute more to the attainment of the motherland's modernization." ... "These tests were the first of their kind since the crushing of the 'Gang of Four.' When the 'gang' held sway over education, they perverted it to serve their scheme to usurp Party and state power. They babbled about 'creating havoc will make one an official' and concocted a 'hero' who turned in a 'blank' examination paper. They countered proletarian criteria for the selection of college students, opposed cultural tests in enrollment exams, interfered with choosing the most talented, and hampered the building up of a contingent of working class intellectuals. This created a big gap in the ranks of qualified scientific and technical personnel and slowed down the modernization of China's industry, agriculture, national defense and science and technology."

We arrive at Shanghai Hongchow Airport at about 11:45 a.m. (All of The People's Republic of China has a single time zone.) It is raining and we are transported by bus to the Terminal Building. Here we are met by Huang Wei-yuan (Deputy Director, Shanghai Institute of Organic Chemistry, member of the Delegation of Chinese Chemists to the U.S. last year, and who received his Ph.D. with Louis Fieser at Harvard University in 1952 and who stayed on as a postdoctoral fellow until 1955, thus overlapping with Ron Breslow), Liu Tse-wei (Head, Foreign Affairs Office, Shanghai branch, Chinese Academy of Sciences), Chiang Hsi-k'ui (Professor, Institute of Organic Chemistry), Liang Wen-hua (Director, Office of General Affairs, Shanghai branch, Chinese Academy of Sciences), Liang Kuo-chih (staff member, Foreign Affairs Office, Chinese Academy of Sciences), Ms. Hsu Tsen-o (staff interpreter, Foreign Affairs Office, Institute of Organic Chemistry).

We go to the main waiting room, where our Chinese hosts are introduced; and Bob Geyer, speaking Chinese, introduces the members of our Delegation of Pure and Applied Chemistry. We spend some time talking.

We then go outside to our cars, ride in a caravan of seven cars to our hotel, the Chin-chiang Hotel (a former American Hotel built before Liberation and the place in which our Delegation stayed in 1973). I ride in the first car with Huang, Ch'ien and Liu. Huang, who speaks English, tells me it is now the monsoon season, and the present rain started last Saturday. I tell him about our visits in The People's Republic of China so far, and that we have already met eight (including himself) members of the ten-member Chinese Delegation of Chemists to the U.S. last year and will soon meet the other two (one more at Shanghai, Ms. Hsia Tsung-hsiang, and one at Lanchow, Yin Yuan-ken). Huang tells me we will meet in my suite at 2 p.m. to discuss our schedule in Shanghai. The ride to our hotel is over the more westernized streets that Helen and I became so familiar with five years ago. Also, as at that time, there is almost no passenger automobile traffic, but myriads of bicycles.

We arrive at the Chin-chiang Hotel at about 12:30 p.m., are shown our rooms. I have a suite, numbers 619-620, including a large living room with overstuffed chairs and sofa, tea table, writing desk, radio, a bedroom with a large double bed, overstuffed chairs, two dressers, and a complete bath with standard U.S. plumbing, including an overhead shower. We all have rooms on the sixth floor. Our hotel is in the old "French Concession" area of Shanghai.

At a little after 1 p.m., we all go up to the restaurant on the eleventh floor to have our lunch at two tables. Those of us who choose "western" food have a more "western" meal than we have had in China before.

From about 2 p.m. to 3 p.m. our Delegation meets in the living room of my suite with Huang Wei-yuan and his colleagues, along with Ch'ien Jen-yuan and Shih Wei-ming, to discuss our schedule in Shanghai. As a total Delegation we find we are scheduled to visit a number of research institutes, in smaller groups and individually, to give a number of lectures, and will do some visiting in groups to a People's Commune and a Workers' New Village, the Shanghai Industrial Exhibition, Fudan University (the entire Delegation), etc. We suggest some changes which Huang accepts or will investigate as to feasibility.

On Sunday, and overnight, we will visit Hangchow for sightseeing (Wei may visit the Chemical Engineering Department of Chekiang University there), and we will depart for Sian by plane on Tuesday morning.

After this session, I meet with Liu Ken-pao, Research Assistant at the Institute of Nuclear Research, who will help as our translator during the visit of Bigeleisen, Lee, Suttmeier and me to the Institute of Nuclear Research tomorrow afternoon and will serve as the translator for my talk on the "Transuranium and Super-heavy Elements" at the Institute of Organic Chemistry on Saturday morning. I give him the slides for my talk, so he can study them,

and some of my reprints that are relevant to my talk, for him to read.

After this I take a walk with Yuan Lee up and down nearby Huai Hai Street, a major shopping area in this former French Concession region. Here we see all kinds of restaurants and shops, much like some European cities. There are radio and television stores, camera stores, used camera stores, book stores, used book stores (with some action in selling used books by students on the sidewalk area), stores to sell suits, sweaters, etc., portrait studios (including for color), a little restaurant serving Wonton soup, sort of carry-out places for people who work to buy dinners to take home (with the cooks wearing protective nose and mouth masks), bicycle shops (a large supply at the one price of 156 yuan), shops selling eyeglasses, a bakery with many kinds of cake including a huge, very tall wedding cake, etc. I stop in an optical store to buy some dark glasses (mine have been broken), get a pair with the holding arms fitted to my ears for 5 yuan, 10 fen (one fen = 0.01 yuan). Yuan buys some ping-pong paddles. We drop in the post office to buy a supply of Chinese stamps of many variations commemorating a range of events (standard price, 8 fen per stamp).

We return to our hotel a little before 6 p.m. I stop by the reception desk on the sixth floor to ask to have my gray suit repaired (a slight tear is developing in the left back shoulder); this seems to be difficult to arrange with the two men and two girls at the desk, but perhaps I have succeeded. I also ask them to press my gray suit and my dark suit (the one I wear to the dinners given for us by our hosts at our various stops); this can be done on short time scale.

Our Delegation has dinner at 7 p.m. in the eleventh floor dining room. Those who choose "western" food have apple pie for dessert. Breslow is wearing the gray Mao jacket that he bought this afternoon at the large department store in town.

After dinner, Bigeleisen, Lee and others decide to go to the Friendship Store. Since I would rather be free to wander, I ask Bigeleisen to buy some Chinese neckties for me if he can find any that are really Chinese in design.

I return to Huai Hai Street, this time with Breslow and Geyer. Now, mostly all the shops are closed, the street is dark in contrast to this afternoon.

Both this afternoon and this evening, I note the contrast to the other parts of The People's Republic of China we have visited. There is more varied clothing than the universal blue and gray uniforms worn by men and women alike. Here many women wear blouses, sweaters, etc. and some boys and girls walk arm in arm or hold hands, which is not seen elsewhere in China.

We stop at a women's department store. Here, with the

help of Geyer, and several male and female clerks and onlookers, I buy Helen a gray Mao-like coat. A woman of about Helen's size offers to model it for me; so I hope that I have approximately the right size. I don't know whether Helen will want to wear this to demonstrate to her friends a form of Chinese clothing.

Breslow and Geyer decide to take the No. 36 bus on down Huai Hai Street to the Yangtze River. I decide to walk back to our hotel to get a haircut. I manage to describe to the barber what I want and do get a satisfactory job. He uses scissors only, no clippers, and finishes with the traditional shaving operation but uses no lather.

I retire at about 11 p.m.

Thursday, June 1, 1978 - Shanghai

I arise at 7 a.m.

Today our entire Delegation is scheduled to visit the Institute of Organic Chemistry in the morning. In the afternoon James Ibers, John Baldeschwieler and Ronald Breslow plan to visit the Institute of Biochemistry; Jacob Bigeleisen, Yuan Lee, Richard Suttmeier and I the Institute of Nuclear Physics; and Richard Stein, Thurston Larson and James Wei the Shanghai Institute of Chemical Engineering. Alan Schriesheim will do some writing on his part of our report and Robert Geyer will be on his own.

I go up to the eleventh floor restaurant, have breakfast with the members of our Delegation. We see Jack Steinberger (of CERN, formerly of Brookhaven National Laboratory) and John Ellis who are just completing a high-energy physics mission to The People's Republic of China.

I have the same sort of nasal congestion and sore throat that I had in Shanghai five years ago. Is it due to a kind of allergy?

We assemble in the lobby at 8:30 a.m. to meet our hosts to start on this morning's visit.

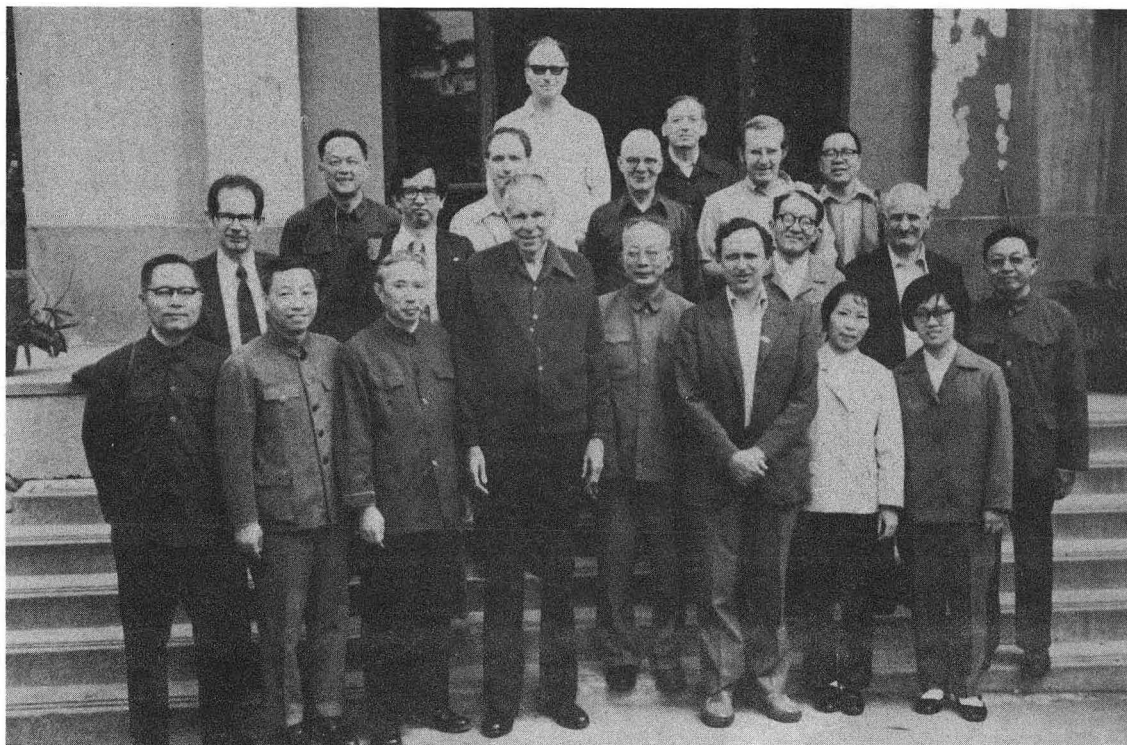
I ride in the first car of our seven-car caravan with Ch'ien Jen-yuan and Tai Li-hsin (Associate Professor and Scientific Secretary at the Institute of Organic Chemistry). Ch'ien tells me he worked with Paul Bender (did not obtain Ph.D.) at the University of Wisconsin, 1944-47. He knew Daniels, Mathews, Meloche and Willard.

We arrive at the nearby Institute of Organic Chemistry at about 8:50 a.m. and are greeted by Huang Wei-yuan (Deputy Director), Ms. Hsia Tsung-hsiang (member of the Delegation of Chinese Chemists to the United States last year), Chiang Hsi-k'ui (Professor), Yao Chieh-hsing (Chief, Scientific Administrative Unit), Ms. Hsu Chen-o (staff, interpreter).

We take pictures of the combined groups on the front steps.

We go upstairs to a second floor reception room in the main, old building. Here we sit at a long table with the traditional tea cups in front of us. We are served tea. There is a large, bronze, colored bust of Chairman Hua at one end of the room. Above this are pictures of Chairman Mao and Hua, and at the opposite end the usual pictures of Marx, Engels, Lenin, and Stalin.

Huang introduces his colleagues and I then introduce the members of our Delegation with translation by Geyer.



Institute of Organic Chemistry, Shanghai, June 1, 1978.
From left to right: front, Shih Liang-ho (Institute of Chemistry, Peking), Ch'ien Jen-yuan (Institute of Chemistry, Peking), Huang Yao-tseng (Deputy Director), Seaborg, Huang Wei-yuan (Deputy Director), Breslow, Ms. Hsu Chen-o (Staff Interpreter, Foreign Affairs Office), Ms. Hsia Tsung-hsiang (Researcher), Tai Li-hsin (Scientific Secretary); back, Baldeschwieler, unidentified, Lee, Ibers, Schriesheim, Larson, Bigeleisen, Suttmeier, Chiang Hsi-k'ui (Professor), Wei, Stein.

Huang then welcomes us, referring to his warm welcome in the United States last year, then gives us a briefing on the Institute. He expresses regrets that Wang Yu, Director of the Institute of Organic Chemistry, is out of town. The Institute operates under the Chinese Academy of Sciences. There are about 500 (2/3 bachelors degree, 26 professorial rank) research workers in the Institute, and 700 total. They operate in three general areas: (1) natural products, (2) organo-elements (organo-metallic), (3) physical organic.

Formerly they studied antibiotics. Now they study polypeptides, nucleic acids, insect hormones, prostaglandins and steroids. They study the microbiological oxidation of hydrocarbons, organo-fluorine, organo-phosphorus, and organo-metallic compounds. They have studied organic tin and arsenic chemistry and boron compounds. Now they are beginning to study transition elements.

Organo-phosphorus compounds are used as extractants in solvent extraction. In organo-fluoro chemistry they study polymers and liquid crystals, and as well, they study the mechanism of free radicals in polymerization. Their organic chemistry of natural products deals with medicinal chemistry, synthesis, and structural chemistry.

They also stress basic and theoretical work, especially physical organic chemistry.

They work in organic analysis and instrumental analysis. They work with and make their liquid chromatography apparatus, have a small pilot plant.

They have a proton NMR machine (60 megahertz, English model), mass spectrometer (Japanese made), gas chromatograph mass spectrometer (GCMS, German made), a high resolution mass spectrometer, and standard infrared and ultraviolet machines, but no ESR or Raman instrumentation.

The Institute was started in 1950. They moved to the present location in 1959. Now they need another large building and are scheduled to get it. They will accept 10 to 20 graduate students to start work this fall.

A number of products developed here are used in industry such as polytetrafluoroethylene (teflon) and organic agents used in the separation of nickel, cobalt and rare earths by solvent extraction methods. They have developed some of the steroids now used for contraceptives in The People's Republic of China.

There is an Institute Committee (currently 15 members) that decides on new ideas proposed by staff, and the priority of research, which includes rotating members, mostly senior but also some junior members. A significant number of projects originate

within the Institute itself, but an industry can request the Academy of Sciences to undertake a project and the Academy may then request the Institute to undertake it. The Institute then has a voice in whether it accepts the assignment, depending on its interest in the field and the extent of its overall commitments.

The support funds from the Chinese Academy of Sciences come mostly as a lump sum to be spent by the Institute as it chooses. The budget is determined annually, but the research projects are planned on a five- to ten-year period. They usually have budget increases, not cuts in budget. They apply separately for funds for equipment from foreign countries, which are most difficult to obtain.

We begin the tour of the laboratories at about 9:45 a.m. after the conclusion of the briefing by Huang Wei-yuan. We divide into our A and B groups and start from opposite ends of the tour. Huang Wei-yuan leads the B group of which I am a member. Ch'ien Jen-yuan, Ms. Hsia, Yao Chieh-hsing accompany us on our tour. Our group B (Bigeleisen, Lee, Larson, Stein, Geyer and I) go first to a neighboring second floor room where T'u Chu'an-chung briefs us on the chemistry of carboxymethyl amylase (CMA), the enzymatic degradation of its sodium salt, etc. CMA is used chemically as a blood plasma substitute.

Next we go to a neighboring room where Ms. Chou Feng-yi briefs us on studies of the blocking of the functional groups of nucleotides by acylimidazole benzylation. Ch'en Hai-pao then describes to us the syntheses of Dodecacaribonucleotide and Hexadecacaribonucleotide with enzymatic ligase reactions.

In a neighboring room we hear Chin Shan-wei brief us on the isolation of trichosanthin, a protein isolated from a plant used in Chinese herb medicine as an agent for induction of abortion. Trichosanthin, with a molecular weight of 240,000, contains 210 amino acid residues; it has been used clinically and now they want to determine its structure.

Across the hall we hear Ms. Wu Chao-hua brief us on the structure and reactions of arteannium, a new sesquiterpene derivative isolated from Artemisia. The structure was determined by the use of their proton NMR and mass spectrometer, ^{13}C NMR (done at the Institute of Photography in Peking), x-ray diffraction (done at the Institute of Biophysics in Peking), and optical rotary dispersion and nuclear Overhauser measurements. Dissolved in hot water, Arteannium is used as a beverage for drinking in the summer.

We are furnished chairs to sit on in each of the laboratories we visit.

We go downstairs to a laboratory where Wang Yung-lu shows us a carbon dioxide laser, built here, for use in identification of products from pyrolysis of polymers. This is a better laser than a ruby laser because its output is in the infrared (10.6

micrometers) where most polymers absorb. The products are identified through gas chromatography. He shows us some sample chromatograms.

We walk to another building. Here we meet Tai Hsing-yi who briefs us on some of the work of the Polymer Physical Chemistry Group that works under the direction of Huang Wei-yuan. Here they work on synthesis and structural determinations of fluoropolymers. They show us some of the instrumentation. We go next door to see their Scanning Electron Microscope, built in Shanghai. This has a resolving power of about 100 angstroms and a magnification of 50,000. As often happens I bump my head on the door entrance frame as I enter.

Across the hall Shih Kuan-yi briefs us on the relationship between stress cracking resistance and composition, composition heterogeneity, melt index, and morphology of fluorinated ethylene copolymer. They show us their Chinese-made apparatus.

We go across the hall where Wu Hou-ming briefs us on liquid crystals, their polymeric forms and applications. Again we see rather sophisticated Chinese-made equipment. They show us an example of the central components of a watch operating on such a liquid crystal. It shows the time as 11:30 a.m., in agreement with the time shown on Bigeleisen's, Lee's and my watches. They are spending considerable effort to duplicate liquid crystals (described tersely in various patents) and to explore their properties. This expertise will then be applied to the development of new liquid crystals appropriate to the technology they hope to develop to suit their national needs.

In the next laboratory Ch'en Ching-yun briefs us on the synthesis and applications of oxa-perfluoroalkyl sulfonic acids.

Larson drops out of our tour to visit with some of the other scientists.

Most of these briefings are in English, spoken in a quite understandable fashion.

As we walk back across the grounds to the old main building Huang Wei-yuan shows me the site where their new building will be constructed. Ms. Hsia Tsung-hsiang asks me to be sure to extend her best regards to Helen.

We go back to the reception room on the second floor of the main building. Here the members of our group A (except Ibers and Breslow) join us and I thank Huang Wei-yuan for their hospitality and our interesting visit. This is an excellent Institute, perhaps the best we have seen in China. I present him with a Hewlett-Packard HP-21 calculator and battery charger.

At our request we (except Breslow and Ibers) visit their

shops in a neighboring building. Here on the third floor we see their excellent electronic and glass blowing shops and on the first floor their well equipped machine shop.

Ibers and Breslow have not yet returned from their conferences with our Chinese hosts on details of what they have seen so I remark that they have been so well impressed they are probably going to "defect" from our Delegation and remain in The People's Republic of China.

We decide to say good-bye now, leaving Ibers and Breslow to return later, then ride in our cars back to the Chin-chiang Hotel. I ride with Huang Wei-yuan and Ch'ien Jen-yuan and we arrive at the hotel at about 12:30 p.m.

I soon go up to the eleventh floor restaurant to have lunch with our Delegation. After lunch I go down to my suite for a few minutes. Looking out my sixth floor window I see the many closely spaced multistoried buildings with slanted tile roofs, reminiscent of many European cities and unlike other Chinese cities we have seen. In the distance I see the immense tall building of the Shanghai Industrial Exhibition which our Delegation visited in 1973 and which some members of our Delegation will visit on Saturday morning.

At 1:30 p.m. Bigeleisen, Lee, Suttmeier, Baldeschwieler (who has decided to join us) and I gather in the lobby to meet our hosts for the ride out to the Institute of Nuclear Research, which is about 30 kilometers away in the northwest part of the city.

Huang Wei-yuan, Yuan Lee, Ms. Hu Feng-hsien (who was not with us this morning) and I ride in one car, Bigeleisen, Baldeschwieler, Suttmeier, and Shih Wei-ming in the other.

We drive through very heavy truck and bicycle traffic with incessant blowing of horns. Today, June 1, is Children's Day, a national holiday, but we do not see so much activity of children as Helen and I did in Peking on June 1st five years ago. For some of the last few miles we drive on North Road, which is also full of traffic, especially trucks. The Institute of Nuclear Research is located in Chia Ding county. The Technical University (which we pass on the way) is also way out here in Chia Ding county. There are one- and two-story stucco-like single family dwellings along this road that are reminiscent of "western" homes in the United States.

We finally arrive at the Institute of Nuclear Research at about 2:40 p.m. Here we are greeted by Chao Chan-hsin (Chief Engineer, radiochemist, principal host, responsible person, whom I met [with name written as Chao Tung-xin] during my visit here in 1973), Chang Chia-hua (Professor, Responsible Member of the Institute), Liu Nien-yan (Professor, Radiation Chemistry), Li Yun-che (Nuclear Chemistry), Sha Chen-yuan (Office Staff), Liu Ken-pao

(nuclear physicist, translator for my talk Saturday morning).

There is a welcome sign at the door of the Administration Building. We take pictures of the combined groups.

We go to the reception room on the second floor of the Administration Building, where we find the conventional tea serving setup.

Chao speaks to us with translation by Liu Ken-pao. Our hosts are introduced and Yuan Lee, speaking Chinese, introduces the members of our group. Chao welcomes us, says there are five departments of the Institute: (1) Nuclear Physics, (2) Isotope Research, (3) Radiation Chemistry, (4) Nuclear Electronics and Detectors, and (5) Accelerators.

In the first department they do work on nuclear reactions and fission. In the Isotope Research Department they work on the applications of radioisotopes to industry and nuclear medicine. Their cyclotron is used to produce isotopes. For radiation chemistry they have a cobalt-60 source, 120,000 curies, purchased from AECL in Canada.

They do work on and with nuclear detectors.

Their cyclotron is 1.2 meters in diameter, was built by them and patterned after the machine in the Institute of Atomic Energy in Peking. They plan to upgrade the cyclotron to higher energy. They plan also to build a Tandem accelerator of total energy 12 MeV for protons. This will be similar to the FN accelerator which is available from the High Voltage Engineering Corp. in the United States. The accelerator is currently being designed, the scientific program for its use now being planned and this will be more in the applied than basic area.

Today they will show us (1) the cyclotron, (2) radiochemistry, (3) radiation chemistry, (4) neutron generator, and (5) nuclear instrumentation.

They have a 14 MeV neutron generator, with neutrons produced by the D-T reaction.

I ask if they are still working on thermoelectric generators powered by alpha particle emitters. They reply that this work is still in a design stage, and is going on at another site.

The Director of the Institute, Chin Ho-tsu, is in Peking at a meeting today. He is a political cadre, not a scientist. He was under criticism five years ago when I was here so I did not get to see him. The Deputy Director is Shih Hsuan-wei, a physicist who also is not present; he has been here since the Institute was established in 1959.



Institute of Nuclear Physics, Shanghai, June 1, 1978.
From left to right: Baldeschwieler, Bigeleisen, unident-
tified, Seaborg, Chao Chan-hsin (Chief Engineer, Radio-
chemist), unidentified, Lee.

The Institute was built way out here because the Shanghai government planned to build many institutes out here in Chia Ding county but later the plan was changed.

They have 500 scientists, engineers and technicians, with a total of 700 including all supporting staff.

We now start our tour of facilities and laboratories, accompanied by Chao Chung-hsin, Chang Chia-hua, Liu Ken-pao, and others of the group that met us upon our arrival.

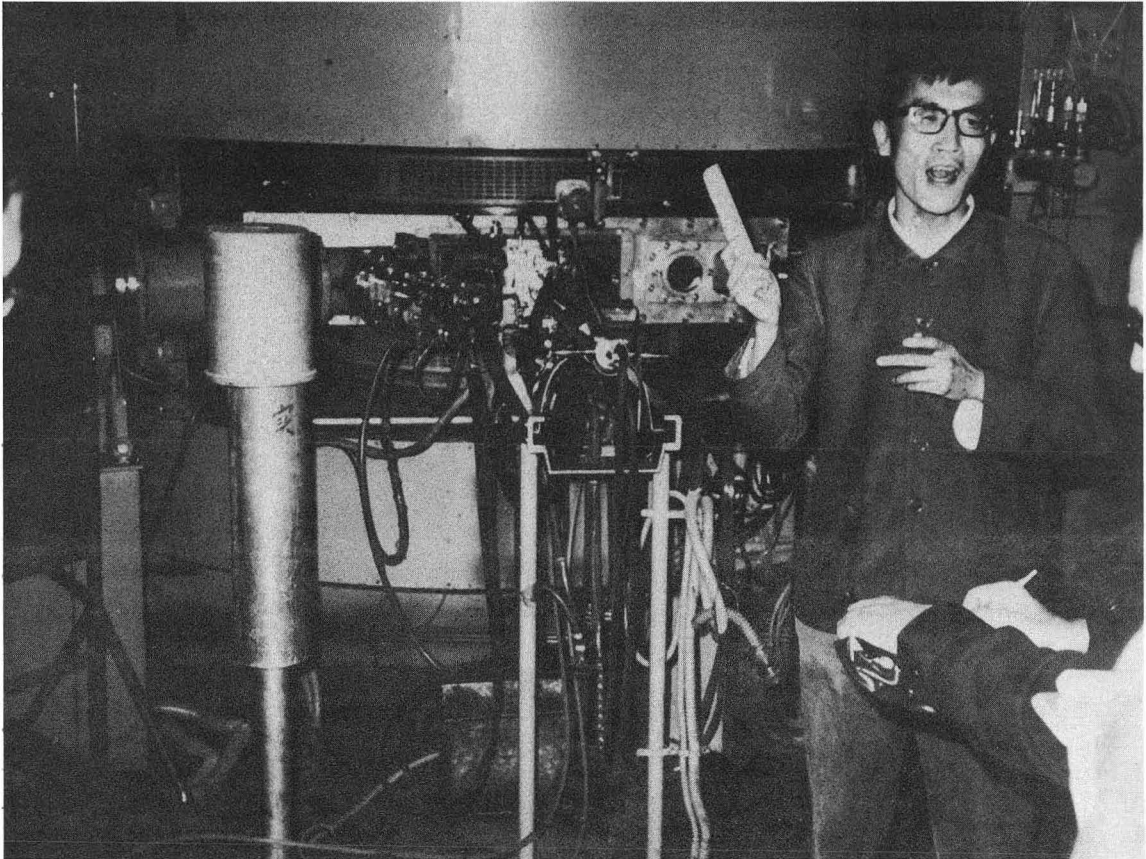
We walk across the campus to the Cyclotron Building and find a PLA guard with a rifle and bayonet at the door. Here we are greeted by Ch'ang Hung-chun (head of the cyclotron) and Ch'en Mo-pai (engineer) who shows us through the control rooms, then takes us to the cyclotron itself, which commenced operation in 1964. It produces 8 MeV protons (maximum internal beam, 1000 microamperes), 15 MeV deuterons (2000 microamperes internal beam), 30 MeV alpha particles (300 microamperes internal beam). For deuterons they get 80 microamperes external beam. The external beam is divided into components by good three-dimensional steering through the use of quadrupole and bending magnets. They produce radioisotopes for nuclear medicine such as ^{67}Ga , ^{85}Sr , ^{111}In . They will convert to a spiral ridge, sector focussed machine, to accelerate protons to 10-30 MeV, deuterons to 20-60 MeV, and will then also have a heavy-ion capability.

Next, we go to the laboratory where work on proton induced x-ray fluorescence analysis goes on, shown us by Li Ming-ch'en (nuclear physicist) and Ling Shen-hao (nuclear chemist). They have analyzed valuable old swords of the Yu state (about 2500 years old). The body of the sword consists of Cu, Sn, Fe (small amount), Pb. The green lines on the surface contain sulfur. The handle of the sword is inserted with glass containing Si, K, Ca. For these proton bombardments they use the electrostatic generator of Fudan University.

We next go upstairs where Ni Hsing-po describes his work on perturbed angular correlation. They are measuring the magnetic moment of the first excited state of ^{111}Cd and are using this isotope to measure local magnetic fields in solid state materials. They are also using perturbed angular correlation, employing the isotope ^{111}In , to study the enzyme nitrogenase, which is responsible for nitrogen fixation.

We leave the Cyclotron Building to walk to the Radiochemistry Building, go up to the third floor. Here we visit a radiochemistry laboratory where tritium-labelled compounds are stored; two girls are working here. We are given special dispensation, in order to save time, not to don white coats and shoe covers.

In a neighboring room they study the mass and radiation effect of tritium in biological matter (blood cells of the thyroid).



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Cyclotron (1.2-meter), Institute of Research, Shanghai,
June 1, 1978.

All this work is done in lucite glove boxes.

In the next room a girl tells us about the work on tritium-labelled nucleosides, APT, UDP and cytosine. They do their labelling by chemical and biological synthesis at a level of 20 curies per millimole of nucleoside starting with tritium-labelled amino acids. The labelling is effected by reduction of unsaturated compounds using tritium gas and various catalysts. In response to a question from us they tell us they get their tritium from the "Institute of Atomic Energy in Peking."

In the next room they produce tritium-labelled steroids and hormones, including cortisone, progesterone and testosterone.

In the next room there is a tritium gas line of the type used in our tritium laboratories in the United States (Argonne and Los Alamos Laboratories). Next is the room for tritium labelling of amino acids. Ms. Yen Yi-fa helps show all this. Yao Fu-chun, head of the section, is out of town today. Next we leave the Radiochemistry Building and walk to the neighboring Radiation Chemistry Building. Here Teng Liang-ch'ing shows us the cobalt-60 source under water (twelve 10,000 curie sources). We skip our visit to the Neutron Generator due to lack of time.

We walk next to the nuclear physics and nuclear instruments building. There we walk up to the third floor where we are greeted by Ling Ching-hsin. We go to a laboratory where nuclear detectors are made and studied. We go through an air lock to enter this clean area. Here they have Ge-Li detectors for gamma rays and Si-Au surface barrier detectors for charged particles. They show us cylinders of germanium metal, obtained from the Peking Institute of Non-Ferrous Metals. Also in the same case there are a number of Si-Au barrier detectors varying in size from 4 mm to 50 mm diameter.

In a neighboring room we see the Dewar flask of liquid nitrogen for a Ge-Li detector.

In another room we see instrumentation for measurements to support their program. Here we see a circuit under construction.

In the next room we see 256 and 512 multianalyzer equipment using integrated circuits, the first Chinese-built pulse analyzers with integrated circuits we have seen during this visit to China. Everything we observe is made here at the Institute.

It is now nearly 5 p.m. so we bring our tour to an end, walk back to the Administration Building. We go back to the second floor reception room, exchange pleasantries. I express appreciation for the hospitality of our hosts. In response to Chao's request for suggestions, Bigeleisen compliments them on their safety precautions. I remark on the size of their library and Chao Chan-hsin says it contains more than 100,000 books, was built three years ago,

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is made necessary by the relatively great distance from Shanghai. I ask if they do any design work on nuclear power here and Chao says they do not.

I then present Chao Chan-hsin with a Hewlett-Packard HP-21 calculator and battery charger.

We all go back down to the front steps of the Administration Building to say good-bye. The presence of the PLA at several buildings and the content of what we have seen suggests that there is some interesting work going on at this large complex that has not been revealed to us. We start the ride back to our hotel at a little after 5 p.m. There is less traffic on the way back, and we arrive at our hotel at 6 p.m.

I find my suits returned, one mended, both pressed.

I go to the eleventh floor restaurant to have dinner with our group. We then assemble in the lobby for a 7 p.m. departure for the Acrobatics Show this evening. Our entire Delegation attends, as well as Ms. Hu, Shih Liang-ho and Shih Wei-ming. Ch'ien Jen-yuan came from Shanghai (before he transferred to Peking he worked at the Shanghai Institute of Organic Chemistry) so he is visiting his brothers here tonight.

We ride in our cars, I with Tai Li-hsin and Shih Liang-ho in the first car, to the Theatre of Acrobatics. Here we see a very good show, starting at 7:15 p.m., put on by a Shanghai Municipal troupe. The first acts, acrobatics, are extraordinary and I am sorry I did not bring my movie camera. The ability of the young men, dressed in green, to leap through some small loops is amazing. This is followed by an act with six well-trained dogs, then a panda bear act, monocycle gyrations, juggling of various kinds by men and women, magic acts, card tricks, monkeys riding bicycles and performing, two young men using their voices to imitate birds, cars, trains, etc. The performance takes place in a circular, well lighted arena and the audience sits in a complete circle around the arena. The show ends at about 9:30 p.m. and we return to our hotel in our cars as we came.

I retire a little before 11 p.m.

Friday, June 2, 1978 — Shanghai

This morning I arise a little before 7 a.m. thus managing to get about eight hours sleep. The weather is cloudy as it has been much of the time since our arrival.

Today our entire Delegation is scheduled to visit Fudan University in the morning. In the afternoon Ronald Breslow is scheduled to give a lecture at the Institute of Organic Chemistry, Yuan Lee a lecture at the Science and Technology Center, and James Wei at the Shanghai Institute of Chemical Engineering. Wei was born in Shanghai and he and his family still have their home here which Wei has had some opportunities to visit.

The rest of our delegation will visit a People's Commune this afternoon. Tonight our local hosts will give a dinner in our honor here at the hotel.

I go up to the eleventh floor restaurant at 7:15 a.m., have breakfast with our Delegation. (During our travels our guides, in this case Ms. Hu, Shih, Shih, and Ch'ien, have their breakfast in a different place from our delegation.) As usual, the restaurant this morning is filled with Americans, Europeans, etc., who are here as members of various delegations. Many, of course, are tourists. We speak to a young man who is here with a trade delegation.

I go down to the lobby to meet our delegation at 8 a.m. preparatory to departure in our caravan of cars to Fudan University. By now the sun is beginning to show through the clouds.

I ride in the first car with Huang Wei-yuan. Chiang Hsi-k'ui and Ms. Hsu Chen-o accompany us in the following cars. Huang tells me Ch'en Wang-tao, President of Fudan University during our visit in 1973, died last year at the age of 87. Huang tells me they were forced to stress applied research too much during the reign of the "Gang of Four." As we approach Fudan University we are caught in a line of about 30 Shanghai cars, all holding members of various delegations headed for Fudan University.

We arrive at the Physics Building of Fudan University at about 8:30 a.m., are met by Cheng Tzu-wen (Vice President of Fudan University), Ts'ai Ch'uan-lian (Chief, President's Office and the Scientific Research Bureau, Fudan University), Cheng Shao-lian (Responsible Person, Scientific Research Bureau), Ch'en Wen-han (Professor and Associate Chairman, Department of Chemistry), Wu Hao-ch'ing (Professor of Electrochemistry and Deputy Chairman, Department of Chemistry), Ku Yeh-tung (Professor, rare earth chemist, changed from organic chemistry, received his M.S. degree, 1923-25, and Ph.D. degree, 1934-35, with Professor Stieglitz, University of Chicago, and knew there Dr. and Mrs. Herbert N. McCoy, Thorfin Hogness, Warren Johnson, many other of our University

of Chicago friends), Yu T'ung-yin (Professor of Polymer Chemistry, educated at the University of Michigan), Teng Chia-ch'i (Associate Professor of Analytical Chemistry), Kao Tsu (Associate Professor of Catalysis), Ch'in Ch'i-tsung (Associate Professor of Nuclear Chemistry), Fei Lun (Lecturer in Physical Chemistry), Li Fu-ming (Optics Department), Lu Ho-fu (Professor of Physics whom Helen and I met in 1973, with Ph.D. degree from the University of Minnesota).

Buchin Su, President of Fudan University and a mathematician, was not able to be present here to meet us.

There is great congestion as we arrive because of the approximately 30 Shanghai cars all arriving at about the same time. We do not know who these visiting delegations are. We go to the reception room on the second floor of the Physics Building. Here Chang Tzu-wen welcomes us on behalf of the faculty and students of Fudan University. Our hosts are introduced and Robert Geyer introduces the members of our Delegation. Cheng Tzu-wen tells us the central government has laid out a series of new policies and they are working to implement these. One of their professors has visited America and soon another (associate professor) will do the same. He extends his thanks for our visit.

He then calls on Ts'ai Ch'uan-lian who briefs us on Fudan University. It was founded in 1904. There are now 14 departments — seven in arts and seven in sciences. These consists of, in the arts, (1) Chinese language and literature, (2) foreign languages, (3) journalism, (4) history, (5) philosophy, (6) economics, (7) government; and, in the sciences, (1) mathematics, (2) physics, (3) chemistry, (4) biology, (5) optics, (6) computer science, (7) nuclear physics. There are 3,600 students and 2,100 faculty members.

We will visit the Department of Chemistry and the Department of Optics. There are 240 students, more than 200 faculty in the Department of Chemistry. More than 40 are lecturers, associate professors and professors. The floor space is 10,000 square meters. There are seven groups and a work shop and a small pilot plant in the Chemistry Department. The seven groups are (1) inorganic, (2) organic, (3) analytical, (4) physical, (5) catalysis, (6) electrochemistry, (7) polymer chemistry.

The library has more than 20,000 books, with 800 journals in 17 languages.

After the downfall of the "Gang of Four" there has been reformation and establishment of specialities; curriculum is being expanded from three to four years. The professors worked against the "Gang of Four," managed to conduct some work in catalysis, luminescence, high polymers, electrochemistry, environmental science, quantum chemistry (which suffered most from interference).

We are scheduled to visit these laboratories: (1) luminescent materials from rare earths, (2) detectors for environmental

chemistry, (3) instrumental analysis, (4) physical chemistry, (5) catalysis, (6) polymer chemistry and polymer physics, (7) gas discharge (in Department of Optics).

Vice President Cheng Tzu-wen leaves us after this opening session. Our group will divide into three subgroups according to our interests.

We divide into three groups to visit the following areas of work: (1) luminescence of rare earths, detectors for environmental chemistry, instrumental analysis — Suttmeier, Larson, Bigeleisen and I, (2) physical chemistry and catalysis — Schriesheim, Ibers, Baldeschwieler, and Lee, (3) chemistry and physics of polymers — Stein, Breslow, and Geyer. Lee will first visit in detail the electronic tube laboratories in the Optics Building.

Our entire delegation briefly visits the Optics Laboratory before we start our group tours.

We walk to the Optics Building, walk up to the third floor to see the Exhibition Room of various lamps. Here Ch'en Hsing-hua briefs us on these lamps. We also all visit two laser laboratories on the second floor before we break into our three groups. Li Fuming and Ching Ya-keng brief us here. Lu Ho-fu, Huang Wei-yuan, Teng Chia-ch'i also accompany us. Here we see a sub-nanosecond CO₂ Transfer Excitation Atmospheric-pressure (TEA) laser system being tested, to be used for the study of multiphoton excitation and dissociation of polyatomic molecules, and two nitrogen pumped-dye lasers in operation, one of which has a peak power of 500 kW.

Next our group 1 walks across the grounds to the Chemistry Building, goes to a first floor laboratory where rare earth fluorescent material is studied. Here Ms. Hsu Yen and Wang Ching-fei brief us on this work. First we see rare earths used as fluorescent tube coatings to convert ultraviolet light to visible light. We see blue, red and green fluorescent lamps, also a "welcome" message on a television-like screen. A yield of 80 lumens per watt is reached in conventional types of fluorescent tubes. The red color comes from Y₂O₃:Eu, the green color from (Ce_{1-x}Tb_x)MgAl₁₁O₁₉, the blue color from (Ba_{1-x}Eu_x)Mg₂Al₁₆O₂₇. The lamps use light from mercury vapor discharge to convert to the observed colored light by the rare earth compounds coated on the inside walls of the cylindrical lamp tubes. They also produce white light by mixing fluorescent coatings of various rare earth compounds.

At the other end of the room we observe the use of La₂O₂S to intensify 65 Kv x-rays for detection on the final photographic (silver halide) plates. This material is better than the CaWO₄ they have been using because the time of exposure can be reduced by a factor of four (from 1.2 to 0.3 seconds). This process, imported from the United States, replaces the use of x-ray film with ordinary photographic film, and is being used in the countryside with small portable x-ray machines for medical diagnosis.

We go next to a room on the second floor where Teng Chia-ch'i briefs us on work on electrochemical analysis for environmental science. They do polarography and anodic stripping voltametry.

They analyze for trace amounts of Cu, Zn, Cd, Pb in waste water, at concentrations of 0.1 part per billion (one part in 10^{10}) by weight. We see the anodic stripping voltameter — this has a platinum anode and glassy graphite for the cathode. The glassy graphite is manufactured by a factory in Peking by pyrolyzing a high polymer at high temperature. The deposition occurs for one minute to start the analysis, then the applied voltage decreases linearly until the metal begins to redissolve and the current is then proportional to the concentration. The nitric acid and other reagents used in this process are purified by stripping out all the cations by the same process.

In a demonstration we see on the oscilloscope the large signals corresponding to ten parts per billion of Pb and of Cd. The apparatus is produced in Shanghai, designed by Teng's senior (third year) and graduate students. They have two graduate students on this work, more than ten in the Chemistry Department.

We then go to a neighboring laboratory where Tsu Sz-hsin shows us an apparatus for determining total oxygen demand from organic pollutants. This includes a high temperature combustion furnace into which the water is introduced and the organic matter oxidized to carbon dioxide. Difference in amounts of oxygen is measured. They can detect 20 mg of oxygen consumed per liter of water.

Next we visit a student laboratory for instrumental analysis for third year students. This is shown by Sung Hung-tsz.

Ku Yeh-tung is in charge of this entire environmental program which relies so heavily on the work of students. These laboratories were closed for almost ten years due to interference by the "Gang of Four," but the equipment remained intact. Here they now have instruments employing (1) optical, (2) electrochemical, and (3) chromatographic methods. The optical methods use ultraviolet and visible radiation. In 1980 they will have infrared capability. The electrochemical methods employ coulometry, potentiometric titrations, polarography, anodic stripping voltametry. The chromatography is limited to gas chromatography employing both thermal conductivity and flame ionization detectors.

Students are trained to design instruments so they can solve concrete problems. They do environmental and water analyses for the city of Shanghai. The students analyze fish and rice for metal content by anodic stripping voltametry and determine concentrations of mercury by atomic absorption spectroscopy (with a Zeiss and a Shanghai-made spectrometer) using fluorescent detection methods.

We complete our tour, go out in front of the Chemistry Building to take pictures.

We then walk back to the Physics Building, go to the second floor reception room. On the way Lu Ho-fu tells us the black list during the reign of the "Gang of Four" was, with the worst listed first, as follows: (1) landlords, (2) rich farmers, (3) counter revolutionaries, (4) rightists, (5) renegades, (6) traitors, (7) foreign agents, (8) capitalist leaders, (9) intellectuals (including university professors). They referred to intellectuals as the "smelly" number 9.

We return to the reception room a little after 11 a.m. before our tour groups 2 and 3 arrive. These arrive soon and we spend some time in individual and group conversations. Lu Ho-fu has to leave at 11:30 a.m. to go to Shanghai Airport to see Steinberger off. (He introduced Ellis for a talk yesterday morning and Steinberger yesterday afternoon.) Lu is now President of the Shanghai Physical Society and will introduce me for my talk tomorrow morning, partly under the auspices of this Society. He sends his greetings to Helen, asks if we received his Christmas card (I assure him we did), thanks me for our Christmas cards and the pictures from our 1973 visit we sent him.

Ts'ai Ch'u'an-lian makes some concluding remarks, expressing pleasure for our visit and emphasizing the value of such exchange visits.

I express delight with the way our visit has been handled — especially the division into three groups, thus giving us the opportunity to see more — agree about the value of exchange visits, invite our hosts to visit us in the United States. I then make a presentation to Wu Hao-ching, Deputy Chairman of the Chemistry Department, of a Hewlett-Packard HP-21 calculator and battery charger, for use in the Chemistry Department.

We say our good-byes, ride back to the hotel in our cars, I with Huang and Ch'ien. We pass a sports stadium, an old one Huang tells me — there is now a new larger one in town. We pass through the central business district of Shanghai, the corner (with Nanking Road cross-street) where Department Store No. 1 is located. We arrive back at our hotel at a few minutes after noon.

We have lunch in the eleventh floor restaurant, compare notes on the tours our three groups have made this morning at Fudan University. We agree that it went well, that we learned a great deal, and that this is a good way to make our visits.

Ibers and Larson have decided not to take part in the visit to the People's Commune this afternoon. I agree with Wei that he should make a presentation of a Hewlett Packard HP-21 calculator and battery charger to the Shanghai Institute of Chemical Engineering when he speaks there this afternoon. This



Fudan University, Shanghai, June 2, 1978. From left to right: Suttmeier, Bigeleisen, Huang Wei-yuan (Institute of Organic Chemistry), Ku Yi-tung (Rare Earth Chemist), Seaborg, Lu Ho-fu (Professor of Theoretical Physics), Larson, Wu Hao-ching (Deputy Chairman, Department of Chemistry).

leaves only two more calculators to present and I suggest these be reserved for presentation to the Institute of Modern Physics and Institute of Chemical Physics at Lanchow.

At 2 p.m. we gather in the lobby for our ride to the Hongchow People's Commune. I ride in the first car of our four cars with Baldeschwieler and Shih Liang-ho. We drive toward the southern outskirts of Shanghai. We arrive at 2:20 p.m., Bigeleisen, Stein, Schriesheim, Suttmeier, Baldeschwieler, Geyer, Shih Liang-ho and I. We are greeted by Tao Shao-pao who gives us a briefing. Three girls are also there to help brief us.

As usual green tea is served as we sit at a long table in a kind of dining hall. This commune was established in September 1959. There are 16 brigades and 120 working teams, 700 families and a total population of 28,000. Of these, 20,000 are workers. The main occupation is agriculture. Vegetables constitute 75% of their output. Last year they produced 211 tons of vegetables per day. This can feed 600,000 people in the city.

There are about 180 kinds of vegetables produced here, compared with only 90 kinds at the beginning of Liberation. They have an average of $4\frac{1}{2}$ crops per year, with a maximum of six. They also grow grain, mainly rice and wheat, three crops per year. The annual production is 11 tons per $2\frac{1}{2}$ acres.

They also raise pigs. They provided 43,000 pigs last year as compared with 1,000 pigs in 1949, of average weight 100 kilograms. They collect and use natural fertilizer from the pig operation. Chemical fertilizers consist of only 15% of the total used.

They have 100 cows (for milk) and 13,000 rabbits (in 1977). Most of the milk is used elsewhere, although some is used by the weak people in the commune. They also raised 30,000 ducks and 120,000 chickens last year. They have a 75-acre pond for growing fish. They devote 60,000 square meters to the cultivation of mushrooms.

They now have 34 large, 132 small (hand) tractors. They have 20 to 30 two-ton trucks. Also they have agricultural machinery, such as seeding and harvesting machines, and a whole system of underground irrigation with a total length of 150 kilometers. They use some oxen for plowing of the ground but mostly this is done by tractors. They have more than 80 oxen.

The income for each worker is more than 400 yuan per year. They pay for food out of this but no rent. Every worker has his own house, as private property. Each person has 46 square meters of land, if he or she has been here since 1961, when the land was distributed. Any increase in family size since then must be accommodated within this original allotment, although some land allotments can be made to newcomers.

This commune has its own research institute; its operating expense is borne by the commune. The commune has 14 elementary and 4 middle schools, with a total student population of more than 6,000. They have more than 60 medical personnel with salaries paid by the state. In the last few years, due to the influence of the "Gang of Four," very few middle school graduates (less than 5%) have gone on to college. More than 90% of the graduates of elementary school go on to middle school. Graduates of middle school have not yet taken the college entrance examination.

There are 60 barefoot doctors in the commune operating at the brigade level. They give medical services and also work at labor. They diagnose and treat the common diseases. For medical expenses, 30% must be paid by the sick person and 70% is paid by the commune. Only 3.5% of the commune's production goes to the state as a land tax.

The government of the commune is divided into three levels: (1) commune, (2) brigade, (3) team. The commune level of government is a combination of production control and political authority. The leading members of the Revolutionary Committee of the commune are elected. The Chief and Deputy Chief of the Brigade are elected. The teams also elect their Chief and Deputy Chief. The terms are two to three years and they can be re-elected. Some of the Leading Members, not the most important ones, are appointed by the state.

Our host, Tao Shao-pao, is the Chief of the Administration Office of the Commune, an appointed position. He was appointed by the commune officials.

Today we will visit the Exhibition Hall, hospital, a store, vegetable field, electricity producing station and an individual home.

We first go to the Exhibition Hall in the neighboring room, see a lighted map plan of the commune which is explained to us. Tao lights up each category as he explains them. We see a display of the products in glass containers — vegetables, grain, fruit, etc.

Next we go outside, ride to the two-story hospital, where a doctor shows us the various facilities on the first floor. We see the patients in the various rooms. We visit the room for acupuncture, with charts showing the more than 625 acupuncture localities, the needles used, etc. There are 30 beds in the hospital located on the second floor.

Next we ride to the department store. Here there is an interesting system of conveyor strings for carrying the purchase money to a central point.

Next we visit a pump station, of which each pump (of 24) pumps water to irrigate 130 acres. Near here we see the 30-foot-

wide irrigation ditch and valves for releasing the water to the nearby large fields of vegetables, grain, etc.

It is, unfortunately, raining now as we continue our tour. Two of the girls, who were present for our briefing, accompany us in our four car caravan. Tao Shao-pao rides with us in our car.

We then ride to the "typical" home. This is a six-room complex, described to us by a 70-year-old great grandmother. There are 14 people living in this house, four generations, and the total income is 250 yuan per month. They received a 2,000 yuan bonus at the end of last year. They saved their money for ten years to build their six-room home and to help their three grandsons get married. The house was built two years ago, has two stories with three rooms on the first and three on the second floor. The room in which we are now visiting with the great grandmother has a large double bed with large colored pillows and flowered bedspread, an excellent table radio, a green sofa, a portable clothes closet, two dressers, two chests, a table, chairs, end tables, made of good-looking wood. This room is about twelve feet by twenty feet, has three windows. There is a fluorescent light in the ceiling, but no visible source of heat.

The great grandmother says their life is much better now than it was before Liberation. Before Liberation she had eight children but only one has survived until now. In the New China things are quite different. In the old days three members of the family died in one year, only four survived to Liberation. Now the family has fourteen members.

We then drive to a field area to see a greenhouse, many men, women, girls and boys, working in a tomato field. We see a pill box ornament built here by the Kuomintang. We walk along the paths through the fields of tomatoes, etc.

Here we can see some apartment houses, a factory for repairing farm machinery, the agricultural institute on the premises, etc. We wander somewhat separately although I stay close to our host, Tao Shao-pao. I present him with a Kennedy half dollar.

We say good-bye to Tao who seems reluctant to have us leave. We then ride back to our hotel in our four cars as we came, arriving a little after 5 p.m.

I write in my journal a while, then shower and change clothes for the dinner to be held in our honor tonight, at a restaurant on the fourteenth floor. Wang Ying-lai, Head of the Shanghai Branch of the Chinese Academy of Sciences and Director of the Shanghai Institute of Biochemistry, will be our host.

At a little before 7 p.m. our delegation goes up to the fourteenth floor where we meet our hosts in a reception room.



70 year-old great grandmother in bedroom, Hongchow People's Commune, Shanghai, June 2, 1978.

Present are Wang Ying-lai (whom, he recalls, I met during my 1973 visit to Shanghai), Huang Wei-yuan, Tai Li-hsin, Lu Ho-fu, Chiang Cheng-fan (Responsible Person, Science and Technology Association of Shanghai), Liang Wen-hua (Responsible Person, Science and Technology Association of Shanghai), Wang Ch'eng-ming (Professor, Shanghai Institute of Chemical Engineering), Yu T'ung-yin (Professor, Fudan University), Chiang Hsi-k'ui (Institute of Organic Chemistry), Liu Tse-wei (Head, Foreign Relations Office, Shanghai Branch of the Chinese Academy of Sciences), Hsu Chen-o (Interpreter, Institute of Organic Chemistry), the twelve members of our Delegation and the four hosts traveling with us (Ch'ien Jen-yuan, Ms. Hu Feng-hsien, Shih Wei-ming, Shih Liang-ho). We converse individually, I with Wang and Lu, and in groups for a while, then go into a neighboring room to have our dinner. I sit at a table with Wang, Lu, Huang, Ch'ien, Chiang Chen-fan, Baldeschwieler, Bigeleisen, Geyer, and Shih Liang-ho. Near the beginning of the meal Wang makes his welcoming remarks, reading from prepared text, with translation by Shih Liang-ho. He makes reference to the setback in Chinese science brought on by the "Gang of Four," the steps being made to close the gap with Western science, the value of increased cooperation between the United States and China, and ends with a toast to my health and that of our Delegation and to increased cooperation and friendship between our peoples.

I have a delightful conversation with Lu about his work at the University of Minnesota, 1936-41. He determined the abundance ratio of the two boron isotopes, obtaining a value that was used in our Table of Isotopes for nearly 38 years. He also said he could tell that Helen did the writing on the Christmas cards we sent him because of the handwriting. He has been a theoretical physicist almost from the time he returned to China in 1941.

Toward the end of the meal I respond to Wang's remarks and toast. I recount our two and one-half weeks stay in The People's Republic of China so far, our remaining week to go, our many visits to research institutes and universities and our less scholarly pursuits and fine dinners. I take note of the fine science we have seen in places, especially Shanghai, and the eight priorities enunciated by Vice Premier Fang Yi at the Chinese National Science Congress in March, saying this convinces me China can close the gap. I call for increased exchanges, including that of students. I then present Wang with a Lawrence Hall of Science "Accelerator Forest," saying this is absolutely unique because there is no other one exactly the same, suggest it might be kept on his desk as a memento of our visit. I finish with a toast to our hosts' health and increased friendship between the scientists and peoples of our two countries. The dinner ends at about 8:30 p.m.

After the dinner our hosts stay to mingle with us a while. Since our Delegation is dressed in their best, this seems a good time to take a picture of the entire group. We use Bigeleisen's and my camera; (Ch'ien operates my camera, Shih Wei-ming, Bigeleisen's).

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After saying good-bye to our hosts, I go up to my room.
Ms. Hu and Ms. Hsu drop in to discuss some purchases I would like
Ms. Hsu to make for me.

I do some writing in my journal, then retire at about
11 p.m.

Saturday, June 3, 1978 - Shanghai; Hangchow

I arise at about 7 a.m. Looking out my window, I notice a cat in the driveway of our hotel, the first I have seen on this visit to China. Perhaps with the overthrow of the "Gang of Four" the ownership of cats is again possible.

This morning I am scheduled to give my talk on "Transuranium and Superheavy Elements" at the Institute of Organic Chemistry. Ibers is scheduled to give a talk at the Shanghai Science and Technology Center; Wei to have a discussion on education in chemical engineering at the Shanghai Institute of Chemical Engineering; Bigeleisen and Lee a discussion on theoretical chemistry; Baldeschi, Breslow and Larson will visit the Shanghai Institute of Materia Medica. Schriesheim, Suttmeier, Stein and Geyer will visit the Shanghai Industrial Exhibition.

This afternoon we will all catch the train for Hangchow at 1:23 p.m.

I go up to the eleventh floor restaurant for breakfast at about 7:30 a.m. Here I join the members of our Delegation. Today we have a discussion about the degree of invention or innovation in the science that we are seeing in The People's Republic of China; the consensus is that it is comparable with that in the Soviet Union.

I go down to the lobby at 8:30 a.m., join Lu Ho-fu, ride with him and Shih Liang-ho to the Institute of Organic Chemistry to give my talk on "Transuranium and Superheavy Elements." I present Lu with Lawrence Hall of Science picture post cards, a Kennedy half dollar as a souvenir and an LBL reprint (number 6509), "A Search for Superheavy Elements with Half-Lives Between A Few Minutes and Several Hundred Days, Produced in the $^{48}\text{Ca} + ^{248}\text{Cm}$ Reaction."

We arrive at the Institute of Organic Chemistry at 8:45 a.m., greeted by a colorful sign with a welcome message for me. We go immediately into the building and into a full auditorium (some 200-300 people), greeted by vociferous applause. Lu introduces me, speaking in Chinese, in a very complete manner, recounting most of my career in outline form. Liu Ken-pao gives me a personal translation as Lu talks.

I begin my talk, expressing delight at being in Shanghai again after five years, and regret that Mrs. Seaborg is not with me this time. Lu interrupts to say, as far as he is concerned, Mrs. Seaborg is invited to accompany me here on my next visit. I make reference to my "periodic table" necktie as a potential aid to understanding my lecture. I give my talk on "Transuranium and Superheavy Elements," illustrated with 42 slides, with sentence by sentence translation by Liu Ken-pao. In the course of my talk

I invite members of the audience to come to Lawrence Berkeley Laboratory, when our United States - People's Republic of China Exchange Agreement is expanded, to help us synthesize and identify the superheavy elements because we have not been able to do it ourselves. This invitation receives a tremendous response. Toward the end of my talk I describe my \$100 bet with Albert Ghiorso. Lu comments this is not a very large bet and I reply we cannot afford more because we do not have very large salaries. I explain why Ghiorso can never win this bet.

After my talk, which last $2\frac{1}{4}$ hours, I answer questions for about fifteen minutes. These cover such areas as limitations on the reliability of spontaneous fission detection for discovering new elements, prediction of chemical properties of superheavy elements, status of discovery of superheavy elements in nature. My audience consists of members of many neighboring research institutes, Fudan University, etc. A contingent from the Institute of Nuclear Research sits in the front rows, asking most of the questions.

I join in the applause before and after my lecture, observing a recent Chinese custom of Soviet origin in this regard which I had not realized I should observe when I gave my previous lectures during the last two weeks.

As I am leaving, I give a copy of my "Actinides and Trans-actinides" article to Ku Yeh-tung, as he stands in front of the audience.

I ride back to our hotel with Lu Ho-fu and Shih Liang-ho, arrive a little after 11:30 a.m. After a short visit to my room, I go up to the restaurant on the eleventh floor to join the members of our Delegation for an early lunch. We compare notes on our various activities this morning, find a generally favorable reaction. There is some reference to our own "Gang of Four" (Nixon, Erlichman, Haldeman, Mitchell) in the United States, our accompanying setback in the support of science, subsequent attempts at recovery and our present aim to do better than we have done — all analogous to the references to the "Gang of Four" in The People's Republic of China.

After lunch I go up to my room to pick up my overnight bag. We are retaining our rooms in the Chin-chiang Hotel so we can leave our heavy luggage here.

We leave for the Shanghai Railway Station at about 12:45 p.m. I ride in the first car with Ch'ien Jen-yuan and Liu Tse-wei. Our group traveling to Hangchow (Hangzhou) consists of the twelve members of our Delegation and our four (Ch'ien Jen-yuan, Ms. Hu Feng-hsien, Shih Wei-ming, and Shih Liang-ho) traveling hosts.

As we walk through the Shanghai Railway Station, at the entrance to the train track area, over the door in an illuminated red script, we see the inscription "The Just Struggles of Peoples

of All Countries Support Each Other." We board the train, find our group of sixteen has three compartments. I am in a compartment with Bigeleisen, Wei, Stein and Geyer. The traditional green tea in covered cups is served by a young girl just as we leave the station at 1:23 p.m., on time. In another compartment we have Lee, Ibers, Baldeschwieler, Schriesheim and Suttmeier, and in a third compartment, Ms. Hu, Shih, Shih, Ch'ien, Larson and Breslow. About an hour later we see, on an irrigation channel parallel to the train tracks, about a hundred concrete boats. These boats are used widely in China for the transport of goods and merchandise.

Bigeleisen and I dictate into our tape recorder the section of our report covering our visit to the Institute of Nuclear Research of Shanghai.

Ch'ien joins us in our compartment to have a talk with Wei; they converse in Chinese. Baldeschwieler also joins us for a while to make his contribution to the section of our report covering our visit to the Institute of Nuclear Research in Shanghai.

As we look out the train window, we see miles and miles of water-soaked fields of rice.

When we reach Chia Shin, at about 3 p.m., we see the island on South Lake where the First Congress of the Chinese Communist Party was held in 1921.

The weather has turned sunny and pleasant this afternoon and is apparently so all the way to Hangchow.

We arrive at Hangchow Railway Station at 4:10 p.m. Here we are met by Chang Huai-li (head of Administrative Office, Science and Technology Committee, Chekiang Province), Yang Shih-lin (Professor, Department of Chemical Engineering, Chekiang University), Chou Ch'un-hui (Professor, Department of Chemical Engineering, Chekiang University), and Ma An-tung (Secretary, Science and Technology Committee, Chekiang Province).

We all ride in a bus to the Hsi'ling Guest House on West Lake. We ride through Hangchow on Qingtai Road to Hubin Road on the eastern shore of beautiful West Lake. We see on the way the picturesque streets of Hangchow with their quaint shops. The sidewalks are teeming with people and, as usual, there are many bicycles; there are no passenger automobiles and few trucks. This is perhaps the most beautiful city we have seen in China on this trip. It is obviously a large city — we hear the population is nearly one million. We are told that Marco Polo visited here, said it was the most beautiful city he visited in China. A Chinese proverb says, "Above there is heaven, below there is Soochow and Hangchow."

We drive along Hubin Road, then across a corner of West Lake on Bai (Pai) Causeway, over an island containing Gu Shan

(Solitary Hill) and Zhongshan Park. We see Baochu (Pao Shu) Pagoda on the neighboring hill. We see boats of various kinds, including rather large pleasure boats, on the lake. We continue past the island to the Hsi'ling Guest House, where we are shown to our rooms on the sixth floor.

I have a suite (no. 617) consisting of a large living room, large bedroom with large double bed with a white lace cover, and large bathroom with modern plumbing, but no clothes closet. The bedroom has a door leading to a balcony. I have an excellent view of West Lake, the Bai Causeway, Gu Shan, the Su Causeway crossing the western part of West Lake, and the top of Baochu Pagoda.

Hangchow is at the southern extremity of the Grand Canal and is one of China's old cities with a history of over 2,100 years. Since Liberation it has developed industries on a fair scale and is famous for its brocade. The hills around West Lake are impressive, have many fountains and springs. The prized Dragon Tea is grown near Dragon Well (Longjing) Spring.

I go out on the balcony and take a number of pictures from my sixth floor vantage point. West Lake reminds me of Tai Lake which Helen and I saw and visited in Wu-hsi in 1973.

When we reach the hotel, we learn that there is a dinner scheduled in our honor at 6:10 p.m. tonight, to be hosted by Wang Chieh, Vice Chairman, Science and Technology Committee, Chekiang Province.

There is a PLA guard, with rifle and bayonet, at the front of the hotel as has been the case in practically all the hotels in which we have stayed. Ch'ien tells us the guard is there to keep unauthorized Chinese out.

I am late to our dinner because my watch (a new quartz liquid crystal type that I bought for my trip to China) mysteriously loses about 40 minutes.

I join our hosts and our group in a reception room on the sixth floor. Present, besides our group of sixteen, are Wang Chieh, our host tonight, Chang Huai-li, Yang Shih-lin, Chou Ch'un-hui and Ma An-tung.

Wang makes some welcoming remarks. In my response I say that Hangchow is a beautiful city, reminiscent of my visit to Soochow five years ago. This provokes a laugh from our hosts because Soochow and Hangchow are rivals for standing as the most beautiful city in The People's Republic of China. I also say West Lake reminds me of beautiful Tai Lake which I saw in Wu-hsi five years ago. West Lake is man-made while Tai Lake is of natural origin.

We soon go next door to the room where we are to have our

dinner. I sit at a table with Wang, Yang, Ch'ien, Ma, Shih Liang-ho, Ibers, Baldeschwieler, Lee, Stein and Larson. Tonight Wang does not offer a toast — we are told it is a very informal dinner — so I do not offer a toast. The dinner tonight features the famous "vinegar" fish from West Lake (cooked for four minutes), and a sweet dish, White Silver Ear of Tree (a fungus), near the end. As at many of these dinners we are also served loquats.

We finish our dinner at about 7:45 p.m., thank our hosts and bid them adieu. A number of us then walk over to the neighboring Hangchow Hotel to do some shopping in the shop on the second floor. I buy some Chinese handkerchiefs and paper cuttings for use as gifts back home.

I return to my suite a little before 9 p.m., retire at about 10 p.m.

Sunday, June 4, 1978 — Hangchow

I get up at 6:30 a.m. Ibers and Suttmeier do their jogging this morning on the Bao Causeway. It is a clear day, which is fortunate for our planned sightseeing. The view to the east over West Lake, with the sun well above the horizon, is gorgeous.

We are scheduled to visit a Buddhist Temple, take a boat ride on West Lake, and walk around downtown on the streets of Hangchow.

As I go out on the balcony, I hear what appears to be the music of a flute in the distance. The verdant, abundant growth of green trees, bushes everywhere reminds one of a tropical area. The temperature is warm but not hot — in short, very pleasant.

At 7:15 a.m. I go down to the dining room on the second floor, join our delegation for a Western style breakfast — the only kind offered this morning.

At 8 a.m. we meet in the lobby to set off on our day's activities. The sixteen members of our group, plus local hosts Chang, Chou and Ma, board our bus and ride to the Ling Yin Temple (built 1,600 years ago). Here there are two large temple buildings, many rocky hills with Buddhas carved in the rock cliffs, rock steps up the hills, a stream running through the area.

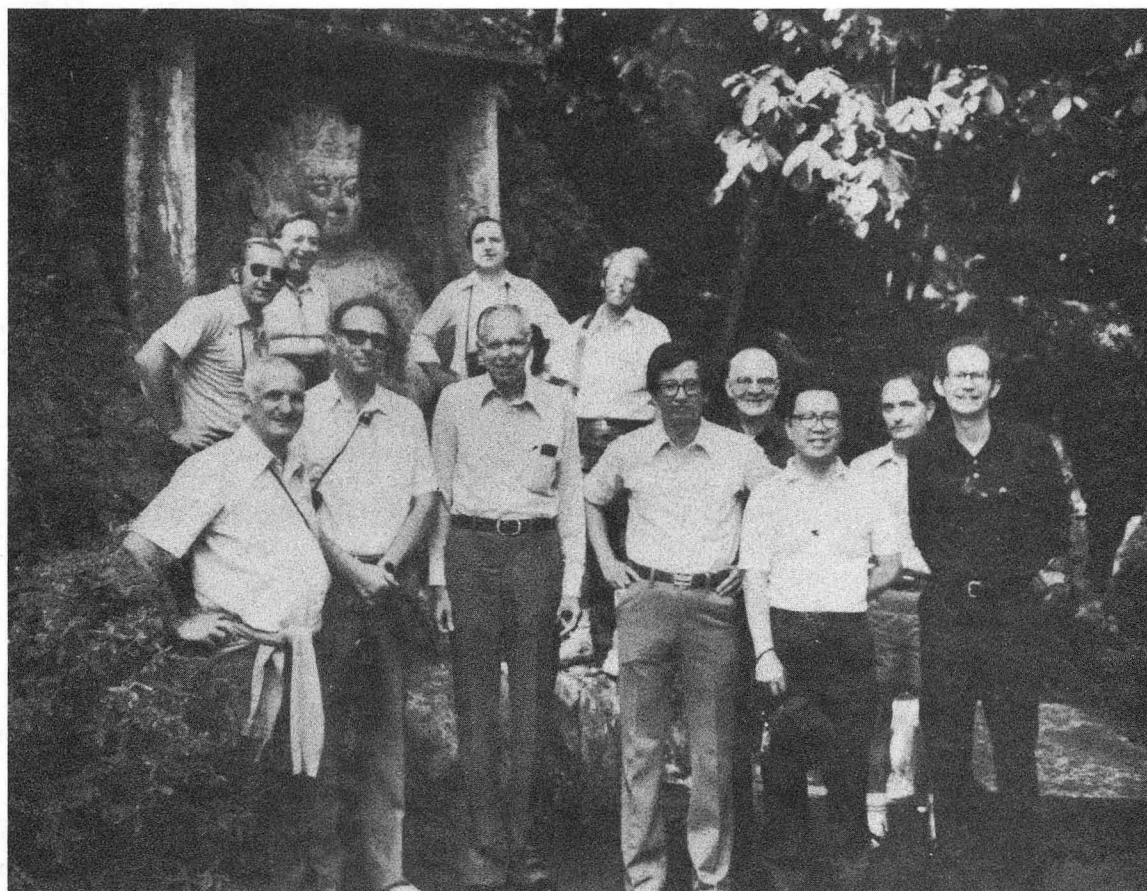
We enter the first Buddha Building. The center area has, on the front side, the Miller Buddha, on the back side the Wei Tow Buddha, with two large guard figures on each of the two sides. The Wei Tow Buddha is carved from one piece of wood (camphor wood).

We go to the second Buddha Building which has, in the center, on the front side, the second largest Buddha in all of China. This Buddha is 19 meters high, made out of 24 pieces of wood. The building is 33 meters high. On the back side of the center area there is a huge panorama of figures — a woman Buddha, Kwanying, in the center, two attendants, eighteen monks on the bottom, about a hundred smaller figures spread over the entire panorama.

We then climb stone steps on one of the rocky hills. Here we see workers carving figures of Buddhas in the rock cliffs and carvings in rock hills.

We walk up and down rock paths, come back to the entrance area. Here we take pictures of our Delegation.

We now enter our bus, ride some distance to the southwest corner of West Lake. Here we wander through Flower Harbor Park, a beautiful place. We come to a small lake containing many red colored fish (carp) of a large range of sizes. A number of us feed bread to the fish.



Members of Delegation at entrance area in front of rock Buddha, Ling Yin Temple grounds, Hangchow, June 4, 1978. From left to right: front, Stein, Schriesheim, Seaborg, Lee, Larson, Wei, Ibers, Baldeschieler; back, Suttmeier, Bigeleisen, Breslow, Geyer.



West Lake showing Bai Causeway, Hangchow, June 4, 1978.

We now enter a cruise boat, ride a short distance to an island. There is a lake within this small island full of water lilies.

Many Chinese people are here, and elsewhere on our tour, taking pictures with their Chinese-made cameras. (The two brands of Chinese-made cameras are called Sea Gull and Great Wall.) We see a fair number of the girls and children wearing colorful clothes here, more than in Peking.

We walk across to the other side of the island, find our boat has been brought around to meet us there. We board the boat, which now takes us across almost the entire length of West Lake. West Lake has a circumference of 15 kilometers. It is only 1.8 meters deep on the average. We arrive back at our hotel at about 11 a.m., immediately board our bus to ride to downtown Hangchow to do some meandering and shopping. The streets are crowded with bicycles, a few buses, essentially no trucks, so people walk on the streets as well as on the sidewalks. We visit the Hang Zhou - Fu Zhuang Dian Department Store, also another department store. I try to buy a Mao jacket, but they cannot find one to fit me. We divide into a number of groups - I walk with Shih Wei-ming, Shih Liang-ho, Ms. Hu Feng-hsien, Ma An-tung and Dick Stein. We visit a number of other shops, meet Bigeleisen at a shop where he purchases a pot suitable for bonzai plants, which will be difficult to carry home.

We return to our bus at the appointed time, 11:40 a.m., find we have to wait for Schriesheim, Suttmeier and Baldeschwieler. We ride back to our hotel, where we arrive about noon. We use this opportunity to have some pictures taken of our entire twelve-member Delegation in the area in front of the Hsi'ling Guest House.

The members of our Delegation soon go down to the dining room on the second floor to have our lunch. Toward the end of the meal I rise, take note of the fact that "Comrade Ronald Breslow" will leave us tomorrow, say that he is the member of our delegation who has been most converted to Chinese customs (such as wearing a Chairman Mao jacket), present him, therefore, in the name of the American members of our delegation, with an ACS Centennial T-shirt (as I have to many of our Chinese hosts).

We all assemble in the lobby after lunch, have our picture taken as a twelve-member delegation, with Bigeleisen's camera, in front of a huge wall painting of the mountainous Weng Chou area of southern Chekiang Province. We are taking a number of pictures of our entire delegation, prior to Breslow's leaving, in order to insure having at least one satisfactory result.

This afternoon all of us, except Jimmie Wei, who is scheduled to give two lectures at Chekiang University, will be taken on a sightseeing tour of "scenic spots."

At 2 p.m. we assemble in the lobby, then board our bus for our afternoon tour. This afternoon Chang and Ma serve as our local host guides. Our first stop is at the Hwa Pu Nursery for Plants, Trees and Flowers. Here we see numerous small trees (some 30 to 40 years old) in bonzai pots and rock formations. We wander through a number of corridors. At one place there is a line up of windows in the corridors so we can look in a straight line through a total of seven of them. We meander through acres of grounds with many kinds of plants, including hundreds of the old small trees. We also visit some nurseries.

We then board our bus again, ride to Tiger Spring. We drive along roads lined with dense growths of trees on each side. Upon arrival we view the spring awhile. The Tiger Spring is more than 1,000 years old. We then go on to a reception area to have some tea, made from Dragon Wheel Tea, from the nearby Dragon Wheel area, and Tiger Spring water; this is reputed to be the best tea combination available in The People's Republic of China. The tea has a high mineral content, and a girl pours some into a little bowl until it is completely full, then adds some coins until it bulges at the top, made possible by the large surface tension. I give Lawrence Hall of Science bimetallic elements to Chang, Ch'ien, Ma, Ms. Hu and we all have fun watching them jump. Lee tries them on the top of the bulging bowl of tea but they only pop, do not jump. (I also give, as a souvenir, a Kennedy half dollar to Ma, who has been very helpful and whom I like very much.)

There is a large stuffed tiger at Tiger Spring and many Chinese children have their picture taken standing next to the tiger.

We go back to our bus, ride to the Liuhe (Lui Ho) Pagoda (Pagoda of Six Harmonies). This is 900 years old (twice repaired since Liberation), 13 stories or 60 meters high. I climb to the top accompanied by Ch'ien and Chang. Some of the others also make this climb. From here we have a fine view of the Ch'ien T'ang River and the long bridge across it (a train is crossing at this moment) built in 1935, the first large bridge to be built by Chinese engineers. Also in sight, behind the bridge, is the southern part of Hangchow city. Walking around the circular path for observation of 360° of the surrounding area I note excellent hiking trails leading up to the top of rather good-sized hills (or small mountains).

We then go back down the staircases to the ground. In order to get a good vantage point for photographing the Pagoda Suttmeier, Chang, Ch'ien and I climb a hill on the sunny side of the Pagoda.

We all return to our bus, which brings us back near our hotel where a number of our delegation disembark. We pass Chekiang University on the way.

Suttmeier, Stein, Baldeschieler, Breslow, Ch'ien, Chang, Ma, Ms. Hu Feng-hsien, Shih Wei-ming, Shih Liang-ho and I continue

on the bus to the Yellow Dragon Cave area. Near here we see fields of tea and other crops. Baldeschwieler, Breslow and Shih Liang-ho visit the crop fields while the rest of us walk up the short distance to the Yellow Dragon Caves. The Yellow Dragon Cave we see is no more than a cave room of some ten-foot radius now. This is a former area of Taoist worship.

We see here some rare violet bamboo and back near the entrance to the area some larger green bamboo. The bamboo crop is on a two-to-three year cycle. Breslow joins us and also visits the Yellow Dragon Cave area.

We return to our bus, ride back to our hotel, arrive at about 5:15 p.m. We assemble in front of the hotel, ride our bus to the Hangchow Railway Station. Chang, Yang, Ma and Chou accompany us to see us off.

The train leaves at 6:30 p.m., on schedule, to the sound of special music emanating from the station. It is a double decker and we have seats on the upper level. We sit two by two facing each other across little tables in a coach. We eat the box lunches for dinner that were furnished by our hotel and which we brought aboard.

Breslow is wearing his ACS Centennial T-shirt.

The girls across the aisle from us are part of a 56 member contingent from Australia who are in China to study its social structure.

As the train rolls over the flat plains, we see many people out working in the fields at this time of day — dusk. The frequency of houses is not far different from that to be found on the plains of Nebraska; but the style of the houses is, of course, different. Many of the houses have a stucco-like construction. Many are of moderately large size but they may be multiple units. There are many waterways (canals or irrigation ditches). Prominent, of course, are the water-flooded rice fields.

Baldeschwieler, Wei and I have a session with Breslow to go over with him some of his sections for our report because this is the last opportunity we will have to discuss this with him before he leaves us.

I sit a long while with Ch'ien, Ms. Hu and Shih Liang-ho to talk and get better acquainted. We make a number of comparisons between life in the United States and The People's Republic of China.

The train arrives in Shanghai Railway Station at 9:41 p.m., on time. We are met by Ms. Hsu Chen-o, Liu Tse-Wei, and Tai Li-hsin. I ride to our hotel (Ch'in-chiang Hotel) with Ch'ien Jen-yuan and Liu Tse-Wei. Soon after going up to my room Ms. Hsu

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and Ms. Hu come by to show what Ms. Hsu has purchased for me during my absence in Hangchow — some Chinese neckties, handkerchiefs, Mao buttons and another gray Mao-like coat for Helen.

I settle my accounts with Ms. Hsu because I have not left her with quite enough money.

I retire a little after 11 p.m.

Monday, June 5, 1978 - Shanghai

I arise at a little after 6:30 a.m.

This morning Geyer and I are scheduled to have a discussion on Chemical Education at Shanghai Normal University. Bigeleisen and Stein will give talks at the Shanghai Science and Technology Center; Ibers and Breslow will give talks at the Institute of Organic Chemistry; Larson will visit the Shanghai Institute of Chemical Engineering; Wei, Schriesheim and Suttmeier the General Petroleum Works of Shanghai.

Baldeschwieler and Lee were scheduled to visit the Institute of Optics but we have learned this cannot be arranged. Alternatively, three people from other institutes will come to the hotel to discuss theoretical chemistry with Lee, and Baldeschwieler will stay in his room to work on our report and then do some meandering around town. This afternoon Baldeschwieler and I will visit the Institute of Ceramic Chemistry and Technology, Larson the Shanghai Water Works, while the others except Breslow will visit a Workers' New Village. Breslow will leave the Shanghai Airport for Peking at 1:20 p.m.

I go up to the restaurant on the eleventh floor at 7:30 a.m. for breakfast with our delegation. This morning everybody eats "Western style" (use of the words "American style" is frowned upon) because no Chinese breakfasts were ordered last night. Bigeleisen tells me he reached his wife Grace by phone this morning, learned she has sold their house in Rochester and purchased one at Stony Brook, New York, preparatory to Jake's assuming the position of Dean of the Graduate School and Vice President for Research at Stony Brook University this fall. He has a little hoarseness this morning.

Baldeschwieler, Ch'ien and I confer on our schedule for our visits to Sian and Lanchow.

A little after 8:30 a.m. Geyer and I, with Tai Li-hsin, ride to the western part of Shanghai to the Shanghai Normal University. We encounter a good deal of air pollution out here. We arrive at about 8:50 a.m., drive through a beautiful campus. We are met in front of the Administration Building by Hsia Jan (Deputy Chairman, Academic Affairs Committee of the University and Professor in the Department of Chemistry), Ku K'o-ch'uan (Professor of Organic Chemistry), P'an Tao-ch'ian (Associate Professor of Chemistry), Wu Hsing-jan (Lecturer, Department of Chemistry), Yang Wei-ta (Lecturer, Department of Chemistry), Fan Chieh (Teaching Assistant, Department of Chemistry), Ch'en Liang (Teaching Assistant, Department of Chemistry), Hsu Po-lung (Teaching Assistant, Department of Chemistry).

We have our picture taken with some of the group that greets us. We go to a reception room on the second floor, furnished



Shanghai Normal University, June 5, 1978. Geyer and Seaborg with hosts Hsia Jan (Deputy Chairman, Academic Affairs Committee of the University and Professor of Chemistry), to left of Seaborg, Ku Ko-ch'uan (Professor of Organic Chemistry), P'an Tao-ch'ian (Associate Professor of Chemistry), Chou Nai-fu (Associate Professor of Chemistry), Wu Hsing-jan (Lecturer, Department of Chemistry), Yang Wei-ta (Lecturer, Department of Chemistry), Fan Chieh (Teaching Assistant, Department of Chemistry), Ch'en Liang (Teaching Assistant, Department of Chemistry).

rather elegantly with leather-covered chairs and sofas. Here Hsia extends greetings, tells us we are going to join with members from other Shanghai institutions for a discussion meeting after a short tour of the campus.

We go outside, walk over a bridge spanning the campus's river, head for the complex of science buildings.

We look at the several large science buildings, then visit the Chemistry Building, a large building of nearly 6,000 square meters of floor space. I look in on a class in analytical chemistry where a woman is lecturing at the blackboard. We look in on a gas chromatography laboratory (all Chinese-made equipment), a student organic chemistry laboratory (much like our undergraduate teaching laboratories), an x-ray diffraction laboratory.

We then visit the Chemistry Department library — the student and the faculty reading rooms, and the stacks. (Each department has a library — this is in addition to a main library.) Here I see some of the list of journals they stock (*Journal of the American Chemical Society*, *Journal of Chemical Education*, *Journal of Inorganic and Nuclear Chemistry*, *Journal of Physical Chemistry*, *Journal of Organic Chemistry*, *Journal of Organometallic Chemistry*, to name a few). They have 140 chemistry journals, 5,000 foreign language books. (The main library has more than 1,000 journals.) They have Chemical Abstracts from Volume 1, Number 1, 1907. They received the early copies of this as part of their heritage from St. John's University (formerly a U.S. Episcopalian missionary school before Liberation) when Shanghai Normal University was formed by the amalgamation of all or parts of several universities following Liberation.

We go outside again, find the students in their mid-morning (twenty-minute) recess during which they are performing calisthenics.

The Shanghai Normal University has schools of the kindergarten, elementary and middle school levels associated with it — the best middle school in Shanghai they tell us.

We now go to a second floor reception room for our discussion. The visitors from other institutions clap as we and our hosts enter.

Included in the discussion are people from the Shanghai Institute of Chemical Engineering, Fudan University, Shanghai Teachers' Institute (a two-year college), and the members of the Chemistry Department here — about 25 in all.

These visitors from these institutions are as follows. From the Shanghai Institute of Chemical Engineering: Li Kuo-chen (Associate Professor), Lu Ching-hua (Associate Professor), Ch'eng Chen-ta (Teaching Assistant). From the Department of Chemistry of Fudan University: Wu Hao-ch'ing (Professor), Teng Ching-fa (Asso-

ciate Professor), Hsu Ho-kung (Associate Professor), T'ao Tseng-yu (Lecturer), Hsieh Kao-yang (Lecturer), and Teaching Assistants Chin Jo-shui, Cheng Ch'eng-fa, Li Ch'i-tung, Yeh Ming-lu, Chu Po-ch'ing. From the Department of Chemistry, Shanghai Teachers Institute: Wu Ti-sheng (Lecturer), Ch'iu Hsian-hsin (Teaching Assistant), Ts'ao Chin-jung (Teaching Assistant).

Hsia Jan briefs us on the history of the university. It was founded in 1951, as an amalgamation of several universities. There are ten departments: (1) Chinese, (2) foreign languages, (3) history, (4) pedagogy, (5) political education, (5) mathematics, (7) physics, (8) chemistry, (9) biology, and (10) geography.

Due to sabotage by the "Gang of Four" they now have only three years for students, about 4,000 students (50% men, 50% women). Soon they will go to four years, 5,000 students. They have about 1,100 teachers. There are about 100 postgraduate students that have a three-year curriculum, teach at a higher level or go to research institutes when they finish.

Shanghai uses TV in teaching. The University prepares programs for the Shanghai TV station, which reaches about 2,000 students in teaching via TV.

They have some research units (institutes): (1) estuary and coastal, (2) foreign education, and (3) world history. They will increase the number of research institutes in order to develop science and technology. They have high schools and primary schools attached to the university. All students go to the middle school for six weeks of teaching practice.

Now we go into a question and answer session. A summary of my questions and their answers follows: "How are students admitted?" Before the downfall of the "Gang of Four" there was no entrance examination. The first entrance examination took place in February-March, on a national basis, almost at the same time. In the future the examination will take place in the summer. It is a unified examination nationally — no individual examinations are given. The students specify choices of universities and subjects. "Can a student flunk out?" The answer is generally no, but it can happen due to bad attitude or behavior. I explain the system generally used in the United States for dropping students. "Do you have a grading system?" They have a grading system of one to five, with five the highest grade. Below three is failure, three and above is passing. If the student fails, he repeats the course. "What do most of your students do when they finish school?" Most of the graduates will be middle school teachers, but some will teach basic courses at universities. "How does the curriculum of a chemistry teacher differ from that of, for example, a history teacher?" Students of social and natural sciences share courses such as politics, foreign languages, physical education, pedagogy and teaching practice. As to the specialty, they have a curriculum, for example, in chemistry such as inorganic (freshman year), organic

(second year), analytical (second year), physical (third year), structural (first half of fourth year). In their fourth year they do a special research project and write a report, taking about 18 weeks. In addition the chemistry students study physics and mathematics the first year. In the fourth year they have chemical engineering. "How are the students placed when they graduate?" There is a unified assignment plan from the Planning Committee of the Ministry of Education which is transmitted to the Education Department of Shanghai city to make the assignments. The assignment plan specifies only the numbers. The assignment of individuals is made by a special committee of the university, to whom the faculty of the Chemistry Department offers opinions after discussion with the individual students within the department. The chemistry department offers a single overall recommendation involving all the students to be assigned. The student discussions are held in a group.

I now call for questions from my hosts. Hsia asks about the reform of chemistry teaching in the U.S. high schools in the early 1960's — the Chem Study and Chemical Bond approaches. I explain the history and result of these undertakings. They are now translating the third edition of Chem Study into Chinese — the textbook, laboratory manual, teacher manual. They have no Chem Study films so I say I will try to send them a set of films.

I am asked about the chemistry curricula at U.S. universities. I describe the diversity of the 2,000 to 3,000 U.S. colleges and universities, then describe the situation at Berkeley in some detail.

Hsia asks me about textbooks in organic chemistry that are getting thicker and thicker — is this a problem. I think so but have no first-hand knowledge. In the use of 1,000-page-textbooks, are choices made to lessen the burden? I indicate that choices of material are usually made.

"What is the content of the physical chemistry course?" I describe some of the content at Berkeley, say much of the content is also covered in more detail in other courses.

"What are the basic course requirements for a chemistry major?" I describe the situation at Berkeley, including G. N. Lewis' system of full professors teaching freshman laboratory sections, and describe my role as an advisor to a freshman chemistry Cluster Group.

"How many units are taken up by undergraduate research work?" Can be zero, go up to ten or twenty, out of a total of 180. "How many credits are in physics and mathematics courses?" I say something like 30 or 40. "Do students that take quantum chemistry also take mathematics?" My answer is yes.

"Is there summer school in the U.S.?" Yes, almost universally. "What is the relationship between the lecture course and

the accompanying laboratory course?" Often each is handled by a different professor. "What is the role of descriptive chemistry in the first year?" At Berkeley almost zero, if this means description of manufacturing processes. However, there is some description of the properties of the chemical elements, etc.

"Once Pauling said physical chemistry will be covered in freshman chemistry — is this true and, if so, what is the content of physical chemistry?" I say this is true compared to the days when I attended UCLA, describe again the content of Berkeley's freshman and physical chemistry courses.

"What is the curriculum of nuclear chemistry undergraduate majors?" I describe the situation at Berkeley as an example. "In using the Mahan textbook in freshman chemistry can the student cope?" I again describe the use of Mahan's two freshman textbooks, which are graded to different levels. "What is the role of qualitative analysis courses?" I describe the situation at Berkeley — the major part of one quarter in the freshman course.

I then ask a question again, "What is the relative role of pedagogy compared to subject matter?" Here the students take less than 10% pedagogical courses, not including the six weeks of teaching practice.

"Is the freshman laboratory closely related to the lecture?" I say not at Berkeley. "Does the emphasis in the laboratory lie on principle or technique?" Principle, at Berkeley. "How many hours of high school chemistry are taught in the U.S. per week and how many years?" I answer two to three lectures per week plus laboratory, usually one year, sometimes two years, one or two places three years.

I ask what is the length of the school day at this university. There are seven teaching periods per day, four in the morning and three in the afternoon, each period fifty minutes, six days per week.

We bring the session to a close at about 11:15 a.m. Hsia Jan expresses his appreciation, suggests expansion of the U.S.-China Exchange Agreement. I present Hsia with two copies each of the ACS Centennial and Joseph Priestley Centennial first day covers, say I will give Tai Li-hsin two of my small books for their chemistry library (*Man-Made Transuranium Elements* and Part I of *Nuclear Milestones*).

We go down to the front of the building, say good-bye to our hosts, then Geyer, Tai and I ride back to our hotel. Here I give Tai autographed copies of *Man-Made Transuranium Elements* and *Nuclear Milestones*, Part I, to give to Hsia Jan.

I then go to Huai Hai Street with Ms. Hu Feng-hsien and Yuan Lee to do some shopping. I buy a gray Mao jacket for myself

and some Mao caps, have some difficulty finding sufficiently large sizes.

We then return to our hotel. I go immediately to the restaurant on the eleventh floor to join our delegation for lunch. Wei, Suttmeier and Schriesheim do not return from their visit to the Shanghai Petroleum Works, may be having their lunch there.

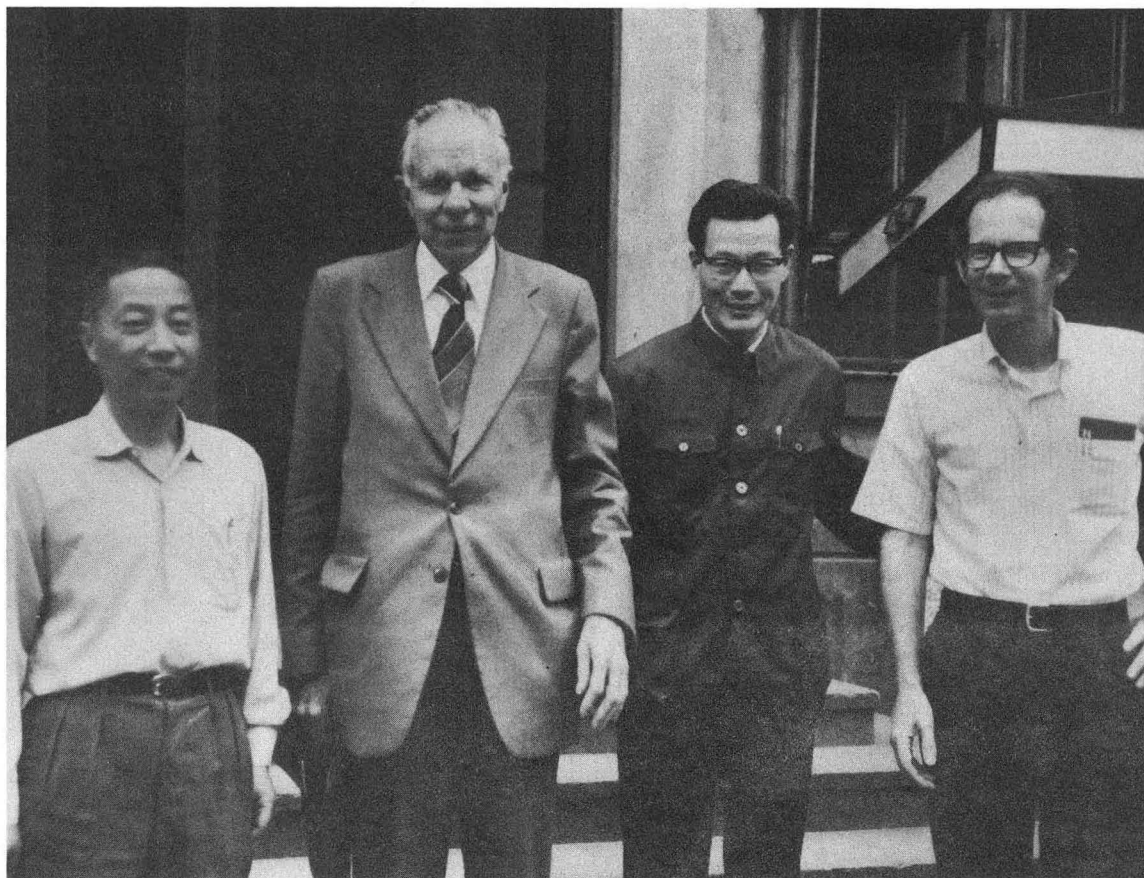
I go down to the lobby at about 2 p.m., meet Baldeschwieler and Ch'ien Jen-yuan, ride with them to the Institute of Ceramic Chemistry and Technology. Ch'ien tells us the work of this Institute has expanded to encompass work on ceramics in general. We pass the Shanghai Industrial Exhibition building en route. We pass a rally-type meeting which Ch'ien tells us is for the purpose of explaining the new constitution to the people.

We are again heading toward the western part of the city. We arrive at the Institute at about 2:15 p.m. and are met by Yen Tung-sheng (Director of the Institute of Ceramic Chemistry and Technology and Vice President of the Shanghai Branch of the Chinese Academy of Sciences), and Yu Shen-ching. The Institute of Metallurgy is located on the same grounds.

We go up to a second floor reception room in this main (or new) building. Here we meet Ying Chih-wen, Li Chin-chih and Wen Shu-lin. Yen briefs us on the Institute of Ceramic Chemistry and Technology. It was formerly a branch of the Institute of Metallurgy and Ceramics, became separated in 1960, along with the Institute of Metallurgy (a split into two institutes). Then it had only one department, a few dozen personnel. Now they have almost 900 personnel, 500 in the laboratory, 250 workers in machine shops and pilot plants, 100 administrative personnel.

The main fields of investigation (departments) are: (1) crystal growth [including synthesis of diamonds], (2) special glasses [including chalcogenic systems and glass ceramics or crystallized glasses, pioneered by Dr. S. D. Stookey of Corning Glass], (3) electronic ceramics [including ferro-electric and piezo-electric ceramic materials, such as transparent polycrystalline ferro-electric materials], (4) high-temperature ceramics [including oxides, nitrides, carbides], (5) ion conducting ceramics [including beta alumina, doped zirconium dioxide, and mainly sodium conducting ceramics], (6) chemical and structural analyses [using emission and atomic absorption analysis, x-ray fluorescence analysis, x-ray and electron microscopy, and new analytical methods], (7) design [with follow-up building of apparatus in their workshops]. They use rare earths as additives or doping agents; for example, in electronic ceramics.

They develop products for a number of industries, such as electronic and laser industries. They are starting to work on the fundamental aspects of optical fibers. This would relate to, for example, the Ministry of Postal and Telephone Communications. As



Institute of Ceramic Chemistry and Technology, Shanghai,
June 5, 1978. From left to right: Ch'ien Jen-yuan
(Institute of Chemistry, Peking), Seaborg, Yen Tung-sheng
(Director), Baldeschwieler.

another example, responsibility for laser work does not yet reside with any one particular Ministry.

Yen did his graduate work at the University of Illinois, 1946-1950, got his Ph.D. in 1949, then had a year of postdoctoral work. He compares his institute with the laboratories that do research on materials in the U.S., as at Berkeley. They are starting to have graduate students again this fall; Wen Shu-lin was one of his last graduate students, in 1963. They have not yet selected their graduate students. The national examination has been held, and they have preliminarily selected about 16 or 18 that passed this national (preliminary) examination out of a total of 100 applicants. This Institute will then give its own examination at the end of June and on the basis of that will select perhaps half of the 16 to 18. The applicants make three choices of institutions that they wish to attend in order of priority. The age limit has been extended to 35 for this next year or two, but in a few years most of the applicants will be in the 23 to 24 age group.

The briefing ends at about 3 p.m.

We first go to a neighboring building where in a first floor laboratory Chu Ping-ho shows us work on ferro-electric materials and some samples of materials. As an example there is the product from the low-temperature decomposition of $Zr(OH)_4$. Another example is a solid solution $Pb_{0.9}La_{0.1}Zr_{0.7}Ti_{0.4}O_3 (M_2O_3)$. Another example is substances with an excess of oxygen to displace the nitrogen in the interstices to produce a transparent product.

In a room across the hall we see a demonstration of the birefringence of such material, induced electrically. This is shown to us by Ms. Ting Hui-li, a very attractive girl. She is anxious to have our reaction to her work, which is favorable.

We go next to a laboratory across the hall, a laboratory on crystal growth, where Chin Chi-jen shows us work on the production of lithium niobate, pure and doped. He shows us some examples. We see a large clear single crystal, a single crystal doped with iron and one doped with rhodium. When exposed to laser light, images are stored that can be subsequently read out with other laser light. Such crystals can be used as electronic filters. We also see an acoustic-optic crystal, lead molybdate.

Next we go down the hall to see a ceramic laboratory and some specimens. Here Hseuh Wen-lung describes work on silicon nitrides. One method of production is by reaction sintering, the other by hot pressing. The reaction sintering method has some advantages. Industrial silicon is used as raw material (98-99% purity). It is pulverized to 2-3 micron size. The silicon is put into forms and nitrogen is introduced at high temperatures. The silicon nitrides have anti-corrosion properties that make them useful components in various kinds of machinery such as pumps for acids and bases. They are not wet by non-ferrous metals.

We go upstairs to a laboratory where the physical properties of their crystals are studied. One property measured is acoustic-optic properties of lead molybdate in the example shown us. They measure the diffraction of a laser beam as part of this measurement. They use a Chinese-made (Shanghai) laser apparatus. This is shown us by T'an Hao-jan who also shows us a laser apparatus (using Nd-YAG [neodymium-Yttrium Aluminum Garnet]) that gives the frequency doubling effect; this uses a laser of 1.06 microns wavelength which goes to 0.53 microns with an efficiency of some 10-20%. Here we also see a vacuum evaporator used to put anti-refraction coatings of MgF_2 on crystals such as lead molybdate.

We go to a neighboring laboratory where Wu Chung-jen describes the work on non-crystalline amorphous semi-conducting materials. They work on chalcogenides. There are a number of important aspects: (1) glass formation, (2) study of thin film effects, (3) study of optical-electrical property changes, (4) study of possible applications of these materials.

They are, in effect, studying the electrical and optical storage properties of the chalcogenides. These may have applications to RMM (Read Mostly Memories). They show us an example of transfer of memory information onto a silicon wafer. They get contrasts of four orders of magnitude.

Now we go back to the first building to a second floor laboratory where Kuo Ch'ang-lin shows us an x-ray diffraction apparatus (made in northeast China). This employs detection with a Geiger counter. We also see a Lang camera, and a 30 KW rotating (1,200 rpm) anode x-ray diffraction apparatus, using detection with NaI(Tl) scintillation counting (a Japanese-made apparatus). This is used cooperatively with the Institute of Physiology of the Chinese Academy of Sciences. The high power speeds up the scan period for a diffraction peak to one minute (or a few seconds using TV).

We go upstairs where Yen Tung-sheng demonstrates for us the optical storage effect of chalcogenides using a double laser system. An argon CW (home-made) laser picks up the message "Chinese people are great. American people are great;" and this is then read with a helium-neon laser.

Across the hall, Li Chia-chih and Ch'en Hsian-chiu show us work on old (700-year-old Yuan Dynasty) porcelain. The piece of porcelain they are working with, and which they show us, is worth 50,000 yuan. There are only about ten such pieces of porcelain extant today. We see electron microscope and optical interference microscope pictures of this material. They aim to determine the phases present in this precious porcelain.

We finish our tour a little after 5 p.m., go back to the reception room for a wind-up session. Baldeschieler and I say we think we have seen a good research program here. We acknowledge

our lack of expertise in this field, but say we have the feeling they are working at the leading edge of their area. Yen protests that this is not the case.

I invite them to visit us in the United States, say that things are much better there now since our "Gang of Four" has been overthrown; this, of course, evokes much merriment.

As we take our leave, I present Yen with an ACS Centennial and a Priestley Centennial First Day cover. We take our leave at about 5:30 p.m.

Baldeschwieler and I agree that the Institute of Ceramic Chemistry and Technology is a first-class place and agree that we are very favorably impressed by Yen Tung-sheng. He is very personable as well as knowledgeable. His institute is very well equipped. He must be a person of considerable influence in The People's Republic of China.

Baldeschwieler, Ch'ien Jen-yuan and I ride back to our hotel, arrive at about 5:45 p.m.

I soon join our delegation for dinner at the restaurant on the eleventh floor. We compare notes on our day's activities, decide we have had an unusually good day. Wei, Schriesheim and Suttmeier had lunch at the faraway General Petrochemical Works and stayed on a couple of hours after lunch for discussion. This plant is devoted to the production of a wide variety of petrochemicals (no gasoline) and they are very impressed with it. Larson is pleased with his visit to the Shanghai Water Works and Ibers with his visit to the Computer Center. Lee, Stein, Bigeleisen and Geyer enjoyed their visit to the Workers' New Village where they saw a cute group of nursery children perform skits and sing, with the theme of "down with the Gang of Four."

Since it was not possible to get me a ticket to see the Acrobatic Show again tonight (to enable me to take movies of it), I go to a movie at the hotel movie auditorium across the way with Lee, Shih, Shih, Ms. Hsu and Tai. Here I meet the Treves family (he was an assistant professor at Berkeley, 1958-59, when I was serving as Chancellor).

The movie theatre has a wide screen. The program begins with a short on "Wild Animals in the Province of Yunan." The main feature, "Chu Yuan," filmed in excellent color and with a huge cast, concerns struggles among the Chi, Ch'u and Ch'in states of China in the third century B.C., in which Prince Chu Yuan (author of the famous poems Li Sau and Tien Wen) tries to help the oppressed people of Ch'u (Hunan). It is essentially a tragedy from the point of view of the state of Ch'u. Emperor Ch'in-shih-huang of Ch'in (Shensi) takes over Ch'u (Hunan) and Chi (Shangtung) and four other states to unite China for the first time. Finally there is another short on the history of pandas in China. The program lasts from 7 p.m. until nearly 10 p.m.

We learn, near the end, that some faculty members from Fudan University are here, having been waiting since 7 p.m. to have discussions with Yuan Lee; Yuan did not receive the message. He agrees to talk with them awhile despite the late hour.

I return to my room and retire around 10:30 p.m.

Tuesday, June 6, 1978 - Shanghai; Sian

Today is our 36th wedding anniversary!

I arise at about 5:30 a.m., finish packing my bags, soon go up to the eleventh floor to join the members of our delegation for breakfast. Larson tells me that he suffered from a rather severe stomach upset last night. I think this is the first occurrence of this type for any member of our delegation. He feels fine this morning. Bigeleisen also tells me he is getting over his hoarseness.

Today we travel to Sian, capital of China during eleven dynasties, with a history of more than 3,000 years, and now an archeological area of great interest.

We assemble in the lobby at about 6:45 a.m. preparatory to our departure for the Shanghai (Hongchow) Airport. Our local hosts here to see us off are Huang Wei-yuan, Ms. Hsu Chen-o, Tai Li-hsin, Liang Wen-hua, Chiang Hsi-k'ui. As tokens of my appreciation for all their help, I present Ms. Hsu with a Lawrence Hall of Science Sunprint Kit, Tai with an ACS Centennial T-shirt, Chiang with an ACS Centennial deck of playing cards, Liang with an ACS Centennial deck of playing cards and a Kennedy half dollar.

I ride in the first car with Huang and Ch'ien Jen-yuan, which gives me the opportunity to present Huang with an ACS Centennial First Day Cover and a Priestley Centennial First Day Cover. I also use this occasion to present my driver, Yen Fu-gan, with a Kennedy half dollar and a couple of LHS bimetallic elements.

Our caravan of cars arrives at the airport at about 7:15 a.m. Our hosts check our baggage and we go to the large central waiting room to converse with our hosts until departure time.

We say good-bye to our hosts; our traveling group of fifteen boards the plane, China Airlines flight no. 527, and the plane (a British Trident jet) departs on time at 7:45 a.m. We sit three abreast in seats on each side of the aisle, each receiving a fan from the hostess. The trip is uneventful. We make a stop at Chengchow in Honan Province, where we arrive at about 9:10 a.m. Here we get off the plane, spend the time in the waiting room of the airport building. We see a number of small jet military planes lined up at each end of the airport.

We return to our airplane which takes off again at about 9:50 a.m. Below I see flat plains, dotted with farms, several lakes, and this soon gives way to rolling hills. As we approach Sian I see plains again.

Sian (Xian) lies on the south bank of the Wei He River. It is here that Huang Chao and Li Tzu-cheng, famous leaders of peasant revolutions in Chinese history, established their regimes.

Here we shall probably visit Northwestern University.

We fly over the city to arrive at the airport on the west side at about 11 a.m. We are met by Ch'in K'o-chia (Chief, Administrative Office, Science and Technology Committee, Shensi Province), Ch'en Yun-sheng (Deputy Chairman, Department of Chemistry, Northwestern University), Liu Kan-lieh (Deputy Chairman, Department of Chemical Engineering, Northwestern University), Han Jui-min (Secretary, Administrative Office, Science and Technology Committee, Shensi Province), Yang Ming (Staff, Administrative Office, Science and Technology Committee, Shensi Province), Ch'eng Yan-ju (Division of Foreign Affairs, Shensi Province).

We ride in a caravan of six Shanghai cars to the People's Hotel, I in the first car with Ch'in K'o-chia and Shih Liang-ho. The weather is warm, perhaps hot, much like a typical midwestern U.S. city in June. We pass many dwellings of stucco-like construction. As we drive into the city the bicycle traffic becomes very heavy. There are a few buses, very few trucks, no passenger cars other than those conveying us.

We come into Sian and drive along Liberation Road, wide and spacious, turn into People's Road and soon reach the People's Hotel. The hotel has facing wings five to six stories high, a kind of auditorium building at one end, with a large garden area in the center.

We go up to our assigned rooms on the third floor. I am in room 308, a large room with a large double bed, immense writing desk, China closet with a tin of green tea, tea cups and thermos bottle, dresser, portable clothes closet, an air-conditioning unit, and a bathroom with an overhead shower above the bath tub.

Our hosts tell us we are scheduled to visit the archeological site, about 35 kilometers out of town, this afternoon. The site is not yet open to the public. This excavation covers the period of the Ch'in Dynasty. Here we will see the recently opened 2,000-year-old memorial to Emperor Ch'in-shih-huang. Tomorrow morning we will visit Northwestern University.

Our Delegation soon goes up to the fourth floor to the restaurant. Jimmie Wei tells us his ancestors (with the name of Wei already at that time) lived in Sian 900 years ago at the time of the Sung Dynasty.

The restaurant has many tourists representing a number of countries, including Japan.

We go back to our rooms for a while. It is now rather hot and we do not venture out. At 1:30 p.m. we gather in a reception room on the third floor, where the traditional green tea is served and we are given the traditional briefing on the area we are visiting.

Ch'in briefs us on Sian. Sian is located in the center of a plain, is the capital of Shensi Province. The city has a population of 2,500,000. It has a history of 3,000 years, was known as Chang An in ancient times. Since 1126 B.C. this city has been the capital for many emperors (until the Yuan Dynasty, 1280 A.D.).

The city was liberated in 1949. Before Liberation it was a consumer city, and it was a backward city. After Liberation great changes took place. Now it is known for its machinery and textile industries. The residence area has increased five times since Liberation. The number of buses has increased 18.5-fold. Before Liberation there were only two schools and a total of 60,000 students. Now there are fifteen universities, 166 middle schools, 551 primary schools. The number of students has increased 7.5-fold.

There are numerous areas of great historical interest. Han Jui-min then describes the schedule for our visit. This afternoon we will visit the Hua Ch'ing-tzu Hot Springs and the tomb of Ch'in-shih-huang (in the area featured in *National Geographic Magazine*). This evening the head of the Committee on Science and Technology of Shensi Province will give us a banquet. Tomorrow we will visit Northwestern University. I express appreciation to Ch'in for the welcome and briefing.

We then suggest that our schedule be modified to allow for a visit to the Shensi Province Museum in Sian and they say they will look into it.

We learn to our dismay that we will not be permitted to take photographs at the excavation site we are about to visit.

Our fifteen-member group starts out at about 2 p.m. in our caravan of six cars. (These are usually gray in color but here one of them is blue.) We are accompanied by the local hosts who met us upon our arrival. I ride in the first car with Ch'in K'ochia and Shih Liang-ho. As we drive through the center of Sian, and also further along, I see many people wearing bright colored blouses and shirts.

We drive toward the east to reach our destination. The dwellings along our route are built of brick and clay or adobe (much as in the southwestern part of the U.S.). We soon cross the Ba River, very wide and almost dry. The land we drive through is very flat. I see some large mounds where people have dug caves in places to retreat from the hot sun and also some homes are apparently in these mounds. Near here also there is a labyrinth of clay dwellings. Many people are out working in the fields despite the heat.

We arrive at the Hua Ch'ing-tzu Hot Springs at 2:45 p.m., a total distance of 30 kilometers. We go into a large ornate reception room, are served tea in ordinary tea cups (not the covered kind). We are briefed on the Hot Springs and its history. They

were developed 3,000 years ago. The emperor Ch'in-shih-huang took his baths here and met his wife here. Sian is famous for its revolutionaries. The "Sian Incident" took place on December 12, 1936, when Chiang Kai-shek was captured here. Two generals wanted to resist the Japanese invasion and to cooperate with the Chinese Communist Party. Chiang Kai-shek refused this request, therefore the two generals turned on him and captured him here. Chou En-lai then came here to talk to the two generals. On December 24, Chiang Kai-shek accepted the program to resist the Japanese, and he was released to cooperate with the Communist Party.

We will visit (1) the place where Empress Yang Kwei-fei took baths (time of Tang Dynasty, 618-907 A.D.), (2) the origin of the Hot Springs, and (3) the place Chiang Kai-shek lived at the time of the "Sian Incident."

Following our briefing we go out on the grounds which have a pond and numerous buildings. Looking on the hillside we see the place where Chiang Kai-shek was captured.

We walk on to the building housing the Queen's bath where we see the bath she used. We look at the nearby source of the Hot Springs water, which gushes forth at a volume of 25 tons per hour at a temperature of 43°C.

We then go on to view the room (containing the bed and table) where Chiang Kai-shek was living in December 1936 when he suddenly heard the two generals and soldiers coming and fled up the hill behind, leaving one shoe and his false teeth behind; he was immediately captured by his pursuers.

At this point Baldeschwieler, Ibers, Suttmeier and I, together with our host Ch'in and others, as well as Shih Wei-ming and Shih Liang-ho, decide to climb up to the point on the hill where Chiang Kai-shek was captured. (Most of the other members of our delegation use this time to take a bath in the Hot Springs.) Suttmeier and Baldeschwieler try to climb higher up the rocky trail than the point of capture, but are asked to desist.

Having finished our visit here we go back to the reception hall a while. We are joined by a guide who will accompany us to the excavation site, Chen Fon-au, who rides with Ch'in and me the six to seven kilometers on to the site. On the way we pass the unexcavated tomb of Ch'in-shih-huang, the first emperor of the Ch'in Dynasty and the first to unite the seven warring states into a unified China. When we arrive at the site of the excavation, we are met by Yang Tzun-ching, Chief of the Museum (i.e., chief of the excavation site). This is the place where Ch'in-shih-huang had 720,000 people work for more than ten years to build the large memorial to himself that is now being excavated.

We go to the reception room and Yang briefs us on the excavation. The memorial (or tomb as it is called) was discovered

in March 1974, by commune members who were drilling a well. (There used to be walls around the tomb, the outer wall having a total length of 6,000 meters.) The well drillers discovered a pit full of statues. Subsequent exploration led to the discovery of three such places.

They are now in the process of building a shelter over pit number one, which is estimated to contain 6,400 life-size statues. (The national government is sponsoring this with the cooperation of the Bureau of Culture of Shensi Province.) Number two pit contains more than 1,000 statues. The statues in pit number one are mostly of infantry, in pit number two mostly of cavalry and chariots. The statues are fully equipped with armaments, etc. The statues are standing on a terrace five meters down which is being excavated. The roof of the terrace is made of wood, the floor of bricks. The roof has collapsed so the statues were broken and are now being repaired. The full-size statues of the warriors have heights like 1.8 meters. The statues are made of clay but hold real metallic weapons.

Yang shows us numerous pictures of these statues. One is of a general 1.95 meters high. The clay is being colored in the restoration process. He shows us the head of an arrow made of Pb-Cu bronze, a sword made of Cu-Sn bronze. To our amazement he tells us the tip of the arrow is covered with chromium! The head of a Cu-Pb bronze spear has decipherable printing on it.

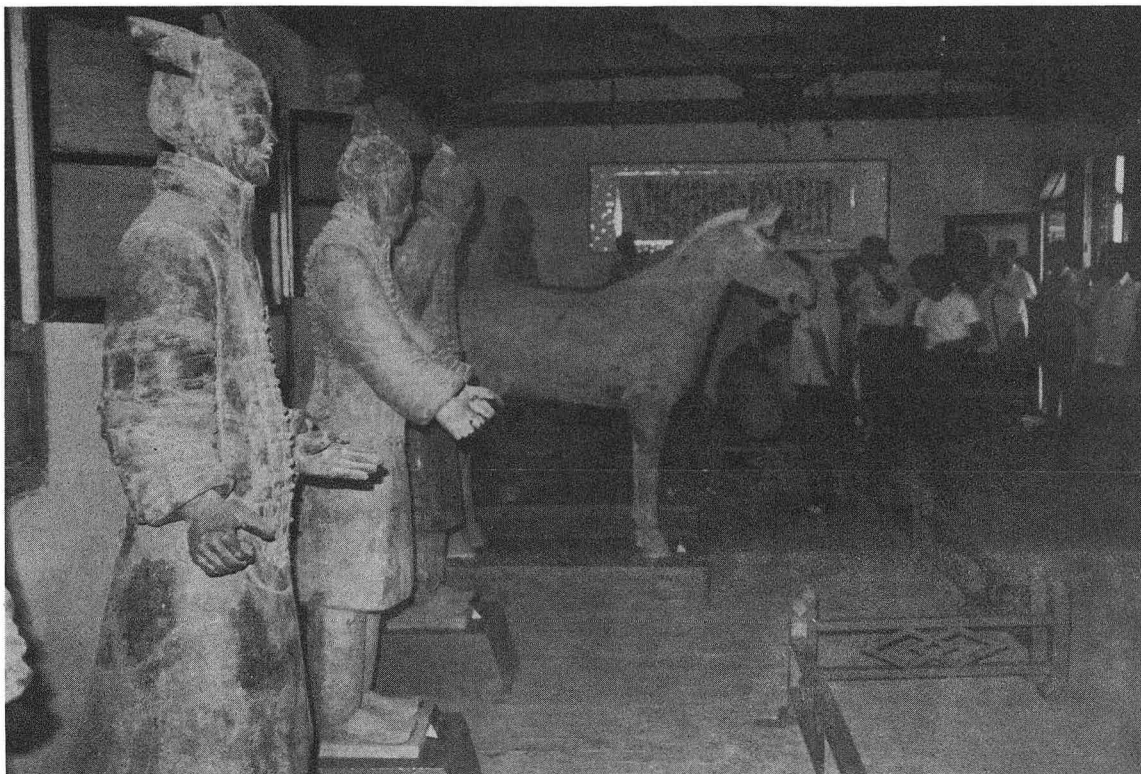
Number one pit has dimensions of 204 x 70 meters. The statues stand in 40 columns; 38 columns face east, one faces north, one faces south.

He tells us that the general, some aides, horses, an archer have been placed in a neighboring museum. He gives us the good news that the Deputy Director of the Bureau of Culture of Shensi Province visited today, decided on the basis of our standing as scientists to allow us to take photographs.

We go outside, see the huge frame of a protective building under construction and many workers busy in the lower excavation area. We now go into the museum to see the statues of the general, his aides, horses, archers, etc.

We go next to see and wander through the excavation and construction site where many workers are busy at their tasks. We say good-bye to Yang, leave at about 5:30 p.m. to ride back to our hotel, in cars as we came, and arrive there about 6:10 p.m.

At 7 p.m. we go up to the main dining room on the fourth floor where, in a corner, we are given a dinner in our honor by Yang Kao, Chairman of the Science and Technology Committee of Shensi Province. Our other hosts are Ch'in K'o-chia, Han Jui-min, Yang Ming, Ch'eng Yan-ju, Ch'en Yun-sheng, Liu Kan-lieh.



Figures in museum at site of Tomb of Emperor Ch'in-shih-huang (Ch'in Dynasty), near Sian, June 6, 1978.



Excavation at site of Tomb of Emperor Ch'in-shih-huang
(Ch'in Dynasty), near Sian, June 6, 1978.

I sit at a table with Yang Kao, Han, Cheng, Liu, Shih Liang-ho, Bigeleisen, Suttmeier, Stein, Ch'ien, Ibers and Wei. Near the end of dinner Yang Kao offers a toast to our health. Soon thereafter I rise to present him with an ACS Centennial necktie, to serve as a reminder of the visit of our group of chemists and offer a toast to the health of our hosts and friendship between our two countries. Near the end we are served a six-tier stack of tsung jiao, a steamed dumpling. Larson leaves the dinner early. He is not feeling well tonight.

The dinner ends at about 8:45 p.m. Being so far west the sun sets quite late, the equivalent of daylight saving time back home.

I return to my room, write in my journal, retire at about 10:30 p.m.

Wednesday, June 7, 1978 - Sian

I arise at about 6:15 a.m. The night has been hot and humid and I have slept under a huge towel furnished for use as a blanket. A mosquito did some hovering over my bed part of the night.

I go up to the fourth floor restaurant to have breakfast with members of our Delegation. Larson comes up somewhat late, tells me he feels fine after a long night's sleep.

We meet in the lobby at 7:30 a.m., preparatory to setting off for our visit to Northwestern University. I ride with Ch'in K'o-chia and Shih Liang-ho in the first car of the six-car caravan. We pass a huge park, Revolution Park, and also Lily Park, as we drive along the Fifth Road. Northwestern University is located in the southwest part of suburban Sian. We pass through the western gate of the city wall and I see remnants of the large wall. The weather is already quite warm at this early hour.

We arrive at Northwestern University at 7:45 a.m. We are met by Chang Po-sheng (Vice President and Professor, Department of Geography), Liu Chian (Vice President), Wang T'ieh-min (Deputy Chief, Administration, President's Office), Liu Shun-k'ang (Deputy Chief, Scientific Research Division), Ch'en Yun-sheng (Associate Professor and Deputy Chairman, Department of Chemistry), Liu Kan-lieh (Associate Professor and Deputy Chairman, Department of Chemical Engineering), Li Shih (Associate Professor, Department of Chemistry), Li Chu (Associate Professor, Department of Chemistry), Sun Chu-ch'ang (Associate Professor, Department of Chemistry), Ms. Hu Yin-hua (Lecturer, Department of Chemistry), Liu Yuan-fa (Lecturer, Department of Chemistry), Ma Pao-ch'i (Teaching Assistant, Department of Chemical Engineering), Tsu Yung (Teaching Assistant, Department of Chemical Engineering), Wang Shan-hsueh (Teaching Assistant, Department of Chemical Engineering).

We go to a reception room on the first floor, sit at a long table with the usual covered tea cups. Our hosts are introduced. I ask Geyer to introduce the members of our delegation. Liu Chian now briefs us on Northwestern University. The University was established in 1937. Before Liberation there were about 500 students and only simple facilities. After Liberation the University expanded. At present there are ten departments, as follows. In the arts school the departments are (1) Chinese literature, (2) history, and (3) politics. In the science school the departments are (1) mathematics, (2) chemistry, (3) physics, (4) geography, (5) biology, and (6) geology. There is also a chemical engineering department.

There are now 1,700 students, 700 faculty and 750 staff members. Since last year they are accepting more students. During the Cultural Revolution they accepted 400 to 500 new students each year; last year they accepted 700, and they will accept 1,000 new

students this year. They are now a four-year university again and have graduate students.

Due to interference by the "Gang of Four" they lost much ground. Beginning the second semester of this academic year they began to recover. Liu tells us the facilities are quite backward, of "the 1950's" standard.

We also learn something about the criteria for faculty promotions. The faculty ranks consist of professor, associate professor, lecturer and teaching assistant. (The graduate students, known as research students, do not teach.) Promotion is based on performance in teaching, research and service. Long overdue promotions will soon be forthcoming, but of course research cannot be a normal criteria for a while due to its curtailment during the reign of the "Gang of Four." A committee consisting of faculty and other workers make suggestions on promotions for approval by the university president. The opinion of students is sought to evaluate teaching and political activities are evaluated to help determine service. Appointments require different levels of approval — lecturer by the university president, associate professor by the Educational Bureau of Shensi Province, professors by the National Educational Ministry in Peking.

I respond with an expression of our appreciation. We begin our tour of facilities at about 8:15 a.m.

The members of our group and our hosts walk across the campus to the library. Here the librarian, Yang Mao-hsing, describes the 900,000 books, 50% science and 50% social science, 250,000 books in foreign languages, thirteen languages, mainly in English. The method of using books are (1) faculty and students borrow books, (2) they can see them in reading rooms, or (3) they are available in small libraries in each department.

We wander through the stacks, see the Chinese science books. We go up to the next floor, visit the reading room for the works of Marx and Chairman Mao. We see a case with the works of Chairman Mao translated into more than 30 languages.

We next go to the room with collections of valuable books. We see scrolls of writing from the Sung Dynasty (12th century). I ask Yuan Lee if he can read this — it is religious writing and difficult to understand. We see numerous books from the period of the Ming Dynasty, one dated 1550. They have camphor in the cases to keep the worms out.

As we saunter across the campus to the Chemistry Building Liu Chian tells me the campus has an area of 50 acres, is completely surrounded by buildings, etc., housing other activities, so expansion is not possible. This limits the enrollment to a little more than 3,000 students. We reach the Chemistry Building where Chen Yun-shen meets us and leads us on a tour. (Wei is already here conducting a discussion.)

First we visit on the first floor a polarography laboratory for research in analytical chemistry. They are determining the concentration of nitromethane in water, a pollutant from a local industrial operation. Here we are briefed by Ms. Hu Yin-hua.

Next we visit a neighboring laboratory where work on emission spectroscopy for analysis is going on.

We go up to a laboratory on the second floor where Tu Wen-hu briefs us on atomic absorption spectroscopy. The apparatus is built by undergraduates (third year) students. They detect zinc, lead and cadmium in water. They also use an atomic fluorescence method to detect mercury in fish, other food, water, blood. The equipment was designed here, put into production in factories in Sian. Two students, girls, are busy at work here as we discuss the work. He also describes another apparatus, using atomic fluorescence spectroscopy, just being set up, which uses a method developed at the University of Florida.

Across the hall we see an ultraviolet (SP700C) spectrophotometer.

At the other end of the hall we visit a thermochemistry laboratory — this has research institute status, is run by the University rather than the Chemistry Department. We see an apparatus for thermogravimetric analysis. They are studying ammonium bicarbonate used as a fertilizer in China. This is described by Sung Ti-hong, head of the thermochemistry laboratory. In a neighboring room he shows us a calorimeter for measuring heat of combustion. They are measuring the heats of formation of new hydrocarbon compounds although it is not clear that there are many such new compounds. The apparatus was built in Changsha.

We finish our tour at about 9:30 a.m., go back to the Administration Building reception room for discussion. (Wei, Schriesheim, Suttmeier have a separate discussion on chemical engineering.) Liu Chian asks us to describe the educational and research process in U.S. universities. Yuan Lee serves as interpreter for this discussion. I describe, with translation and help from Yuan Lee, the situation at Berkeley. Ibers next describes the situation at Northwestern University in Evanston.

They are given the opportunity to ask some questions. To help set the stage for this, Bigeleisen gives a history of graduate research in chemistry in the United States that has led to the present picture. Baldeschwieler then describes some typical graduate curricula in graduate schools of chemistry in the U.S.

Ms. Hu Yin-hua now asks what is the standard for the award of the Ph.D. degree in the United States. Yuan Lee describes in Chinese the situation at Berkeley. Baldeschwieler describes the situation at Caltech.

Ch'en Yun-sheng asks if a graduate student can work a couple of years and then fail. The answer is that this is possible — the student is then given a master's degree. Ch'en inquires about the job market situation in the United States. Baldeschwieler responds that those in inorganic and analytical chemistry are most easily placed. The demand for Ph.D.'s in synthetic organic chemistry, particularly in industry, is very strong. Those trained in experimental physical chemistry can be placed, but with more difficulty. Overall, we are probably training more students than we can place; these go into other areas. Students trained in biochemistry are difficult to place because of the limited industrial market. The balance changes as national priorities and needs change.

Stein says their Ph.D. students in polymer science find positions easily.

Baldeschwieler inquires about placement of graduates of Chinese universities. They respond that these are placed according to need in the planned Chinese economy. The university can make special recommendations for brilliant students, for example.

Liu Chian tells us that Northwestern University will begin to have graduate students in the coming academic year.

We finish our discussion at about 11 a.m. Wei, Schriesheim and Suttmeier rejoin us; we say good-by to our hosts at the University.

We ride back in the cars as we came, I with Ch'in K'o-chia and Shih Liang-ho. I see many interesting narrow side streets coming off the wide streets we ride on. There are many bicycles, no passenger automobiles, and few trucks. Many of the buildings have the clay or adobe construction. The downtown area is quite picturesque.

We stop at the Bell Tower, near the center of the old Sian. This was built in 1384, ten years after the city wall. It has a height of 36 meters, is located 800 meters from the south gate of the wall, 1,800 meters from the east gate, 1,600 meters from the north gate, 1,700 meters from the west gate. Here there is a 500-year-old bell which used to toll in the early mornings. There is a nearby Drum Tower where the drums were beat in the evening.

We climb the Bell Tower to the platform close to the top under the guidance of the manager. We walk completely around the four sides to get views of the south, west, north and east gates and the Drum Tower. We descend from the tower, drive a block south for a good view of the Bell Tower.

We arrive back at the hotel a little after 11:30 a.m. Because it is now June 6 (our wedding anniversary date) in Lafayette I place a call there to Helen. The call goes through soon but Helen is not home. Fortunately Dianne is visiting at home in order to vote today so I talk to her and she brings me up to date. Dolf is

visiting with her. Things seem to be going well. Bill plans to go to Cambridge to attend the tenth anniversary reunion of his class. Eric will start to work in his new job in Washington, D.C. (with the Student Press Service) on June 12.

I buy a couple of Chinese neckties at the hotel shop. I join our delegation at lunch in the fourth floor restaurant where they all wish me a happy wedding anniversary.

At 1 p.m. we assemble in front of the hotel, ride to the Shensi Provincial Museum (a former temple of Confucius) in our caravan as usual.

The museum is closed today and we are seeing it by special arrangement. Our tour group consists of our fifteen member traveling group and our hosts Ch'in K'o-chia, Ch'en Yun-sheng, Liu Kan-lieh, Han Jui-min, Yang Ming and Ch'eng Yan-ju. This former temple of Confucius consists of numerous decorative typical Chinese temple-style buildings. In these buildings are housed archeological specimens from throughout all of Chinese history. The collection is reminiscent of the collection that I saw in the Museum of Chinese History in Peking, but not as extensive.

In the first building we enter we see bronze pieces from as early as the Western Chou Dynasty (1122-770 B.C.), along with such pieces from the Ch'in (221-206 B.C.) and Han (206 B.C. - 220 A.D.) Dynasties. This building houses a collection of statues from the tomb of Ch'in-shih-huang (that we visited yesterday), as many as we saw in the museum at the excavation site, along with a painting of Ch'in-shih-huang. There are also statues from the Han Dynasty and an earthquake detector apparatus of the Han period.

In the next building we see numerous large stone animals covering the periods of the Han through T'ang Dynasties. Here there is script on stone, which Jimmie Wei is able to read, dated 718 A.D., from the T'ang Dynasty (618-907 A.D.).

In the next three buildings we view scriptures on huge stone, 10-foot-high headstones for graves, including some from the Han, T'ang and Sung (960-1280 A.D.) Dynasties. Sian is famous for such headstones.

In another building we see some headstones from the more recent Ch'ing (1644-1911) Dynasty and a detailed script on stone that Wei says can serve as a sort of dictionary.

In the next building we see a map of Sian at the time of the Han Dynasty. We try to decipher where some of the landmarks of today are located on this map, but with not too much success. This building includes many bronzes and ceramics of the T'ang Dynasty. I am especially struck by a horse, made of clay, but covered with colored glaze of striking quality.

Outside we see a large bell made in 711 A.D. We next enter a building where relics from recent excavations are housed and which we are asked not to photograph. We see a huge bronze pot of 600 B.C. and more statues of soldiers and horses from the Ch'in Dynasty.

We complete our tour at about 1:50 p.m. We now ride in our cars to the Da Yen (Big Wild Goose) Pagoda, built in 648 A.D., which is located a little further out (outside the old wall) on the south side. Here Baldeschwieler, Suttmeier, Lee, Wei, Ch'ien and I climb the stairs to the top, seven stories and 64 meters high. The first few stories have two sets of winding stairs, reminiscent of a double helix. There is an excellent view back north to Sian, within its old wall, and in the other directions.

We walk back down the steps. One of the buildings in this complex is where Hsiung Tsang worked to translate the Buddhist scriptures that he brought to China from India in 630 A.D. We visit this building, see the painting of Hsiung carrying the heavy load of Buddhist scriptures. He brought Buddhism to China.

We now drive in our caravan of cars directly to the Sian Railway Station. I give my driver, Li Tzao, a Kennedy half dollar.

We arrive at the railway station a little before 2 p.m. I distribute a number of gifts: ACS and Priestley Centennial First Day Covers to Ch'en Yun-sheng, Liu Kan-lieh and (for delivery to him) Liu Chian, an ACS Centennial T-shirt to Ch'in K'o-chia, and Lawrence Hall of Science bimetallic elements to all of these. Also here to see us off are Han Jui-min and Yang Ming.

Our luggage is put on board the train by our hosts. We spend a while in the waiting room talking to our hosts, then walk with them out to the train. We board the train, say good-bye, and the train leaves at 2:16 p.m., on schedule.

We are due in Lanchow, in Kansu Province, at 6:30 a.m. tomorrow morning. I occupy a compartment with Lee and Larson. Bigeleisen, Wei, Baldeschwieler and Stein occupy a second compartment, Geyer, Ibers, Schriesheim and Suttmeier a third, and our four traveling hosts (Ch'ien, Shih, Shih, and Ms. Hu) a fourth.

It is quite hot and we go immediately to the dining car next door for cold beer and soft drinks. I sit at a table with Bigeleisen, Wei and Baldeschwieler and, at their request make contrasts of this visit to The People's Republic of China with that I made five years ago. I describe the composition of our delegation at that time, say that our hosts accepted the principles of the Cultural Revolution at that time in contrast to now. I describe in some detail the long meeting our delegation had with Premier Chou En-lai.

We reach Boo Ji at about 6:15 p.m. Soon thereafter we

find ourselves proceeding through mountainous territory along a long broad pass paralleling the Wei River (Wei Ho), a branch of the Yellow River (Huang Ho). We pass through many many tunnels — Ch'ien tells me there are 152 tunnels between Boo Ji and Tien Hsai, the first town we will reach in Kansu Province. We pass many picturesque villages, with dwellings made of brick or adobe clay, and in some places there are excavations directly into the clay banks suitable for dwellings. There is farming on the side of very steep hills, made possible by terracing. I am intrigued by the steep hiking trails I see going up the sides of the canyon.

At about 7:15 p.m. as our turn comes up, our group of fifteen goes to the neighboring dining car to have dinner. We watch out the windows as the train continues along the broad passage through the mountains, still paralleling the Wei River. It does not get dark until after 8 p.m.

I give Wei the section of my "China Journal" of 1973 describing in detail the visit of our delegation with Premier Chou En-lai. He finds it very interesting, shows it to Baldeschwieler and Lee. As a result of this interest I also give it to Ch'ien and Ms. Hu to read.

I spend some time after dinner talking to Ms. Hu and Shih Wei-ming, in their compartment, describing my meeting with Premier Chou En-lai and other world leaders.

I retire at about 9:30 p.m.

Thursday, June 8, 1978 - Lanchow

I arise at about 6 a.m. after a good night's sleep in our train compartment. As we approach Lanchow we see an area of plains surrounded by mountains. Going by the cuts it looks like the mountains are composed in large part, of clay. The elevation at Lanchow is perhaps 3000 feet. It is the geographical center of China.

As we come closer to Lanchow the plains give way to mountains. We pass through a wide canyon along the rugged side of the Yellow River, broad and majestic at this point. We pass a high arch-type bridge spanning the river.

As we enter the outskirts of Lanchow we see factories and numerous clay (adobe) and brick dwellings. Closer in we see many factories. Lanchow is obviously an industrial city.

We arrive at Lanchow Railway Station at 6:53 a.m., are met by Yang Ch'eng-chung (Director, Institute of Modern Physics, and whom I met at the Conference on Heavy Ion Research in Caen, France in September 1976), Yin Yuan-ken (Chief, Research Group No. 4, Institute of Chemical Physics, member of the Delegation of Chinese Chemists to the U.S. last year and the tenth member of this ten-member group of chemists we have met during our current visit to The People's Republic of China), Yin Chung-li (Chief, Office of General Affairs, Science and Technology Committee, Kansu Province), Yu Chih-ling (Director, Lanchow Institute of Petroleum Research), Ch'en Hsin-hua (Deputy Director, Academy of the Lanchow Chemical Industry Corporation), Liu Chi-shun (staff, Foreign Affairs Division, Kansu Provincial Government).

There is evidence of recent rain as we avoid mud puddles walking into the station waiting room. Yang tells me the rain is very unusual at this time of the year.

We go to a reception room to wait until our luggage is unloaded. I talk to Yang Ch'eng-chung about our previous meeting in Caen, France, in September 1976. We also discuss the program for our visit in Lanchow. Our delegation will visit the Institute of Chemical Physics this morning, the Institute of Modern Physics this afternoon, and the banquet in our honor will be given tonight. Tomorrow morning I will give my talk on "Mechanism of Heavy Ion Reactions" and tomorrow afternoon I will talk on "Transuranium and Superheavy Elements."

I ride in the first car with Yang Ch'eng-chung and Shih Liang-ho, with the others following in a caravan of cars. Yang tells me he received his Ph.D. with Chadwick in Liverpool, England, 1945-51. He has been Director of the Institute of Modern Physics since its start in 1960. They received a 1.5-meter cyclotron from the Soviet Union but were abandoned and had to assemble it them-

selves. It started operation with protons, deuterons, and alpha particles in 1963 and was converted to light heavy ions in 1973. He tells me we are the first foreign scientists to visit Lanchow, with the exception of Ben Mottelson in 1975.

We arrive at the Friendship Hotel at 7:40 a.m., are assigned rooms on the second floor, I in room 238. Here again we find spittoons in the corridors. I have a suite of two rooms, smaller than in previous places. There is a double bed in the bedroom, adequate bathroom facilities, a writing desk, radio and two chairs in the living room.

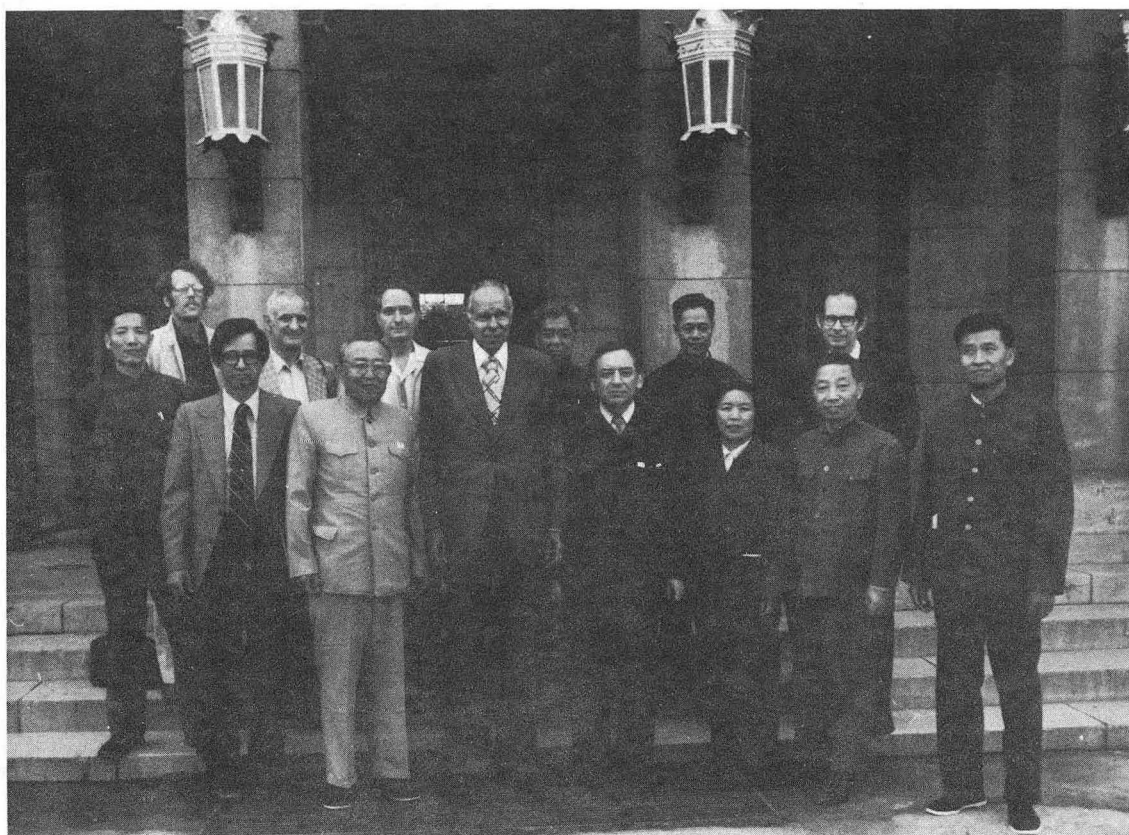
We freshen in our rooms, then go to a restaurant at the far end of the same floor to have breakfast. Here we discuss our schedule. Baldeschwieler, Ibers, Lee, Bigeleisen, Stein, Geyer and I will visit the Institute of Chemical Physics (which operates under the Chinese Academy of Sciences) this morning while Schriesheim, Wei, Larson and Suttmeier will visit the Academy of the Lanchow Chemical Industry Corporation.

We meet in the hotel lobby at 9 a.m. preparatory to departure for our visits. Baldeschwieler and I ride with Yin Chung-li to the Institute of Chemical Physics on the east side of the city. The city of Lanchow is stretched out along the Yellow River. We ride on a street along the Yellow River, which for a little way, is lined with apartment houses on the side opposite from the river, followed by a brick wall shielding an area of individual dwellings.

We arrive at 9:30 a.m., are met in front of the large main building by Shen Sung-ch'ang (Deputy Director, Institute of Chemical Physics), Yin Yuan-ken (Chief, Research Group No. 4, Oxidative Dehydrogenation Catalysis, Temperature Programmed Desorption, Catalytic Kinetics), Li Shu-wei (Chief, Research Division), Ch'en Ying-wu (Chief, Research Group No. 5, Oxosynthesis Catalyst Preparation), Ms. Yu Wei-lo (Chief, Research Group No. 1, GC Glass Capillary Columns and GC/MS Computer System), Chin Tao-sen (Chief, Research Group No. 3, Crown and Cryptate Compounds), P'an Hua-shan (Director, Scientific Information Division), Chiang T'ian-lai (Interpreter).

We go to the second floor reception room in the main building, set up with tea at a long table. Shen Sung-ch'ang greets us, gives us a program for our visit, describes the Institute of Chemical Physics. The Institute started as part of the Lanchow Branch of the Institute of Materials of Peking. In 1958 the Institute became the Petroleum Institute. There were only 120 personnel and three divisions, the Division of Analytical Chemistry, Division of Catalytic Processing of Petroleum, and Division of Investigations on Grease.

By the end of 1961 the name was changed to the Institute of Chemical Physics of the Chinese Academy of Sciences; work on



Institute of Chemical Physics, Lanchow, June 8, 1978.
From left to right: Yin Yuan-ken (Chief, Research Group No. 4), Geyer, Lee, Stein, Shen Sung-ch'ang (Deputy Director), Ibers, Seaborg, Li Shu-wei (Director, Research Division), Bigeleisen, P'an Hua-shan (Director, Scientific Information Division), Ms. Chiang T'ian-lai (interpreter), Ch'ien Jen-yuan (Institute of Chemistry, Peking), Baldeschwieler, Yin Chung-li (Chief, Office of General Affairs, Science and Technology Committee, Kansu Province).

lubrication, etc. was added. Now there are 600 personnel; 300 scientific and technical, 100 in workshops, the rest administrative. They now study components of gasoline, synthesis of butadiene, research on chromatographic analysis, to name a few areas of activity.

In the days of the "Gang of Four" their work was set back and they were forced to work only on practical matters. Now the springtime has come because of the smashing of the "Gang of Four" by Chairman Hua. The Institute is now moving toward basic research to better serve its country.

They now are studying molecular catalysis in a number of aspects that he describes, and are working on lubricating materials, crown and cryptate compounds, synthetic and analytical chemistry and new instrumentation. There are five divisions: (1) catalysis by transition metal complexes, (2) heterogeneous catalysis, (3) solid lubricants, (4) synthetic chemistry, and (5) analytical chemistry.

Today we are scheduled to visit seven laboratories as shown on the schedule: (1) Crown and Cryptate Compounds, (2) Oxosynthesis Catalyst Preparation, (3) GC Glass Capillary Columns, (4) Oxidative Dehydration Catalysis, (5) Temperature Programmed Desorption, (6) GC/MS/Computer System, and (7) Catalytic Kinetics.

Before our visits start, a number of division heads brief us, reading from prepared text in English. First, Chen Ying-wu briefs us on transition metal catalysis. He tells us about work with supported homogeneous catalysts. They are studying hydroformylation (particularly by use of triscobaltammonia carbonyl), photo-assisted catalytic redox processes, the role of reversible oxygen carriers in catalytic oxidation, immobilized glucose isomerases. One catalyst is the Co(III) cluster compound, another a rhodium phosphine complex on a porous silicate support. This corresponds to number two on our schedule list. Second, Yin Yuan-ken then briefs us on his work on catalysis. They emphasize basic work more. They characterize active sites on metallic and metallic oxide catalysts and their correlation and synthesis with catalyst preparation technique and performance. Thus they investigate catalyst reactivity, surface physics, kinetics, as well as the catalytic oxidation of ethylene, the structure and behavior of rare earth catalysts and the single-step synthesis of isoprene from formaldehyde and isobutylene. This corresponds to numbers four, five and seven on our schedule list. Third, Chin Tao-sen tells us about work on the synthesis of crown ethers and cryptate compounds, the synthesis of functional polymers and the study of polymer membranes (for selective gas permeability). This corresponds to number one on our schedule list. Fourth, Ms. Yu Wei-lo briefs us on work in analytical chemistry. They work on chromatographic and inorganic chemistry analyses. They use a microwave plasma detector, GC glass capillary columns and GC/MS computer systems. This corresponds to items three and six on our schedule list.



Briefing, reception room, Institute of Chemical Physics,
Lanchow, June 8, 1978.

I express appreciation and say we are looking forward to our tour. We begin our tour at about 10:20 a.m. Yin Yuan-ken asks me to give his best regards to Gabor Somorjai.

We are led on our tour in the main building by Shen Sung-ch'ang accompanied by the other hosts who have briefed us and others. Shen tells us that the research people in each laboratory will speak English as they explain their work.

We go up to the fourth floor and in the first laboratory Hsia Yuan-chiao (working with Chin Tao-sen) informs us of their work on crown ether and cryptate compounds. They have synthesized eight known crown ethers. Ibers questions him on the synthesis of crown ethers. Hsia says very little on the cryptate compounds because they have done very little on this as yet.

In a neighboring room Yao Chung-ch'i (working with Chin Tao-sen) briefs us on their work on a potassium ion-selective electrode. They have synthesized a polycondensate of dibenzo-18-crown-6-formaldehyde for use as material for a potassium ion-selective electrode. They hope to use such materials to similarly separate rare earth elements from each other.

In the next room Yang Chen-yu (working with Ch'en Ying-wu) briefs us on their work on oxosynthesis catalyst preparation. He describes the synthesis of $\text{PhCCO}_3(\text{CO})_2$ by the phase transfer catalysis method and the synthesis of a silica-supported rhodium complex $(\text{SiI-PPH}_2)_2\text{RhCl}(\text{CO})$. Ibers suggests that such a compound should have hydrogen in place of the chlorine in order to be active in oxo reactions. In response to a question by Baldeschwieler we learn that there is no other work in this area going on in China.

Here I see the most up-to-date Periodic Table I have seen in China — it goes up to element 107.

Across the hall Ms. Lu Tsu-fang (working with Ms. Yu Wei-lo) briefs us on work on high-resolution glass capillary columns using diatomaceous earth. She shows us the end view of scanning electron microscope photographs of such a porous layer capillary column. She also shows us chromatograms of separated gasoline fractions. They have 22-meter and 77-meter long columns.

In a laboratory down the hall we are shown, by Ting Shih-hsing (working with Yin Yuan-ken), their work on the oxidative dehydrogenation of butenes over various catalysts to produce butadienes. He then leads us down to a laboratory on the third floor where we see a bench reactor for testing the catalyst and their gas chromatographic equipment.

Now we go down to a laboratory on the first floor where Ms. Hsu Hui-chen (working with Yin Yuan-ken) briefs us on their work on the physical and chemical properties of solid catalysts. In their program of temperature-programmed desorption, they study the energetics of the surface reactions. We see a vacuum line for chemisorption investigations.



Briefing by Ms. Lu Tsu-fang on glass capillary column chromatography, Institute of Chemical Physics, Lanchow, June 8, 1978. From left to right: Ch'ien Jen-yuan (Institute of Chemistry, Peking), Ibers, Yin Chung-li (Chief, Office of General Affairs, Science and Technology Committee, Kansu Province), Bigeleisen, Seaborg, Baldeschwieler, Stein, Lee, Shen Sung-ch'ang (Deputy Director), hidden, unidentified.

Across the hall Ku Wen-hua (working with Ms. Yu Wei-lo) shows us a gas chromatograph (GC) mass spectrometer (MS) with computer control. This apparatus is made in the Scientific Instrument Factory of the Chinese Academy of Sciences in Peking. It is a 60° sector, single focusing type. The range is 10 to 1,000 atomic mass units with a resolution of one part per 1,000. The sensitivity is one nanogram. We question them in detail about the characteristics of this apparatus.

We now ride in the cars to another building among the many (fifteen or twenty) on the site of the Institute. Baldeschwieler and I ride with Yin Yuan-ken. Here, in a room on the second floor, Ms. Ting Hseuh-chia (working with Yin Yuan-ken) briefs us on their work on the rate of formation of carbon oxide from the oxidation of n-butene to butadiene in three component (Bi, Mo, P) catalysts. As in many of these briefings this morning, Ibers asks a number of questions about the data and the interpretations.

An institute photographer is taking pictures during our visits to these laboratories.

We end our tour at noon. As we are saying good-bye to our hosts I present Shen Sung-ch'ang a copy of my reprint "Chemistry of the Transactinide Elements" and two copies of the ACS and Priestley Centennial First Day Covers and a copy of each of these First Day Covers to Yin Yuan-ken.

We now ride back to our hotel, I in the first car with Yin Chung-li and Ch'ien Jen-yuan. We arrive at our hotel at 12:15 p.m. We soon go to the restaurant on the second floor to have our lunch. We compare notes on our visits this morning. The group that visited the Academy of the Lanchow Chemical Industry Corporation on the west side of town is also well satisfied with its visit.

This afternoon Baldeschwieler, Lee, Bigeleisen, Suttmeier, Geyer and I will visit the Institute of Modern Physics (where research on heavy ion reactions is conducted); Schriesheim, Wei, Stein and Ibers will visit the Lanchow Institute of Petroleum Research. Larson will stay at the hotel to work on this section of our report.

We gather in the lobby at 2 p.m., soon take off for our destinations. I ride in the first of four cars to the Institute of Modern Physics (which operates under the Chinese Academy of Sciences) with Ch'ien Jen-yuan and Yin Chung-li. We ride east again — this Institute is next door to the Institute of Chemical Physics that we visited this morning. En route I see a beautiful park on the side of the mountain across the Yellow River, with a pagoda perched atop the mountain.

We arrive at the Institute of Modern Physics at 2:30 p.m., are met at the Administration Building by Yang Ch'eng-chung, Chu Yung-t'ai (nuclear physicist whom I met in Caen in 1976 and who



Institute of Modern Physics, Lanchow, June 8, 1978.
From left to right: Ms. Chang Min, Tai Kuang-hsi
(nuclear physicist), Bigeleisen, Yang Ch'eng-chung
(Director), Chu Yung-tai (nuclear physicist), Seaborg,
Ch'ien Jen-yuan (Institute of Chemistry, Peking),
Baldeschwiler, Yin Chung-li (Chief, Office of General
Affairs, Science and Technology Committee, Kansu Province),
Suttmeier.

went to school in the Soviet Union), Tai Kuang-hsi (nuclear physicist), Chang Min (staff). Shih Wei-ming is also with us for this visit.

We go to a reception room on the second floor where Yang Ch'eng-chung welcomes us, then briefs us on the Institute. The Institute was formally established in 1963. Before this they had done some preparatory work. Now they have a staff of more than 300 scientists and technicians. There are five research departments, as follows: (1) nuclear physics, (2) design of new accelerators, (3) electronics, detectors and computers, (4) 1.5-meter heavy ion cyclotron, and (5) applied nuclear physics (including radiochemistry).

Turning to nuclear physics, they worked at the time of the "Gang of Four" on applied research. After 1973 they turned to heavy ion physics. There are five fields of research in nuclear physics: (1) fusion and fission, (2) transfer reactions, including recently, work on deep inelastic reactions, (3) high angular momentum states, (4) nuclear spectroscopy, mainly of isotopes far off the line of beta stability, and (5) theoretical research.

We walk to the Cyclotron Building where an Institute photographer takes a picture of the combined groups. We enter the building, pass a PLA guard at the door with a bayonet and rifle, go first to see the Soviet-designed control room. We meet the cyclotron operators, Li Hseuh-k'uan, Li Chen, Chu Hsueh-cheng. This cyclotron was built with Soviet aid, but they withdrew their aid in 1960 at which time the Chinese scientists proceeded on their own. It was designed for 24 MeV deuterons, with 30 microamperes outside beam. In 1972 it was changed to a heavy ion cyclotron. They altered the shimming of the magnetic field to do this. The ^{12}C beam intensity is 5 charge-microamperes of C^{+4} ions with 76 MeV energy.

They plan to build a large machine and will use this machine, changed to a sector-focused machine, as an injector.

We then visit the cyclotron itself and the experimental area, which has dimensions of 8×10 meters. Here we see their helium jet transport system.

Hsu Shih-yuan is our briefer on the cyclotron. We now go to a little room on the same floor where we meet Wu En-chiu, Section Chief for Nuclear Physics. We are briefed first on their nuclear spectroscopy work. They work on neutron-deficient isotopes. They began by studying fusion reactions to produce neutron-deficient Cf, Es, Fm isotopes by the bombardment of U and Pu with ^{12}C . They used the internal beam and the recoil method with a catcher foil of Al. They then measured the alpha particles directly and also following chemical separations. They are plagued by lead impurities in the target — they must have lead-free targets. They find ^{244}Cf , ^{243}Cf , ^{246}Cf , ^{246}Es (via electron capture to ^{246}Cf), ^{250}Fm . They give me reprints on the measurement of excitation functions of At and Fr

isotopes produced by the bombardment of ^{209}Bi with ^{12}C . This is described to us by coauthors Sun Hsi-chun and Kuo Chung-sheng. They show us their huge lead shield used for gamma-ray counting. They use Ge-Li for gamma ray and Si-Au for alpha particle counting.

We see the other end of the helium jet transport system where the recoil nuclei impact on a tape which moves them in timed sequence to the nearby Ge-Li detector.

In the next room we are briefed on the production of iodine isotopes from ^{12}C on Ag. Here they find it necessary to have an additive, AgCl, in the helium jet. The tubing for the helium jet is made of polyethylene and has 1.2 mm inside diameter. They have also used oil vapor and water as the additive, but AgCl is best. They find two new gamma ray peaks (275 and 326 Kv) using AgCl, possibly due to ^{115}I , with about two minutes half-life. According to published data, ^{115}I has only one line at 281 Kv and a half-life of 1.3 minutes. They show us their 16,384-channel-pulse analyzer, made by French Intertechnique, which they purchased in 1975.

In the next room Tai Kuang-hsi (who was trained in Copenhagen) briefs us on the work of the fusion-fission group. (They give me a Chinese isotope table and large wall chart. Yuan Lee offers to carry the large isotope charge home to Berkeley for me.) He shows me the ^{246}Cf alpha peaks from $^{12}\text{C}+\text{U}$, confused by peaks from Pb impurity. They have turned this around as a means of analyzing for Pb in the atmosphere, at concentrations of 10^{-8} to 10^{-9} grams per cubic meter. He shows me fission tracks in mica from $^{12}\text{C}+\text{Au}$ reactions. They deduce a fission time of about 10^{-18} seconds. They have measured the complete fusion cross section using mica, plastic and glass detectors, for a number of ^{12}C reactions. He gives me reprints covering this work. He also gives me a Chinese journal containing one of his articles on angular distribution work.

I have to be careful to keep from bumping my head (in fact, I bumped once) in going through the doors from room to room.

In the next room, where Chu Yung-t'ai works, Chu Yung-t'ai, Fan Kuo-ying and Wu Ching-li brief us on the elastic (and inelastic) scattering and angular distribution of the products from the $^{12}\text{C}+^{12}\text{C}$ reaction. They also show us results on the scattering of ^{12}C by ^{209}Bi , and results from the $^{12}\text{C}(^{12}\text{C}, ^{13}\text{N})^{11}\text{B}$ and $^{12}\text{C}(^{12}\text{C}, ^{11}\text{C})^{13}\text{C}$ reactions, treated by the DWBA method. They plan to work on deep inelastic scattering, using an ionization telescope combined with time of flight method. They are starting to use the E, ΔE method. They have measured the angular distribution of Li, Be, B isotopes produced from $^{12}\text{C}+^{209}\text{Bi}$. From ^{12}C on ^{27}Al they have identified isotopes of He, Li, B, and C up to Si, in work finished just last week using E, ΔE detection. They give me a picture of this He-Si distribution from $^{12}\text{C}+^{27}\text{Al}$.

This completes our tour of the Nuclear Physics Department. We now walk over to the neighboring building housing the Accelerator Department. Here I meet Kuan To (Section Chief) and Chang En-hou (whom I met in Caen, France, in September 1976), Wei Pao-wen and Yeh Wei-yi.

Chang En-hou describes their planned tandem cyclotron accelerator system. Their 1.5-meter cyclotron will inject into a 6.15-meter, sector-focused cyclotron. This will produce 50 MeV per nucleon carbon ions and 6 MeV per nucleon for up to xenon ions. They will have a vacuum of 10^{-7} mm, with cryogenic pumping for the vacuum system. The cyclotron hall will be 30×29 meters, and 12 meters high. The experimental area will be about 50×29 meters in area, 11 meters high, expandable in the 50 meter direction. Including the iron yoke, etc., the cyclotron will be about 12 meters across. They hope to have it completed in the early 1980's. It will be located on this site at a place they showed us earlier outside the fence.

Next, Wei Pao-wen briefs us on the plans for trimming the magnetic field. They are practicing with a quarter-size model magnet which we see.

For a second phase, with a better injector, they hope to accelerate U^{+36} to 10 MeV per nucleon. They give me a number of line print charts depicting the characteristics of the heavy ions to be accelerated.

Next Yeh Wei-yi briefs us on their work on the radio-frequency power system.

Their cyclotron is similar to that planned by the French. The French, however, will have two such large cyclotrons in cascade. Their cyclotron is also similar to the Indiana cyclotron, which Yang et al. will see when they visit the United States later this month.

Next we walk to the radiochemistry building. As we walk over the grounds it is apparent that there are a large number of buildings — perhaps six large ones and many smaller ones. Here we meet Ms. Wang Shu-fang, Section Chief. Li Wen-hsin, Fan Wo and Chou Chih-ming brief us on the programs. They have determined the yield of fission products from 14 MeV neutrons on uranium in an experiment on mass distribution. Li Wen-hsin tells me that to get rare earth separations they use cation exchange resin and elution with alpha hydroxyisobutyrate, using a high pressure (1.7 atmosphere) system. They get a separation in 8 hours. He shows us a typical elution curve showing sharp separations of Y, Cf, Cm, Am in work done in 1973. Lately they have measured the mass distribution from ^{12}C -bombarded Au, Bi and U. Li tells me they have determined independent and cumulative yields. They have determined the mass distribution using three hypotheses; the equal charge displacement hypothesis gives the best fit. This is for full energy (68 MeV) ^{12}C (reduced from 73 MeV by Al absorber) with thick targets. This



Heavy ion radiochemistry group, Institute of Modern Physics, Lanchow, June 8, 1978. From left to right: Fui Ning, Li Wen-hsin, Ms. Sun Tung-yu, Ms. Sun Hsu-hua.

work was done in 1976, to be published in the July issue of the *Chinese Journal of High Energy Physics and Nuclear Physics*. He gives me copies of his yield curves.

In a neighboring room Ms. Wang Shu-fang tells us about the radiochemical isolation of ${}^7\text{Be}$, ${}^{22}\text{Na}$, ${}^{51}\text{Cr}$, ${}^{55}\text{Fe}$, ${}^{59}\text{Fe}$, ${}^{58}\text{Co}$, ${}^{57}\text{Co}$, ${}^{56}\text{Co}$, ${}^{68}\text{Ge}$, ${}^{85}\text{Sr}$, ${}^{109}\text{Cd}$, and ${}^{181}\text{W}$. She shows us a ${}^{68}\text{Ge}$ - ${}^{68}\text{Ga}$ generator. In the next laboratory we see the apparatus for separating ${}^{57}\text{Co}$ from deuteron bombardment of iron.

Next we go to the second floor of the building housing their Cockcroft-Walton accelerator which was built in Shanghai in 1964, and is now operating at 400 Kv. With the D-T reaction they get 3×10^{11} 14 MeV neutrons per second, using a rotating target to facilitate cooling. They also have a beam of deuterons with which to conduct low energy nuclear physics experiments.

We walk to another building, passing a building on the way, where Yang tells us, some work on high intensity plasma sources used to be conducted. This has been stopped.

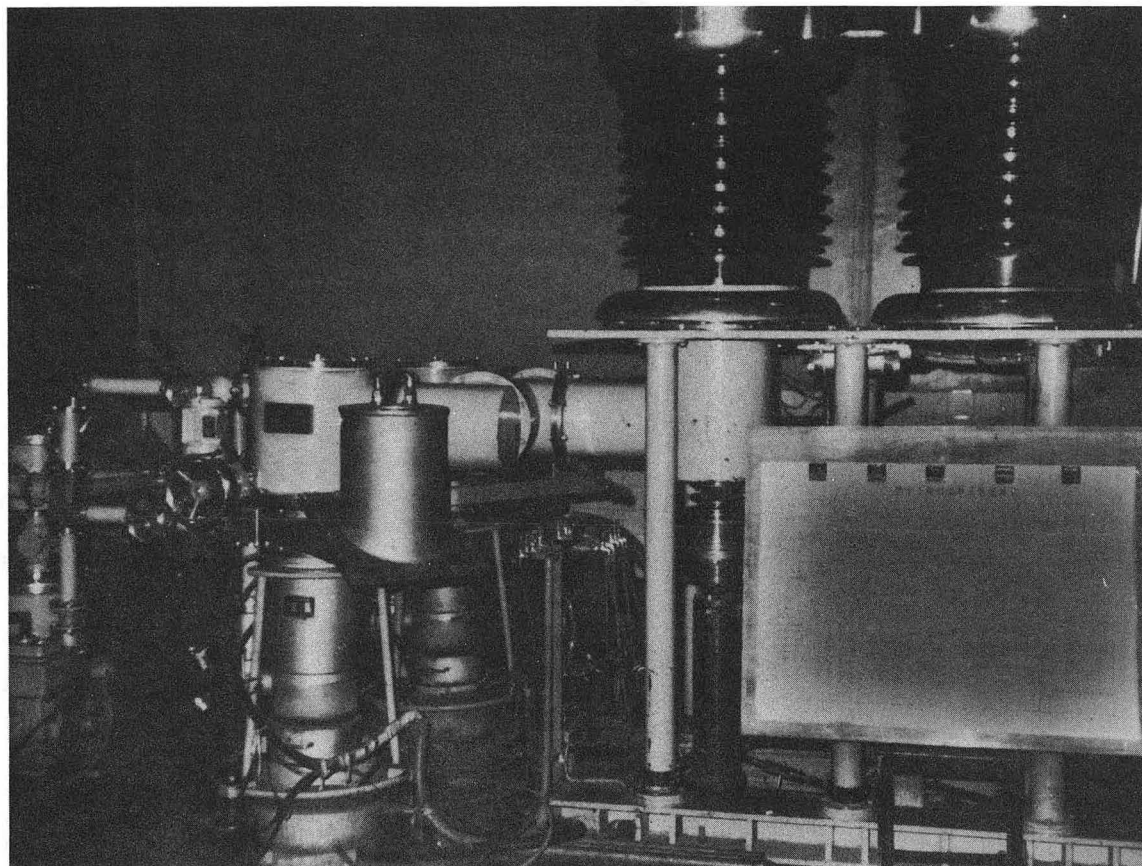
We go to the third floor of the building housing the electronic and instruments division, where Ms. Ch'en An-yi, Section Chief, greets us and Ma Hsi-liang shows us their computer which was built in Harbin. This is programmed for Fortran II.

Ms. Ch'en An-yi then leads us to a room on the second floor where Chang Chin-t'ian briefs us on various counters. He shows us totally depleted Si detectors (thickness 10 to 400 microns, active area 12 to 300 sq.mm.). These detectors are used for charged particle identification. He shows us an annular Si detector with energy resolution for alpha particles of better than 1%. He shows us a large (area 20,000 sq.mm.) ion implantation detector, with resolution better than a surface barrier detector. They are now developing Li-drifted Ge detectors.

We finish our tour at about 6 p.m. As I start to make my gift presentations to Yang Ch'eng-cheng, he thanks me for the Hewlett-Packard HP-21 calculator and battery charger and NAS reprints, which we sent to Lanchow and which apparently wound up at his Institute. We were glad to learn this because our other hosts have been unable to locate the whereabouts of these. I present Yang, for his chemists, two each of the ACS and Priestley Centennial First Day Covers and a stack of my reprints on the heavy ion research of my group at Berkeley as well as copies of my article "Chemistry of the Transactinide Elements" and a copy of my "Actinides and Transactinides" article.

We ride back in cars as we came, arrive at the Friendship Hotel at about 6:30 p.m

At 7 p.m. we meet our principal host for tonight's dinner, Chang Chin-yi, Deputy Chairman, Science and Technology Committee,



Cockcroft-Walton accelerator, Institute of Modern Physics,
Lanchow, June 8, 1978.

Kansu Province, and our other hosts in the reception room on the third floor, preparatory to the dinner. Present are our group of fifteen, plus our hosts Chang Chin-yi, Shen Sung-ch'ang, Yang Ch'eng-chung, Yin Chung-li, Liu Chi-shun, Yin Yuan-ken, Liu San-ming, Yu Chih-ying (Director, Lanchow Institute of Petroleum Research), Ch'en Hsin-hua (Deputy Director, Academy of the Lanchow Chemical Industry Corporation).

Chang inquires about our activities in Sian and I recount them briefly for him. He reiterates that we are the first foreign official delegation to visit Lanchow. We go very soon to the restaurant room on the second floor to have our dinner. I sit at a table with Chang, Yang Ch'eng-chung, Yin Chung-li, Ch'ien Jen-yuan, Baldeschwieler, Geyer, Shih Liang-ho. Near the beginning of the meal Chang offers a short toast to the health of our delegation. During the dinner Yang tells us that the Institute of Modern Physics also suffered harassment at the hands of the "Gang of Four." He reminds me that he told me when we met in Caen, France, in September 1976, that the Tandem van de Graaf accelerator being built at the Institute for Nuclear Research in Shanghai (energy two times 6 MeV) will be built as a cooperative effort between the Institute of Nuclear Research there, the Lanchow Institute of Modern Physics and the Peking Institute of Atomic Energy. He also tells me that the other three members of the six-member delegation of nuclear physicists going to the United States (and the Gordon Conference) later this month are Mrs. Yeh Mei-ling (Institute of Modern Physics) Ch'eng Hsiao-wu (Institute of Nuclear Research) and Chang Wei-chung (an accelerator engineer from the Institute of Nuclear Research).

Toward the end of the meal I rise to say this is our final formal dinner in The People's Republic of China, that we are glad to have it in Lanchow and honored to be the first foreign delegation to China to visit here, extend an invitation to our Lanchow hosts to visit us and our laboratories in the United States. I present Chang with a Lawrence Hall of Science "accelerator forest," say it is unique in the world, explain how it was made and suggest it serve him as a memento of our visit to Lanchow. I then offer a toast to the health of our hosts and increasing friendship between the scientists and peoples of our two countries. The dinner ends at a little before 9 p.m.

After dinner our delegation holds a short meeting to review plans for tomorrow and Saturday in Lanchow. We are asked to give our passports to one of our hosts so he can bring them to the authorities for checking because we are in restricted territory here in the Lanchow area.

I return to my room, write in my journal, go over my slides for tomorrow's talk. I am scheduled to talk at the Institute of Modern Physics tomorrow morning on the "Transuranium and Super-heavy Elements" and tomorrow afternoon on "Mechanism of Heavy Ion Reactions." This order is reversed from the original plans.

Ibers is scheduled to talk tomorrow morning at the Institute of Chemical Physics (at which time he will present Deputy Director Shen Sung-ch'ang with a Hewlett Packard HP-21 calculator and battery charger), Wei at the Lanchow Institute of Petroleum Research, while Stein and Larson will visit the Academy of the Lanchow Chemical Industry Corporation to have discussions. The others will have free time.

In the afternoon Bigeleisen will give a talk at the Institute of Chemical Physics, Schriesheim at the Lanchow Institute of Petroleum Research, and Larson will again visit the Academy of the Lanchow Chemical Industry Corporation. Wei will have a discussion at the hotel with Yin Yuan-ken and the others will have free time.

Tomorrow night our delegation will have dinner alone at some restaurant in town.

I retire a little after 11 p.m.

Friday, June 9, 1978 - Lanchow

I arise at about 6:30 a.m. The night was rather cool following a somewhat hot day yesterday. I soon go to the restaurant at the other end of the second floor to have breakfast with some members of our delegation. Most are eating a little later because it is more consistent with their schedules today. The air is quite dusty and some of us have scratchy throats.

Suttmeier tells me that he has talked to Yang Ch'eng-chung about the method of obtaining approval for their planned heavy ion accelerator. After submission to the section covering physics in the Chinese Academy of Sciences they convened a national Ad Hoc Committee to review the proposal. This Committee is composed of physicists (from institutes and universities), engineers, representatives of industry and a representative from the Science and Technology Committee of Kansu Province.

I return to my room, soon go down to the lobby preparatory to my ride to the Institute of Modern Physics to give my talk this morning.

I learn that my departure time is 8:20 a.m., rather than 8 a.m. as Yang suggested yesterday, so I return to my room for a while. I also learn that Stein's visit to the Academy of the Lanchow Chemical Industry Corporation will be this afternoon rather than this morning.

I meet Yang Ch'eng-chung at 8:20 a.m., ride with him to the Institute of Modern Physics.

Ch'ien Jen-yuan and Yin Chung-li follow in another car. Yang tells me his Institute will take graduate students this fall, chosen according to the regular national and then local examination system. He confirms the method, described to me by Suttmeier, for obtaining the Heavy Ion Accelerator at his Institute, says he had to "fight" for it.

I see the White Pagoda (built about 200 years ago) on the very top of the mountain (hill) across the Yellow River. Below it there are a number of adobe dwellings clinging to the side of the cliff. We pass the first bridges built over the Yellow River (built about 200 years ago, perhaps with iron imported from the United Kingdom).

Yang tells me that besides the six nuclear physicists in the Chinese delegation to the United States there will be five plasma physicists plus an interpreter.

As we drive through Lanchow with its adobe dwellings, brick buildings, etc., I am reminded of the U.S. city of Albuquerque.

We arrive at the Institute of Modern Physics at 8:40 a.m. We go to the reception room on the second floor of the Administration Building (the same place as yesterday). Here I meet Professor Hsu Kung-ngou, theoretical nuclear physicist from Lanchow University which is located near here (about one kilometer away).

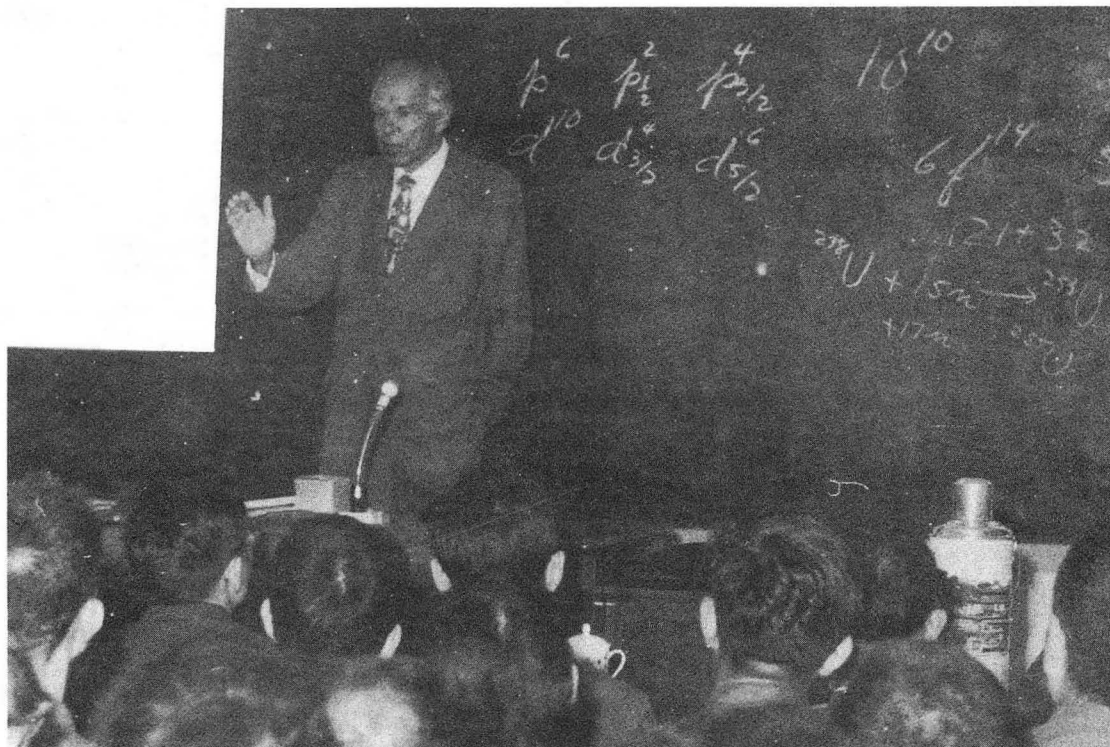
Here we have our green tea and chat while my slides are being put into the projector in the conference room on the third floor. At 9 a.m. we go up to the conference room. It is full with about 90 people, about ten of them women. Yang introduces me in some detail and I give my talk on "Transuranium and Superheavy Elements," illustrated with 42 slides, and translated by Tai Kuang-hsi, assisted by Ch'ien Jen-yuan. I begin with an expression of pleasure at being in Lanchow, show them my "periodic table" necktie and suggest this might help them follow my talk.

I talk for two hours, drinking much green tea during the translation because it is moderately hot today. During my talk I invite members of the audience to come to LBL to help us find the superheavy elements. After my talk I answer questions for about a half hour. The questions are on (1) Dubna's report of the discovery of element 107 [I describe criteria for discovery of new elements, say it does not meet them]; (2) Are we optimistic or pessimistic about discovering superheavy elements? [I describe my \$100 bet with Al Ghiorso, explain why he cannot win it]; (3) What chemical methods do we use? [I describe our CuS, bromide complexation and volatility methods]; (4) Status of Ghiorso's SASSY apparatus [I say we have not had sufficient funds to build it yet, one of the bad effects of our "Gang of Four"]; (5) What equipment do I suggest for their radiochemists? [I suggest alpha, spontaneous fission, gamma detection apparatus, mention computerized method of gamma ray detection, say I will send them a copy of our gamma ray table, etc.]; (6) What is the speed of our chemical separation compared to GSI? [I say we use simple chemistry, being a "poor country" we cannot afford sophisticated fast chemistry apparatus like they have at GSI.]. My references to our "Gang of Four" and our being a "poor country" evoke gales of laughter.

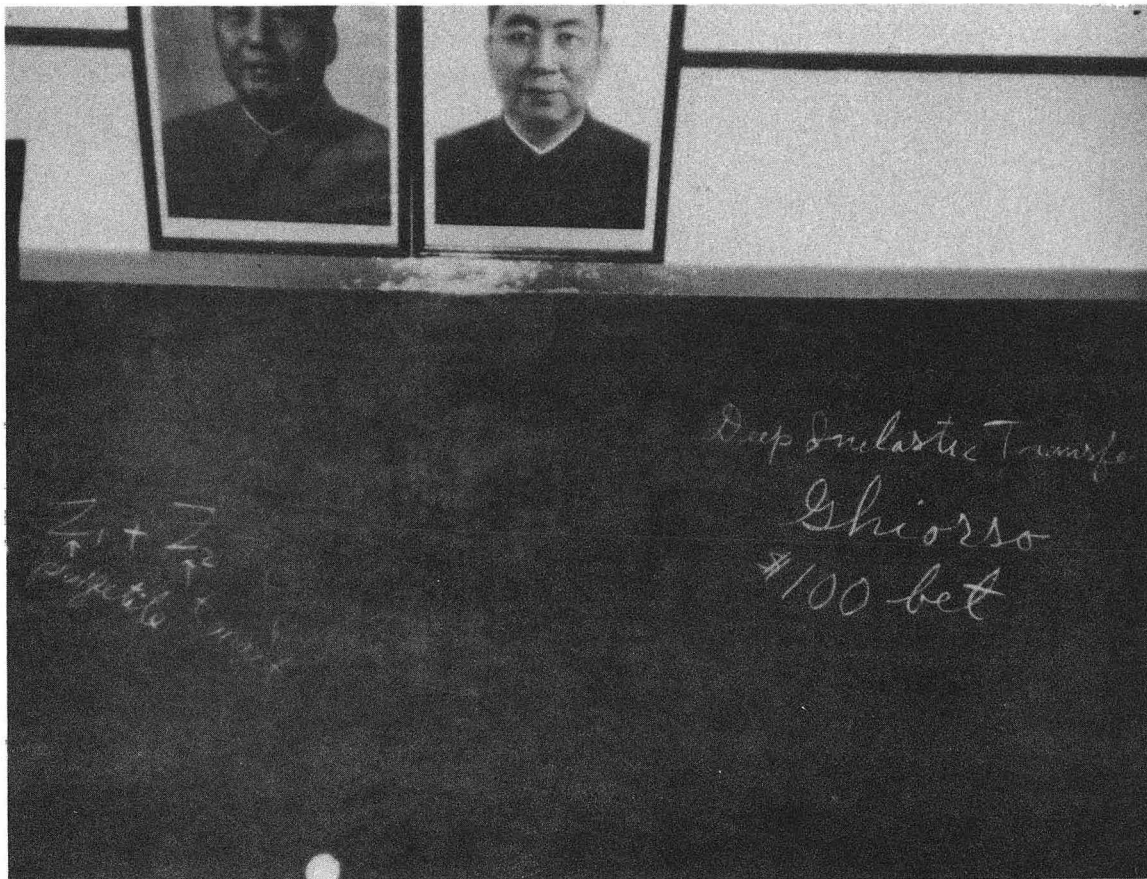
After my talk I return with Yang, Hsu, Ch'ien and Yin to the reception room for a while. Yang tells me he will not be present for my talk this afternoon. My host will be Wu En-chiu, Section Chief for Nuclear Physics. Wang needs to prepare for his visit to the U.S. because he leaves The People's Republic of China next Tuesday. He has delayed his departure to help play host to our delegation. He will be on the same plane as our delegation for the flight to Peking on Saturday evening.

I ride back to the Friendship Hotel with Ch'ien Jen-yuan, arrive a little after noon.

I soon join the members of our delegation for lunch in the second floor restaurant. Bigeleisen tells me that he has been asked to speak on Isotope Chemistry rather than Methods of Isotope



Seaborg lecture, Institute of Modern Physics, Lanchow, June 9, 1978.



Blackboard at Seaborg lecture, Institute of Modern Physics,
Lanchow, June 9, 1978.

Separation at his lecture at the Institute of Chemical Physics this afternoon. Lee and Suttmeier tell me they climbed the hill to the White Pagoda this morning. I express hope I can have the opportunity to do it this afternoon.

After lunch I return to my room for awhile to go over my slides for my talk on "Mechanisms of Heavy Ion Reactions" at the Institute of Modern Physics this afternoon.

At about 1:45 p.m. I go down to the lobby to meet Wu En-chiu, Section Chief for Nuclear Physics at the Institute of Modern Physics, who will escort me to the Institute this afternoon.

I ride with Wu En-chiu and Chu Yung-t'ai and arrive a little after 2 p.m. Yin Chung-li follows in another car, joins us at the Institute. We again go to the reception room on the second floor of the Administration Building. We talk while my slides are being put in the projector in the lecture hall on the third floor. I learn from Wu that the Institute working hours are 7:30 a.m. to 12 noon and 2:30 p.m. to 5:30 p.m., six days a week. I have a look at the site where they are going to build their heavy ion accelerator.

At 2:30 p.m. we go up to the lecture hall which again is full with about 90 to 100 people. The audience claps as we enter. Wu gives me a short introduction, then I give my talk on "Mechanism of Heavy Ion Reactions," illustrated with 35 slides. Chu serves as my interpreter. I talk for 1½ hours, drinking green tea from a continually replenished cup during the intervals Chu is translating.

After my talk I answer questions for about a half hour. The questions are on (1) Dependence of charge dispersion on mass number [I emphasize the dependence on excitation energy]; (2) Reason why 8 GeV $^{20}\text{Ne} + ^{181}\text{Ta}$ behaves like 5.7 GeV protons plus ^{181}Ta rather than 340 MeV protons plus ^{181}Ta [I refer to the importance of collective effect of total nucleons in the projectile]; (3) Any evidence for shock waves? [not yet]; (4) Is it necessary to measure half-life as well as energy of gamma ray? [yes]; (5) Can forward/backward recoil ratios be measured? [yes]; (6) Do we measure ratios of isomer yields? [yes, and I give the questioner a reprint showing some such results]; (7) Do we have any new results on the deep inelastic transfer reaction? [yes, for example in the $^{40}\text{Ar} + \text{U}$ reaction by measuring recoil ranges and angular distribution]; (8) Purpose of studying relativistic heavy ion reactions [to increase understanding of the nucleus and as a possible entry to controlled thermonuclear reactions].

During the question and answer period I give the questioners some reprints of the work of my LBL research group. I also amuse some of those sitting in front near me by giving them some Lawrence Hall of Science bimetallic elements and showing them how to make them jump. I also give them a number of LHS postcards with pictures of the first cyclotron and the Lawrence Hall of Science.

A number of these questions are asked by Li Wen-hsin, the radiochemist I met yesterday who showed me the work on the separation of Am, Cm, Cf, etc., by ion exchange and elution, and the mass yield distribution from $^{12}\text{C}+\text{Au}$, Bi, U (for which he gave me mass distribution curves).

After my talk, to my delight, Wu En-chiu, Chu Yung-t'ai and I, followed by Yin Chung-li, ride to Ba Ta (White Pagoda) Park in order to climb the mountain to the Ba Ta (White Pagoda). To get there we cross the Huang Ho (Yellow River) on the narrow, traffic laden, first bridge.

Wu, Chu, Yin and I climb the steps and follow the path through Ba Ta Park to the top of Ba Ta Mountain where the Pagoda is located. This is on the north side of the Yellow River. Here we have an excellent view of Lanchow, which stretches east and west as a corridor on the south side of the Yellow River. Lanchow itself stretches about 30 kilometers; together with its suburbs it stretches a distance of 60 kilometers. Looking south to the other side of Lanchow we see Gao Lan Mountain.

The Academy of Lanchow Chemical Industry Corporation and the Lanchow Institute of Petroleum Research are in the western part of the city, the opposite direction from the location of the Institute of Chemical Physics and Institute of Modern Physics.

On White Pagoda Mountain we meet a group of about a dozen middle school boys who have just finished the half day of outside work that is required of them each week. I ask them what is their favorite subjects in school, and this time the answer is mathematics, chemistry and physics. On the way down we meet a number of school children. When I say Ni Hao (you well) (which means "hello") they are delighted and respond.

I ride back to the hotel with Wu and Chu, followed by Yin, arriving a little after 5:30 p.m. I say good-bye to Wu and Chu, who are almost emotional in their reaction to this.

I go up to my suite for a while, then meet the members of our delegation in the lobby. Tonight our delegation members are to have a dinner alone and this has been arranged at the Lanchow Restaurant on the east side of town. At about 6:30 p.m. we ride to the restaurant in four cars. The people in front of the restaurant are very curious and as we enter we are greeted at the door by the chief chef.

We go up to the third floor of this large restaurant, with all the waiters, waitresses and customers staring at us in a most friendly manner. We are told that we are the first foreigners to eat in a restaurant in Lanchow outside of the hotels.

We have an excellent meal (which costs us 5 yuan each). Toward the end of the meal Baldeschwieler makes a little speech



View of Lanchow looking southeast, June 9, 1978.

and some mock presentations in the format we have been using to make presentations to our hosts at our various stops. He presents Schriesheim with a pen and pencil set (out of the huge supply Schriesheim brought with him to China for gifts that were never used). He presents me with a battery charger, as a "unique" gift, as I have been saying when I present Lawrence Hall of Science "accelerator forests," Ibers with a set of tapes for his report writing, and pen and pencil sets to Larson, Ibers and Wei, and a set of stamps to Geyer. Several of our delegation make little speeches and I finally make a few remarks expressing satisfaction with our visit to The People's Republic of China, which is accomplishing its mission, and saying I believe our group has been very compatible, has done its work well, and will produce a good and useful report.

When we emerge from the front of the restaurant at about 8:30 p.m. we find that a crowd of some 600 people, more than half of them children, has gathered to see us upon departure. Yuan Lee talks to the children and makes a big hit. The response of this crowd to seeing us is an emotional experience for all of us. Obviously we are a strange species to them. They are very very friendly.

We ride back to the Friendship Hotel, soon gather in Baldeschwieler's suite to further plan our report (all except Yuan Lee, who is having a discussion with Yin Yuan-ken). We decide to include an appendix with a report on each (or most) of the 45 institutions (research institutes, universities, industrial laboratories, etc.) that we have visited, in addition to the main section to be written in a topical fashion. The meeting breaks up at about 10:30 p.m.

I retire at about 11:30 p.m.



Crowd in front of Lanchow Restaurant, June 9, 1978.

Saturday, June 10, 1978 - Lanchow, Peking

I arise at about 6:15 a.m. The weather is somewhat cloudy.

Today all of our delegation, except Ibers and Schriesheim (who will have talks in the hotel with Yin Yuan-ken) will visit the Liuchiahsia Hydroelectric Power Station in Liuchiahsia Gorge to see the large hydroelectric power plant (about seventy kilometers from here). This plant has a capacity of 1,300,000 kilowatts.

At breakfast Bigeleisen tells me that Shen Sung-ch'ang (Deputy Director of the Institute of Chemical Physics) told him yesterday that work on isotope separation using lasers (for lithium isotopes) is going on at the Salt Lake Institute in Tsinghai Province (several hundred kilometers from here).

We leave the hotel in our caravan of cars at a little after 7:30 a.m. I ride in the first car with Ch'ien Jen-yuan and Yin Chung-li. In the following five cars are the members of our delegation (except Ibers and Schriesheim), Ms. Hu, Shih, Shih and Liu San-ming (staff, Science and Technology Committee, Kansu Province), Jiao Jian-min (staff, Foreign Relations Bureau, Kansu Province), and Yu Chih-ying (Director of the Institute of Petroleum Research).

We drive west, pass the Academy of the Lanchow Chemical Industrial Corporation and near the Institute of Petroleum Research, on the way. We soon turn south and head into the mountains driving through a long canyon on a narrow winding paved, but bumpy road. Ch'ien asks me to convey his thanks to Luberoff for sending him copies of the American Chemical Society journal, "Chem Tech." He observes that our visit to the People's Republic of China is nearly at an end and asks if I can summarize my impressions. I express a generally favorable reaction. I say they are, as they have so often told us, in a catching up phase so there is not yet so much innovative research. I say there is much variation in quality among their Research Institutes - some are certainly very good. Overall they compare favorably with those in the Soviet Union. I single out a few Research Institutes for special commendation and mention some fields of chemical research that especially need strengthening. Generally speaking their scientists are well informed on worldwide scientific literature. I suggest that an exchange of journals be arranged with Chemical Abstracts and say I will ask Dale Baker of Chemical Abstracts to correspond with Hu Ya-tung of the Peking Institute of Chemistry about this (I offer to send subscriptions of *Science News* to various places and Ch'ien suggests I pick the list from places we have visited.) I suggest that their institute system has the deficiency that there is not a sufficient coordination with universities in the graduate education program. Also the exchange of information between institutes in various parts of the country needs to be improved.

The weather clears up somewhat as we approach our destination. There are many adobe dwellings on the hillsides and some right in the hillsides (caves). Ch'ien tells me that in former days many more people lived in these "caves," which are warm in the winter and cool in the summer.

The canyon broadens into a valley and the surrounding hills get smaller. Power lines have come into view. We ride into a broad area of large agricultural fields.

Ch'ien tells me the site of the power plant is governed by an autonomous state, Lin Sha, consisting of Tsan, a Moslem people; this is also a part of the Kansu Province.

At a little after 9 a.m. we arrive at a village of adobe dwellings, Siao Chuan (also known as the Liuchiahsia Commune) in Yungching County, which is our destination. We are greeted by Wei K'o-chian, Vice Chairman of the Revolutionary Committee of the Liuchiahsia Hydroelectric Power Station and Li Wen-chung, chief engineer at the station.

We go up to the second floor of a building (which is a dormitory as well as, apparently, the headquarters for the station) to a reception room. (Suttemeier tells me one of the cars in our caravan broke down soon after we entered the canyon and Ms. Hu stayed there with it; however, she joins us soon.)

We are served green tea, extended a welcome, then Wei gives a briefing on the Power Station. It was built under the direction of Chairman Mao's teaching that the Yellow River be both tamed and have its energy made available. The station is for the generation of electricity and the prevention of floods. (There are three gorges with individual electric power stations in Kansu Province.) All design and construction was done by themselves. The height of the dam is 140 meters and the length is 840 meters. The capacity of the reservoir is 5.7 billion cubic meters. There are five generators, three with a capacity of 225,000 kilowatts, one with a capacity of 250,000 kilowatts and one with a capacity of 300,000 kilowatts. This output is larger than the total output of the People's Republic of China before Liberation.

The construction started in 1964 and in 1969 the first generator started operation and by 1974 all five generators were in operation. The cost of the electricity is 0.3 Chinese cents per kilowatt-hour. This includes the amortization of construction costs of 630,000,000 yuan over a period of 100 years. They have already recovered 1.6 billion yuan. Our delegation members have a discussion trying to understand the basis for amortization, etc.

Another power plant was built on the Yellow river and put into operation in 1962 with a capacity of 360,000 kilowatts.

Wei rides with me in our car through a long, then a short, tunnel to the down stream side of the electric power station. We

walk into the huge, high ceilinged room that contains the five generators, of which only three are running now due to the low water level. (The generators were made in Harbin.)

We walk down three or four stories below ground level to see one of the large rotors turning, then up a story to see the power lines conveying the electricity, then back up to ground level to see the Central Control Room. A girl sits here with nothing to do except watch the dials and circuit breakers. Four others (two girls and two men) are standing by. Four of the output lines have a voltage of 220,000 volts and one 330,000 volts, stepped up from the 15,750 volts output voltage. The 330,000 volt line goes to Shensi Province, two of the others to Lanchow, and two to Sining. They generate no D.C. current. Here the members of our Delegation ask numerous detailed questions about the operation, output, controls, etc., making references to the flow diagram, with colored lines and colored lights, on the wall facing the control panel with its various switches.

Next we visit the room for switching with its huge insulators.

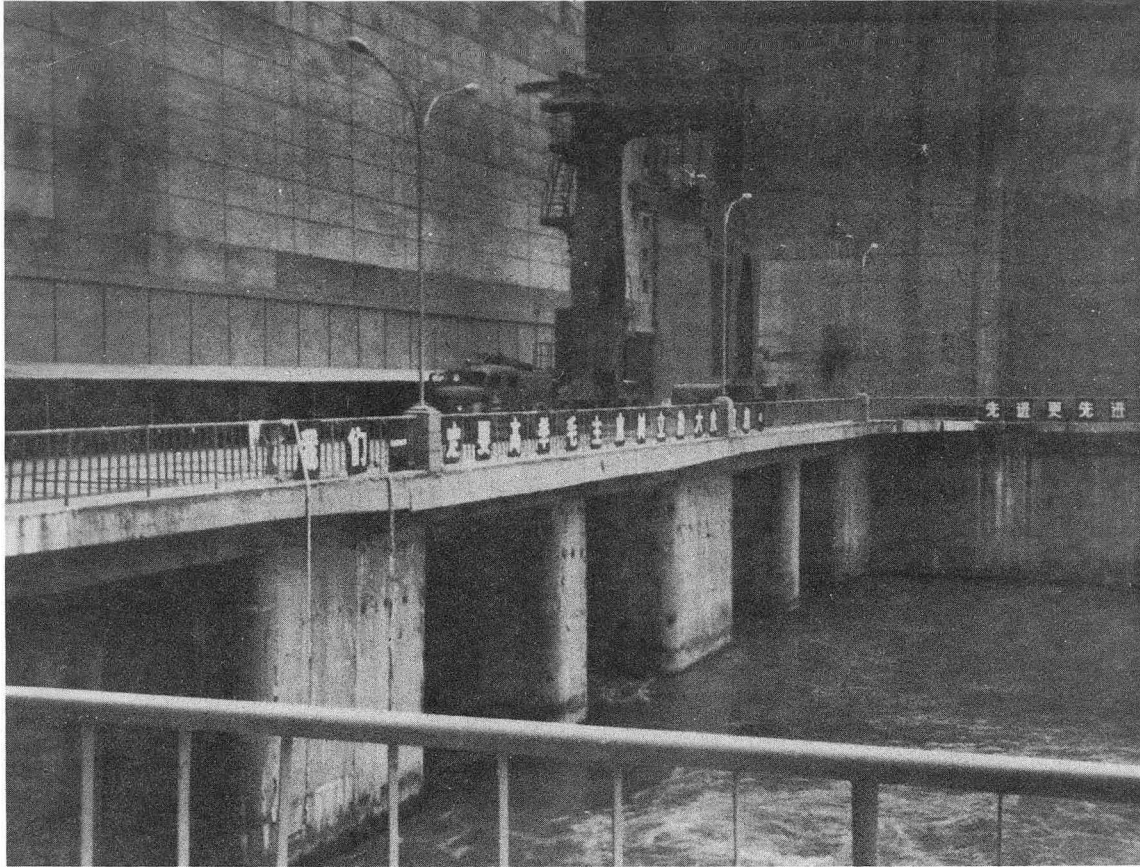
From the opposite end of the huge generator hall we walk down about three or four stories (ten flights of stairs) to the level of the 330,000 kilowatt line, with its huge insulators. This hall is 240 meters long and thirty meters high. (The power line emerges through a tunnel 400 meters long, then goes on to Shensi Province.) This hall lies under the bed of the Yellow River.

We now return to our cars and I ride with Wei and Ch'ien back to Kiao Chuan (Liuchiahsia Commune) to have our lunch. We ride through the Liuchiahsia Gorge along the side of the Yellow River, a picturesque ride.

We have lunch at 11 a.m. in a room on the second floor of the Administration Building with our hosts Wei and Li. Wei serves us with the chopsticks he is using to eat his lunch. The meal includes fish caught yesterday in the Yellow River.

After lunch we ride back to the Hydroelectric Power Station, ride the elevator up to the top of the dam. After drinking in the various views from the top of the dam we climb a long series of steps down to a boat on the reservoir. We enter the cabin cruiser motor boat for a cruise on the reservoir. (The level of the reservoir is quite low.) Green tea is served and, as usual, cigarettes are offered.

We go up on the deck, bask in the sunshine as we cruise along. Suttmeier tells me of his interest in the history of nuclear power in Japan, which leads me to tell him about my "Travels in the New World," Volumes I, II, and III. I promise to send him a set of these.



View of Yellow River dam at Luichiahsia Hydroelectric Power Station, near Lanchow, June 10, 1978.

We finish our boat ride at about 1:30 p.m., walk back to the top of the dam.

As we are saying goodbye to Wei I present him with an Eisenhower silver dollar (courtesy of Baldeschwieler) and ACS and Priestley Centennial First Day Covers.

We depart at about 1:45 p.m. for our return to Lanchow. We ride as we came, I in the car with Ch'ien and Yin. We ride back to Lanchow along the same long, rough, winding road.

Ch'ien and I continue our conversation concerning my impressions of our visit. I say that the People's Republic of China is strong in polymer research, research on catalysis and gas chromatography, needs improvement in synthetic organic and inorganic chemistry. Ch'ien wonders if the way will be cleared for the People's Republic of China to join IUPAC by the removal of Taiwan; I express doubt that this will happen very soon. I tell him about my idea for an International Chemical Society and he seems interested. We discuss the next steps to be taken to further cooperation in chemistry between the United States and the People's Republic of China. I suggest the best plan might be for initiative to come from the chemists in the People's Republic of China; as an example the first step might be to have joint symposia on special topics. Ch'ien says this is a good idea and he will explore with the Chinese Academy of Sciences whether they can take the initiative. To go so far as the exchange of graduate students or exchange of longer visits to conduct research work will be more difficult and might not be possible before "normalization of relations." However, he does not think it would be counterproductive for us to make such proposals in our report.

We reach the western edge of Lanchow, turn right and head into town driving through the industrial districts. It is quite dusty with some air pollution. There are many factories on the western side of town. (Perhaps this is where the gaseous diffusion uranium enrichment plant is located.)

We arrive back at the hotel at about 3:15 p.m., go to our rooms to pack, etc., preparatory to departure for Peking.

At about 4 p.m. a young man from the Institute of Modern Physics knocks on my door, returns the box of slides that I used for my talk yesterday afternoon. In a few minutes Yin Yuan-ken and Ms. Liu Chia-wen (secretary of the Institute of Modern Physics) come by. Yin gives me an envelope of photographs taken during our visit to the Institute of Chemical Physics on Thursday morning and a number of reprints. Ms. Liu gives me an envelope of photographs taken during our visit to the Institute of Modern Physics Thursday afternoon.

We assemble in the lobby a little after 4 p.m., present our hosts with a few gifts. We present an ACS Centennial T-shirt to Liu Chi-shun.

We ride to the Lanchow Airport in our caravan of cars, I in the first car with Yin Chung-li and Ch'ien Jen-yuan. The airport is far out on the northwest side of town, 70 kilometers, made necessary to avoid the hills of the long narrow valley. I present Yin with an ACS Centennial T-shirt and my driver, Ke Chen-chung with a Kennedy half dollar.

Our travelling group of fifteen arrives at the airport at about 5:30 p.m. With us to see us off are Yin Yuan-ken, Yu Chih-ying, Ch'en Hsin-hua, Liu San-ming, Liu Chi-shun, in addition to Yin Chung-li. Yin Yuan-ken asks to be remembered to Gabor Somorjai, Norman Phillips and Sheila Saxby.

Yang Ch'eng-chung also arrives at the airport. He will travel to Peking with us preparatory to leaving for the United States on Tuesday, traveling via Paris. He will be a member of the twelve-member Nuclear Physics-Plasma Physics Delegation of which the six nuclear physics members will attend the Gordon Conference on Nuclear Chemistry in New Hampshire, June 19-22; they will visit Berkeley at the end of their trip in about a month. Mrs. Yang is at the airport to see him off which gives me the opportunity to meet her.

In the course of my conversation with Yang he confirms the location of their Gaseous Diffusion Uranium Enrichment plant as somewhere in Lanchow. It is of modest size. Construction started in 1956 with assistance from the Soviet Union; and, when the Soviet Union withdrew its aid to China in 1960, the Chinese completed the construction themselves.

We board China Airlines flight number 124, again a tightly packed British "trident," which leaves at about 6:30 p.m. I sit next to Yang and we continue our conversation. He tells me the first nuclear research laboratory in China was established as the Institute of Modern Physics in Peking, at a location near the Palace (Forbidden City), in 1950. He joined this when he returned from Liverpool in 1951. This laboratory was split into three institutes in the 1956-57 period, first the Institute of Atomic Energy near Peking, then the Institute of Modern Physics in Lanchow and finally the Institute of Nuclear Research near Shanghai. Yang moved to Lanchow in 1957 to plan the Institute of Modern Physics from the beginning, and the time until 1963 was largely confined to planning for and building the laboratories and facilities.

Yang also tells me the story of John Foster Dulles, who, in talking to a group of Chinese including Chou En-lai and General and Foreign Minister Chen-yi, at the meeting on disarmament in Geneva in 1954, said that the United States will not recognize the People's Republic of China until it acquires the capability to make atomic bombs.

We arrive at Peking Airport at about 8:30 p.m., are met by Li Ming-te, Hu, Ya-tung, Teng Shao-lin, Ms. Ts'ao Hsuan-hsuan and

Stephen M. Horner (U.S. Liaison Office in Peking). We wait for the arrival of our luggage, then ride in our caravan of cars to the Peking Hotel. Baldeschieler and I ride in the first car with Ch'ien Jen-yuan.

As we ride along the familiar, long straight airport road we note again that we ride without any car lights; the car lights are turned on each time a bicycle or other vehicle is met or passed.

We arrive at the Peking Hotel at a little after 9 p.m. Here we are met by Pat Tsuchitani who arrived in Peking a couple of days ago as escort for the U.S. Rural Health Systems Delegation, and by my friend Ms. Chang Hsiao-hsiao.

There is some confusion and wait before we are assigned our rooms on the fourth floor. I am in room 4014. We are offered the opportunity to have dinner but no one feels so inclined. I meet Jimmie Wei's sister and her two daughters and his cousin, who has had the position of sister in his family.

We learn that, in response to the request we made before we left Peking to start our travels around China, a "wrap-up" session has been planned in order to give us the opportunities to summarize our impressions for our hosts. Baldeschieler and I decide to represent our delegation. We go up to the reception room on the tenth floor and meet our hosts, Li Su, who serves as their spokesman, Liu Ta-kang, Ch'ien Jen-yuan, Hu Ya-tung, Feng Yin-fu, Li Ming-te, who serves as interpreter, Ms. Ts'ao Hsuan-hsuan, Teng Shao-lin, Shih Liang-ho, Pat Tsuchitani, Ms. Chang Hsiao-hsiao and others.

After some opening plesantries I try to summarize our observations and recommendations, but I emphasize that these will be only preliminary and rough and that we will write a complete report of which they will receive copies. I say that we have visited forty-five different installations, have found variability in the quality of the work. Our overall impression is favorable. The research in Chinese Research Institutes compares favorably with that which Baldeschieler and I have seen in our rather extensive visits to Research Institutes during our broad travels in the Soviet Union.

I say that we have found that the emphasis is on applied rather than basic research. It is perhaps not too meaningful to try to single out the fields where research of the highest quality is carried out - I do mention polymer science, chemistry of catalysis, gas chromatography, the oil shale operation (which I say is unique in the world). Baldeschieler adds the fields of chemistry of natural products and transfer RNA synthesis. During the subsequent discussion we identify these as areas where expanded collaboration in chemistry might start, and I add the field of radiochemical investigation of heavy ion reactions as particularly interesting to me when they have put their new heavy ion accelerator into operation.

I go on to point out as a weakness the poor coordination of their research institutes with their universities in the graduate education process. I also say we have detected some inadequacy of communication between the Research Institutes in various parts of their country.

I also identify as a problem, but more easily capable of being corrected, the inadequate coverage of Chinese chemical literature by Chemical Abstracts. I say this can easily be corrected by having an arrangement with Chemical Abstracts for the exchange of Chinese and U.S. journals, and I say I will have the Chemical Abstracts people contact them (perhaps Hu Ya-tung) about this.

I suggest we should now consider the next step for expanded cooperation, suggest a feasible first step might be joint (bilateral) symposia on selected subjects to be held in our two countries. Extended visits which research could be performed and exchange of graduate students could logically follow later.

I reiterate that we have met many bright, highly motivated young people and that the knowledge of Chinese scientists of the worldwide scientific literature is good.

I emphasize the widespread desire of chemists in the United States to cooperate and collaborate with their chemist colleagues in the People's Republic of China.

Li Su responds with an expression of appreciation, recounts some of the history of what has led to present emphasis in China on applied research, says the Chinese Academy of Sciences will consider our recommendations very carefully.

As a final word I invite them to send representatives to the Pacific Chemical Congress - the joint meeting of the American Chemical Society, the Chemical Society of Japan and other Pacific (Australia, New Zealand) Basin countries, to be held in Honolulu during April of next year. Li Su asks me to send him further information on this which I promise to do.

Our meeting breaks up at a little after 11 p.m.

Soon after I return to my room there is a light knock on my door. Ms. Ts'ao Hsuan-hsuan and Ms. Chang Hsiao-hsiao come in at my invitation, present me with a gift from Liu Ta-kung, Director of the Peking Institute of Chemistry. They ask me to pass on to Baldeschwieler a similar gift from Liu. I use this occasion to present Ms. Ts'ao and Ms. Chang each with a gift of a book as a token of appreciation for all their help. They offer to mail to me in Lafayette, California, the large box of candy presented to me by T'ang Ao-ch'ing in Changchun because it is too large to fit in the limited space in my luggage.

I spend some time rearranging the contents of my luggage, somehow manage to pack everything into it.

I retire about midnight.

Sunday, June 11, 1978 - Peking, Seattle, Los Angeles, San Francisco

Today our visit to the People's Republic of China comes to an end and all of us, except Yuan Lee (who will remain until tomorrow), start our journey back to the United States.

I arise at about 7 a.m., go down to the dining room on the second floor to have breakfast with the members of our Delegation. The members of the U.S. Rural Health Systems Delegation are having breakfast at a neighboring table and I go by to talk with them. They will visit the Great Wall today, then leave Peking by overnight train tonight to go to their next destination.

After the Rural Health Systems Delegation finishes their breakfast, Pat Tsuchitani joins us; she will not accompany the delegation on their visit to the Great Wall.

After breakfast Ms. Chang comes by my room, presents me with a hand-made leather case for my sun glasses with likenesses of the Summer Palace on the sides.

Members of our Delegation pool our remaining gifts to be presented to our hosts, especially the four who have travelled so much with us. I contribute my remaining three ACS Centennial T-shirts and two ACS Centennial ties and some other small items.

We soon assemble in front of the hotel. Here I meet Dr. G. A. and Mrs. Hambraeus (he is Executive Director, Swedish Royal Academy of Engineering Sciences), and Rudy Scheidt, Berkeley 1943 (a chemistry and physics student I knew and to whom I offered a job at Chicago in 1943).

We depart at 8:30 a.m. in our cars for our scheduled visit to the Mao Mausoleum on the way to the airport. I ride in the first car with Yuan Lee and Ms. Chang. When we arrive at Tien An Men Square, we see a huge crowd, perhaps as many as a thousand people, including many PLA, lined up in mass formation to get their turns to see Chairman Mao in the mausoleum building.

We are given a place near the front in the huge line of people, march four abreast slowly up the steps to enter the mausoleum building at the front side (the side facing Tien An Men Square). We first enter a large high ceilinged hall dominated by an immense white marble figure of a seated Chairman Mao. The walls are lined with huge bonsai pots each containing a five-foot high, nicely-shaped, green tree. The line divides here, two proceeding to the left and two to the right to go around the Mao figure and to reconverge on the back side in the second large room where Chairman Mao lies in his bier. The two lines file slowly past on each side. The Chairman is dressed in a gray Mao jacket with the lower half of his body covered with a red blanket. He is well preserved and presents a good likeness to his pictures.



Mao Mausoleum, Tien An Men (Red) Square, Peking,
June 11, 1978.

We emerge on the opposite side of the mausoleum building, where we see large crowds of people, most of whom have recently emerged from their walk through the mausoleum building.

We now depart for the Peking Airport, I in the first car with Bob Geyer and Ms. Chang. Ms. Chang tells me she tried to buy me another Chinese necktie while I was away but could not find any. She tried to persuade her mother to allow her to present me with one of her late father's neckties, with a picture of a dragon on it, but her mother would not agree. She says she has enjoyed helping me during my visit, more than any other guest whom she has helped, and hopes I will visit China again so she can help me again. I express my deep appreciation for all her help, invite her to visit the United States.

We arrive at the Peking Airport at about 9:45 a.m. Here to see us off are Liu Ta-kang, Ch'ien Jen-yuan, Hsu Mao, Li Ming-te, Hu Ya-tung, Shih Liang-ho, Shi Wei-ming, Teng Shao-lin, Ms. Hu Feng-hsien, Ms. Ts'ao Hsuan-hsuan, Ms. Chang Hsiao-hsiao, Jimmie Wei's sister and her daughter.

I make presentations of packages of gifts to each of our four travelling hosts - Ch'ien Jen-yuan, Shih Liang-ho, Shih Wei-ming and Ms. Hu Feng-hsien, and to Ms. Ts'ao Hsuan-hsuan and Ms. Chang Hsiao-hsiao (in the latter case a picture book of San Francisco).

We say fond goodbyes to our hosts, and then the ten members of our Delegation - Baldeschwieler, Bigeleisen, Geyer, Ibers, Larson, Schriesheim, Stein, Suttmeier, Wei and I - board Iranian Airlines flight number 800, headed for Tokyo. The flight leaves approximately on schedule, at about 10:40 a.m. I learn, to my dismay, from a copy of the Herald Tribune on board the plane, that Proposition 13 passed in California on June 6.

We arrive at Tokyo Narita Airport at about 3:40 p.m. The Narita Airport is finally open and operating. Those of us who are going on via Pan American Airlines make our way to Satellite Number 3. Baldeschwieler and I are flying to Los Angeles, and I on to San Francisco, while Bigeleisen, Wei and Schriesheim are flying to New York, Larson to Hong Kong.

I meet Elliott A. Kearsley, Senior Scientist, who is completing a tour of duty in the American Embassy in Tokyo.

Our flight, Pan American flight number 2, due to leave at 7:30 p.m., is apparently late. During my wait I take the opportunity to summarize some of my observations and thoughts. My first thoughts are to make comparisons with my visit here five years ago.

The most apparent difference, of course, results from the overthrow of the "Gang of Four" and the complete termination

of the "Cultural Revolution." When Helen and I were here five years ago, there was much talk about the end of the Cultural Revolution in the sense that universities and colleges were apparently being reopened; and there was even talk of the start again of graduate education. Apparently this was a false hope and there was a setback extending into 1974-76, due to the actions of the "Gang of Four" - Chiang Ch'ing, the wife of Mao Tse-tung who was manipulating him by taking advantage of his ill health and infirmities, Chang Chun-chiao, Yao Wen-yuan and Wang Hung-wen. For example, Chou Pei-yuan told me that, after his return home from his visit to the United States in 1975, and especially after the death of Premier Chou En-lai in January, 1976, he had a very difficult time. This apparently lasted until the death of Chairman Mao Tse-tung in September, 1976, after which the "Gang of Four" was overthrown.

Our Delegation has made its visit at a propitious time from the point of view of the real changes that have occurred and are occurring following the "overthrow." No longer do the academic people pay lip service to the process of admitting that they need to reform and bring their lives more into conformance with the thoughts of Chairman Mao by spending time with the people in factories and in the fields and in frequent political study meetings. They still claim to be guided by the precepts of Chairman Mao, but all of them refer with satisfaction to the overthrow of the "Gang of Four" and the consequent return to reason in the academic world. Every briefing at the start of our welcoming sessions made reference to conditions before and after the "overthrow." This was apparently in conformance with the government's desire to emphasize the evils of the "Gang of Four" but one could not help get the feeling it was somewhat overdone. There is universal acclaim for the re-institution of entrance examinations at the undergraduate and graduate level. All the representatives of the universities we visited told us they are starting to take advantage of the national entrance examination; and all the major universities and research institutes are now starting to admit graduate students, on the basis of the national examination augmented by additional local examination. And there was implicit indication of satisfaction that it is no longer necessary to waste precious time working in factories and fields.

An important consequence of this reform is the new turn toward basic research. In our welcoming briefing sessions we were nearly always told that emphasis on applied research was, of course, necessary during the first years following Liberation but this would normally have been followed by a turn to basic research in the 1960's had this natural course of events not been interrupted by the Cultural Revolution and/or the "Gang of Four." In a number of instances there were references to the withdrawal of Soviet aid in 1960, making it necessary to stay with applied and delay the introduction of basic research. If, as a result, applied research is neglected in favor of basic research one might expect that China would turn more toward licensing technologies from outside.

The twelve members of our Delegation in Pure and Applied Chemistry have visited all, or in groups or pairs or individually, of a total of forty-five institutions - research institutes, universities, colleges, refineries, factories, etc. Consequently we have observed a broad spectrum of activities and a broad range in the quality of work. We have, of course, been circumscribed in our observations by the itineraries, places and people made available to us by our hosts. Thus our conclusions are subject to the caveat that they are limited by the small cross section of activities that we had time or were allowed to engage in. For example, we did not see much in the area of interface between science and technology, did not meet too many people associated with the ministries and the governance of science and technology in big cities such as Shanghai, and did not see too many chemical manufacturing plants. Obviously, in a number of instances, there must have been somewhat sensitive work taking place on the premises that we were not allowed to see. And, of course, there are many places of greater interest than some of those we saw that we could not see due to one or the other of these limitations.

Nevertheless, I feel we have seen a pretty good cross section of chemical science and chemical engineering in the People's Republic of China. And my overall assessment of the quality of the work is generally favorable, especially for the stage of development of the country. As I told our hosts on several occasions I compare their work, on the basis of my visits to many research institutes in the Soviet Union, very favorably with that of the Soviet Union.

The emphasis has been, and still is to a large extent, on applied research. Some of the applied research is good, as in some aspects of polymer science, in gas chromatography, the chemistry of natural products, some aspects of biochemistry such as transfer RNA synthesis - there are other areas in this category and it is difficult to single out the best. Certainly noteworthy is the oil shale operation that we observed in Fushun.

I am personally very interested in the radiochemical investigation of heavy ion reactions now getting underway at the Institute of Modern Physics in Lanchow. This will be, for me, a particularly interesting area for collaboration when they have their new heavy ion accelerator in operation in the early 1980's.

There is a wide range of ability and knowledge to be found among the directors and key staff of the research institutes and universities we have visited, as there is in any country including our own. I have formed a number of opinions in this regard but shall refrain from recording such thoughts here, which may be quite subjective and not always too accurate.

It has been interesting to note the differences in attitudes and in life styles in the various parts of the country we have visited. The life style and general method of dress seem

to be most conservative in Peking. Here we see, among the members of both sexes, an almost universal adherence to the familiar gray and blue uniforms and other clothing. There seems to be very little activity after dark and no night life. Shanghai, of all the cities we visited, has the life style and dress closest to that of the "West," although still distinctly Chinese; here Huai Hai Street, for example, is full of life until about 7:30 p.m. and displays some activity later than this and there are perpetual line-ups for admission to the cinema theaters. This apparently reflects an enthusiasm of the populace for the non-political movies now being shown that were hitherto banned during the period of the "Gang of Four." (The Acrobatic Show here was fantastic but I believe this is true of other cities as well.) Many people dress colorfully in Shanghai and the young people are open in their courtship, although very proper. In the northeast we found the life style and dress intermediate between that of Shanghai and Peking. Hangchow is an extraordinary city that almost defies description - scenic, full of historical background, good climate. Sian is another extraordinary city and our specially arranged visit to the tomb of Emperor Ch'in-shih-huang, the first emperor of the Ch'in Dynasty and the first to unite China, was a rare privilege and a beautiful experience.

In some ways I found the visit to Lanchow the high point of our visit to China. In this semi-desert area Lanchow reminds me of very much of Albuquerque, New Mexico. Lanchow has not yet been "spoiled" by the entry of foreigners; and it was interesting to watch the people's reactions - very, very friendly - to the advent of this group of Americans. The children, particularly, were enthralled. Helen and I experienced this five years ago to some extent in many places, even in Peking, but in the meantime such visits have become more commonplace and the people are somewhat used to foreigners. This has not yet happened in Lanchow, where we were the first official foreign delegation to visit and the first Americans to venture beyond the protected areas of the hotels.

We found ourselves staying in tourist type hotels in most of the cities we visited, limited to foreigners, of which there were many, and guarded by PLA to keep the natives out.

As was the case five years ago, and not yet much changed by the improved situation, there is a grievous deficiency in the graduate education process because of the separation between the research institutes and the teaching universities. This will be difficult to change even with the new broad trend toward improvement in the support of basic science. As I also pointed out to our hosts, there is need for improvement in the communication between the various research institutes. This problem will be alleviated to some extent when the network of journals for scientific publications, disrupted by the "Gang of Four," becomes re-established. I also pointed out the importance of a tie-in with Chemical Abstracts and our hosts seem to appreciate this and will very probably act on it.

We have learned a good deal about the eight priority areas in their natural science plans. Although there are some apparent omissions and some surprising inclusions among the eight priority areas, it is apparent these are the result of a good deal of compromise following competing suggestions, are meant to be broadly representative, and broadly interpreted, and can cover nearly all important areas. I am especially interested in the energy item and, in this, their plans for nuclear power. Suggestions for this program are emanating from the Institute of Atomic Energy near Peking. They are suggesting the Pressurized Water Reactor (PWR) type, and China plans to build a prototype and an operating plant, and may possibly buy a large PWR from France. They also have some interest in heavy water reactors. They recognize that the high level waste disposal problem must be solved, have some ideas on how to do this. I was told that development of the breeder reactor in China is "inevitable." There also is a serious program of research on Controlled Thermonuclear Power, with a large Tokamak under construction and a special Institute planned for work in this field.

Our hosts were very helpful and worked very hard to make our visit interesting and productive. It is now the Chinese Academy of Sciences, and not the Science and Technology Association as was the case five years ago, that is responsible for playing host to visits such as ours. At least this was true for our visit and will presumably be true for the visits of other U.S. delegations in the future. This closer tie-in with the Chinese Academy of Sciences has many advantages, and it was apparent our Academy hosts were happy with their new role. Formerly, as during my visit five years ago, the leadership in sciences was in the hands of non-scientist members of Revolutionary Committees. The new National Science Policy has apparently changed this. Now scientists assume the role of administrators and decision makers.

I have renewed a number of old acquaintances and made many new friends. I am sure that contacts with many of these people will continue in the future.

I must say that our twelve-member Delegation worked very well together, travelled under many strenuous circumstances with the minimum of interpersonal friction. It was a very able Delegation, well qualified to cover the many and varied areas of chemistry and chemical engineering we observed. The group was hardworking and cheerful, interacted very well with our hosts and experienced almost no health problems. I believe that, under the general direction of John Baldeschwieler, our Deputy Chairman, it should be possible to put together a good, comprehensive report covering all the important aspects of our observations and conclusions.

The important remaining question concerns the next steps in our continuing, hopefully expanding, relationships with our

Chinese colleagues. We have suggested that the first, probably feasible, step in such an expansion should be the initiation of joint bilateral symposia to be held in our two countries. This could be followed by the exchange of visits to conduct research in the two countries and then the exchange of graduate students and more senior scientists for longer periods of time. It is our sincere hope that we can go this far along this path of program expansion without meeting the Chinese governmental requirement of "normalization" of relations between our two countries, a political process over which we scientists have little influence and whose time scale of accomplishment is so indefinite.

Baldeschwieler and I hear our names being paged, go to the Pan American desk, find we have been given seats together in the first class section of the plane.

It is now about 8:40 p.m. and they are about to call our flight, Pan American flight number 2, for boarding. It will leave about two hours late due to late arrival of the airplane from Hong Kong.

We board the plane at about 9 p.m., find our large comfortable seats in the first class section very inviting for our tired bodies. (We meet James Bonner of Caltech as we are boarding.)

After some delay in loading the huge 747 plane, we take off at about 9:30 p.m.

I try to get some sleep but the activity of serving dinner, showing movies, etc., makes this difficult until we are underway for several hours.

We cross the international date line sometime during the night; so it is still Sunday - in fact early Sunday morning. Sometime after daylight our plane captain announces over the loud speaker system that sometime during the night our plane lost its inside engine on the right side due to large scale oil leakage from it. As a consequence we have to head directly for Seattle, which is closer than our destination of Los Angeles.

We arrive at Seattle International Airport at about 2 p.m., stay there until 4 p.m. while the engine is being repaired. We then fly to Los Angeles arriving about 6 p.m. I go through customs, then find that the passengers that are scheduled to go on to San Francisco have been completely abandoned. There is no information available. I call Helen and she, also, has been unable to obtain any information. I finally reach Pan American Airlines by phone, learn that Pan Am flight number 2 to San Francisco has been cancelled and that the passengers will be put on some later flight, perhaps Pan Am flight number 812, coming in from Honolulu and due to leave Los Angeles at about 8:30 p.m.

I go to an airport cafeteria, have a bite of dinner, call Helen again to bring her up to date, then find Pan Am flight number 812 is not due to leave until 9:00 p.m.

I finally board Pan American flight number 812 which leaves about 9:30 p.m. and arrives at San Francisco International Airport at about 10:30 p.m. This means that I have been in travel status for about twenty-seven hours since I left Peking at 10:30 a.m. (Peking time) this (actually yesterday) morning. It has taken about eight hours to travel from Seattle to San Francisco.

Helen meets me at the airport and we arrive home in Lafayette at about 11:40 p.m.

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