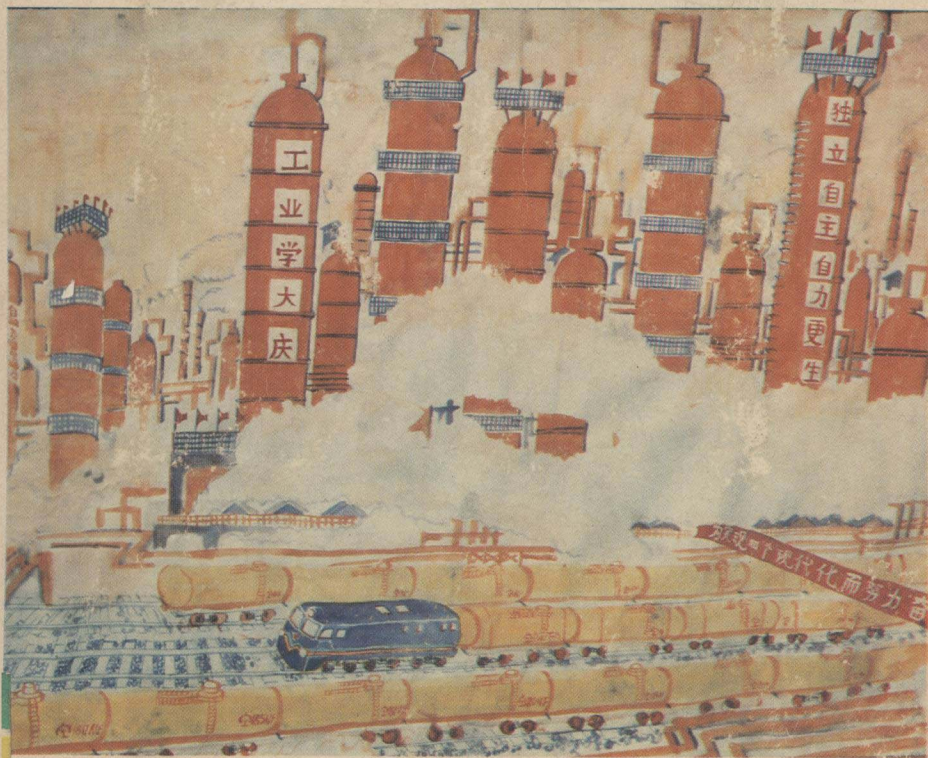


Chemistry and Chemical Engineering in the People's Republic of **CHINA**



EDITED BY JOHN D. BALDESCHWIELER

CHEMISTRY
AND
CHEMICAL
ENGINEERING
IN THE
PEOPLE'S REPUBLIC OF
CHINA

A TRIP
REPORT
OF THE U.S.
DELEGATION IN
PURE AND
APPLIED
CHEMISTRY

Edited by John D. Baldeschwieler

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Cover: A drawing exhibited in Five-Springs Park in Lanchow, visited by the delegation. It represents a petrochemical refinery at Tach'ing and is a child's attempt to depict the slogan, "Learn from Tach'ing," the oil field in Northeast China that is held up as an example of progress.



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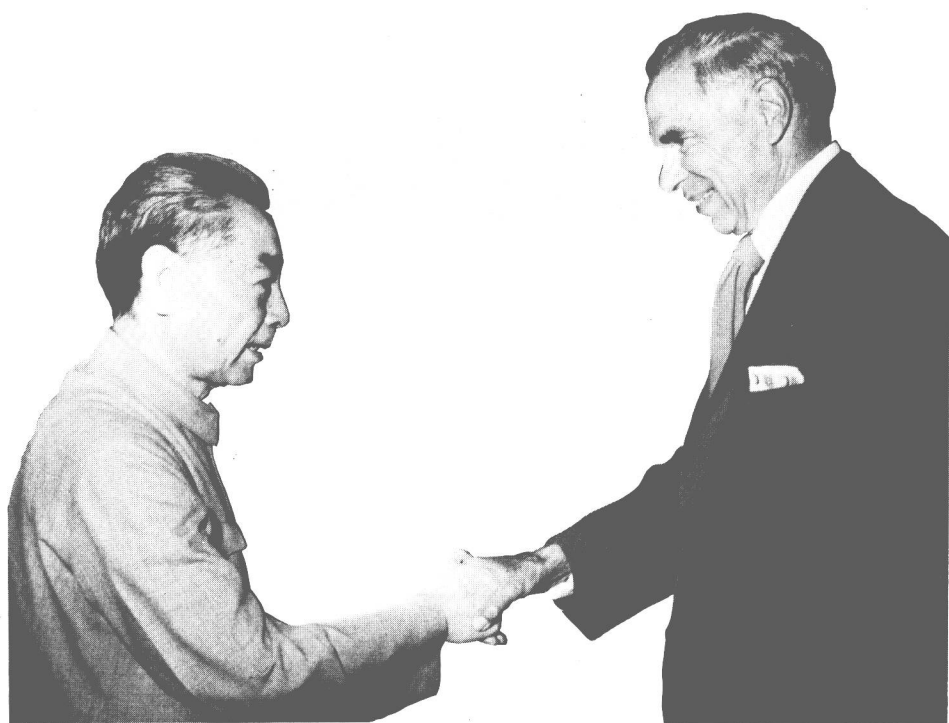
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CHEMISTRY
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FOREWORD

We present here a rather complete description of the research in chemistry and chemical engineering and related areas observed by our 12-member Delegation in Pure and Applied Chemistry during our three-and-a-half week visit to the People's Republic of China in May-June 1978. In order to place our observations in perspective in the face of the current changing conditions in China, we also include a rather substantial account of the historical background of science and its administration in China.

Ours was, in a sense, reciprocal to a visit to the United States made almost exactly a year earlier by a group of chemists from China led by the distinguished quantum chemist T'ang Ao-ch'ing, President of Kirin University. Several members of our delegation had met and formed friendships with these visitors, and we were pleased to have the opportunity to renew our acquaintance with each of the 10 chemists from that delegation during our travels to China.

This was my second visit to the People's Republic of China. I was privileged to be a member of the delegation sponsored by the U.S. Committee on Scholarly Communication with the People's Republic of China that visited China five years earlier in May-June 1973. This earlier delegation had the responsibility for negotiating the terms under which these exchange visits are taking place, and it was under this exchange agreement that the visit of our Delegation on Pure and Applied Chemistry took place. During the visit in 1973 we had the unusual opportunity to meet with Premier Chou En-lai (Fig. 1) to discuss the conditions for future exchange visits, which would take place under the provisions of the Shanghai Communiqué of 1972. During our hour-and-a-half meeting the Premier gave us a wide-ranging view of pertinent Chinese historical background, and on this occasion told us he would accept nine out of the twelve subject areas we had requested to have covered by our exchange agreement. During this early exciting visit, I visited a number of chemical laboratories. This, of course, was during the period when the influence of the Cultural Revolution was still strongly felt and the "Gang of Four," whose existence was unknown to us, was in its ascendancy. Their position of power placed an interesting flavor on our discussions and provided contrast to the visit described in this report.



Figure 1. Chou En-lai greeting Dr. Glenn T. Seaborg at meeting in Peking in 1973.

It is impossible to describe adequately the degree of warmth and cordiality with which we were received by our Chinese colleagues throughout our visit. Their warmth did much to ease the weight of our very full schedule, made so strenuous because our hosts wanted us to see and learn as much as possible. During our visits to the laboratories, educational institutions, and industrial plants, we received the royal treatment. Our hosts in each city entertained us with a multicourse banquet, punctuated with the traditional Chinese toasts, in which mao tai was featured and which always included welcoming remarks by the evening's host at the beginning and my response near the end of the meal. The theme of these remarks always emphasized an increasing friendship between the scientists and the peoples of our two countries and often included an expression of the hope that the degree of our cooperation in science might increase.

We were impressed by the high degree of motivation exhibited by the students and young scientists. They are anxious to learn, do good research, and serve their country in whatever task they might be assigned. They were very familiar with the foreign scientific literature.

One of the interesting features of our visits to the various research institutes and universities was the opportunity for the members of our delegation to give talks in their specialties. In many instances such a talk, together with the following question-and-answer period, would consume half a day. In some cases a delegation member would give such a talk in the morning and another talk in the afternoon of the same day. We were impressed with the high quality of the questions following our talks, indicating an extraordinary knowledge of the relevant scientific literature by the members of our audience.

Of particular interest is the fact that we were the first delegation to visit the mid-China industrial city of Lanchow. This made us objects of curiosity to an even greater extent than during the rest of our visit. Following a dinner in Lanchow Restaurant, our delegation found a crowd of some 500 curious people (Fig. 2), including many children, waiting for us when we emerged from the restaurant. They were smiling, and very, very friendly, but obviously we were a strange species.



Figure 2. Crowd greeting the U.S. Delegation outside a restaurant in Lanchow.

Many interesting comparisons can be made between this visit and my visit five years earlier. The most apparent difference results from the overthrow of the "Gang of Four" and the complete termination of the Cultural Revolution. 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 talk of starting graduate education again. Apparently this was a false hope, and there was a setback extending into 1974-75 due to the actions of the "Gang of Four." Every briefing at the start of our welcoming sessions made reference to conditions before and after the "overthrow." All universities are starting to take advantage of the national entrance examination, are expanding back to the four-year (from the three-year) curriculum, 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 examinations. An important consequence of this reform is the new turn to basic research. We were told that emphasis on applied research was, of course, necessary during the years before the Cultural Revolution, but this would normally have been followed by a turn to basic research in the 1960s had this natural course of events not been interrupted by the Cultural Revolution and/or the "Gang of Four."

Our visit came at a propitious time from the point of view of the real changes that have occurred and are occurring following the Cultural Revolution. We suggested to our hosts in Peking, and at the other places we visited, that our two-country exchange agreement be expanded to include bilateral symposia on selected subjects, exchange of graduate students and other scientists for extended periods of time, and other means of increasing cooperation. We had the impression that our hosts have a great desire to move in this direction, and events that have occurred since our return home, including the normalization of relations between our countries, give me much encouragement that we shall indeed see much more of our Chinese friends.

Any accurate and complete assessment of the impact of our visit must, of course, await future developments. Our goals include making known to our colleagues in the United States some of the vast amount of chemical information that now resides in the People's Republic of China. We hope that this report will serve a useful role toward this objective and that our colleagues will have their appetites whetted to the point that they will seek further information. We have deliberately included a large number of names to serve as points of contact for this purpose. Another goal is the expanded transfer of chemical information from our colleagues in the United States to our vastly increasing circle of friends in the People's Republic of China. These two aims are, of course, closely interrelated as components of the traditional mecha-

nism for the exchange of scientific information. We believe that such increasing, friendly cooperation in scientific fields, in view of the advantages to both our countries, has been and will continue to be a positive force toward an improving political relationship.

As a final word I might add that all of our 12-member delegation, many of whom met each other for the first time on this journey, managed to remain on good terms throughout our full and arduous schedule. Even beyond that, I believe that a bond remains among the members of our group as a pleasant dividend ensuing from our interesting, mutual adventure. And we all acknowledge a debt of gratitude to John Baldeschwieler, our Deputy Chairman, for the competent manner in which he has served as Editor to meld the various contributions of our delegation members into this, hopefully, coherent report.

December 20, 1978

Glenn T. Seaborg
Berkeley, California

PREFACE

The U.S. Delegation in Pure and Applied Chemistry visited China in May and June 1978 under the auspices of the Committee on Scholarly Communication with the People's Republic of China (CSCPRC), a group jointly sponsored by the National Academy of Sciences, the Social Sciences Research Council, and the American Council for Learned Societies. The topic of pure and applied chemistry was first suggested by the CSCPRC in June 1976 during negotiations for the 1977 exchange program with China, whereupon the Chinese Science and Technology Association (the Committee's counterpart organization) proposed a visit of a group of Chinese chemists to the United States. As a result of this agreement, the Committee hosted a delegation of Chinese chemists in April and May 1977 (Fig. 3). During their



Figure 3. Members of the Chemistry Delegation from China visiting in Berkeley, California, May 26-27, 1977 from left to right: Su Feng-lin, Ms. Chou En-lo, Wang Erh-k'ang, Ms. Hsia Tsung-hsiang, Wu Yueh, T'ang Ao-ch'ing, Huang Wei-yuan, Chang Lo-feng, Chiang Ping-nan, Yin Yuan-ken, Hsu Mao.

visit, which took them to many universities, companies, and government laboratories, the Chinese met many American scientists, some of whom participated in the return visit of the U.S. Delegation in Pure and Applied Chemistry.

With little previous knowledge of chemistry in China, we planned the trip relying on published accounts of research in chemistry and chemical engineering, on consultation with several chemists who recently had visited China, and on suggestions provided by the Chinese delegation that had visited the United States. Taking as a base the institutions represented by the Chinese group, we drew up a suggested itinerary that was sent to the Chinese Scientific and Technical Association in April 1978. All of these requests were met by our Chinese hosts.

The trip began in Peking with visits to the Institute of Chemistry of the Academy of Sciences, as well as to other leading research institutes in chemistry, physics, environmental chemistry, pharmaceutical chemistry, and biophysics. The delegation then divided into two subgroups, one visiting Harbin and the Tach'ing oil field complex in Northern Manchuria, while the second subgroup visited the Institute of Chemical Physics and nearby industrial installations in Talien. The delegation reassembled in Ch'angch'un to visit the Kirin Institute of Applied Chemistry and Kirin University, and then it proceeded to Shenyang and Fushun to visit a number of the industrial activities in that area. The delegation visited a number of research institutes and industrial activities in chemistry and chemical engineering in the Shanghai area, including an excursion to the attractive city of Hangchow. A photograph of the U.S. Delegation in Hangchow is shown in Fig. 4. From Shanghai we traveled to Sian to visit Northwest University, as well as the recently discovered archaeological site on the outskirts of Sian. From Sian, the Delegation visited research institutions in the city of Lanchow on the Yellow River in the central part of China. A map of China showing the itinerary of the U.S. Delegation is shown in Fig. 5, while the details of the itinerary appear in Appendix B, and a list of our Chinese hosts can be found in Appendix C to this report.

We were accompanied during our visit by five very able Chinese, Dr. Ch'ien Jen-yuan, Deputy Director of the Institute of Chemistry in Peking (Fig. 6), Dr. Shih Liang-ho, a polymer chemist from the Institute of Chemistry in Peking, Mr. Teng Shao-lin, Librarian of the Peking Institute of Chemistry, Mr. Shih Wei-ming, Peking Institute of Chemistry, and Mrs. Hu Feng-hsien, Ministry of Foreign Affairs.

High quality research and development work in chemistry and chemical engineering is often carried out in "nonchemical" institutions and is not necessarily to be found only in institutes of chemistry



Figure 4. Members of the U.S. Delegation in Pure and Applied Chemistry at the 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.

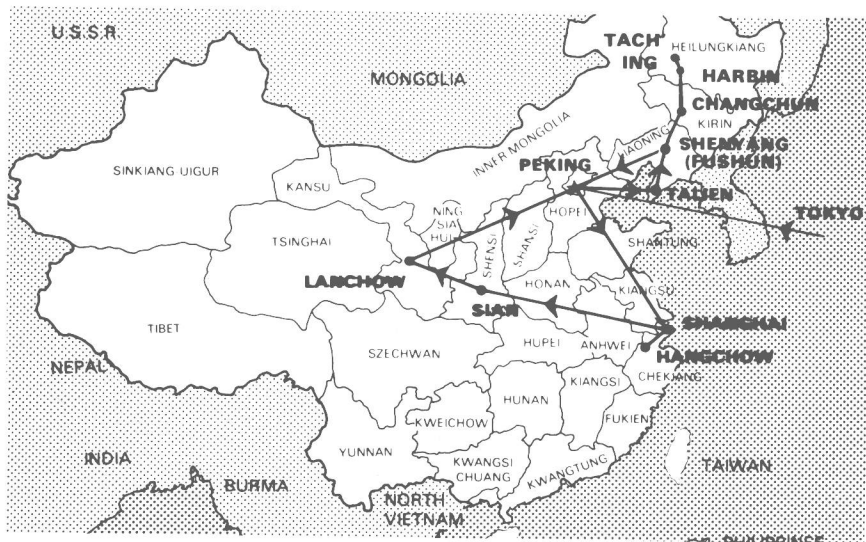


Figure 5. Map showing cities visited in China by the U.S. Delegation in Pure and Applied Chemistry.



Figure 6. *Ch'ien Jen-yuan.*

or chemical engineering, or under the Chinese Academy of Sciences. The Ministry of Petroleum Industry, the Ministry of Chemical Industry, the Ministry of Public Health of the Chinese Academy of Medical Science, and the Ministry of Education are all involved. For example, some good physical organic chemistry and some of the best instrumentation was reported to be found in the Institute of Photography in Peking. Excellent work in solid-state chemistry, physics, and materials science is found in the Institute of Ceramic Chemistry and Technology, and we were told that research in isotope separation and inorganic chemistry is carried out in the Institute of Saline Lakes in Hsining. Although the name of the Institute of Applied Chemistry in Kirin Province appears to stress applied work, some of the best basic research in chemistry that we observed is carried out there. At the Institutes of Chemical Physics in Talien and Lanchow, the focus of research was not on chemical physics as normally defined in the United States (spectroscopy, molecular structure, quantum chemistry) but rather on more classical methods of physical chemistry including thermodynamics, kinetics, and polymer science.

Institutes that the delegation probably should have visited had time and prior information been available would certainly include the Institute of Photography (Peking), the Institute of Saline Lakes (Hsining), the Chemical Engineering Institute of the University of Tientsin, the University of Science and Technology (Hofei, Anhui Province), the Institute of Rare Earths (Anhui Province), the Institute of Metallurgy (Shanghai), the Institute of Chemical Engineering and Metallurgy Research (Peking), and Szechwan University (Chengtu).

The mission of the U.S. Delegation in Pure and Applied Chemistry was to become acquainted firsthand with the status of research, development, and teaching programs in chemistry (not including biochemistry) and chemical engineering in the People's Republic of China. In addition, we hoped to establish personal contact with working scientists and science administrators in China to provide a base for future communication between the Chinese and the U.S. chemistry and chemical engineering communities.

We found that we were able to discuss the possibility of cooperative programs with our Chinese colleagues in a number of areas through mechanisms such as joint symposia, visiting scholars, and joint research programs. Our Chinese hosts were very receptive to these ideas, and the recommendations of this report include a number of specific suggestions for advancing such continuing communication. With the visit of the first official U.S. Science and Technology Delegation to China led by Dr. Frank Press, the President's Science Advisor, which occurred shortly after the return of our delegation; a return visit in October led by Dr. Chou Pei-yuan, President of the Science and Technology Association and Vice-President of the Chinese Academy of Sciences; and the establishment of formal diplomatic relations with China in December 1978, the climate for implementing the recommendations contained in this report is very good. The delegation was indeed fortunate to have had the chance to visit China at such a propitious time, and we believe that our discussions had a significant impact on the role of science and technology in the evolving relationship between China and the United States.

The members of the U.S. Delegation in Pure and Applied Chemistry are prepared to assist in implementing the programs identified in this report, which we feel will be of mutual interest to U.S. and Chinese chemists and chemical engineers.

December 26, 1978

John D. Baldeschwieler
Pasadena, California

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