ing business, and yet it can be conducted on a university campus.

To use a corresponding technique in engineering, it would be necessary to conduct genuine engineering business on university campuses. Real bridges would have to be designed, their erection would be supervised from university campuses, and real people would risk their necks crossing them. Imagine the howl that would go up from the local automobile dealers if, in order to provide practical experience for engineering students, the department of mechanical engineering went into a full-scale business of automobile servicing! The plain fact is that practical training corresponding to that in the teaching hospital is impractical in engineering.

An engineer receives his practical training and experience in industry after obtaining a university education, or sometimes concurrently with it. The vast business activity involved in the practical training of engineers has to be conducted within industry; no other arrangement is feasible or, probably, even desirable. Important, therefore, as the practical training of engineers is to mankind, it is not achieved by exempting university engineering departments from the preeminent educational objective of a university—the development of students' minds (*1*).

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Note

1. This material was presented during a symposium at the University of California, Berkeley, May 1963, and was based on a paper presented before the International Conference on Electrical Engineering Education, Syracuse University, September 1961. The author is IBM Professor of Engineering and Applied Mathematics at Cornell University, Ithaca, N.Y. He is temporarily at the Stanford Research Institute, Menlo Park, California.

Research in China

As agricultural research workers in mainland China several years before 1948, we can hardly agree with the statement made by Cheng in the first paragraph of his article "Insect control in mainland China" [*Science* **140**, 269 (19 April 1963)] that ". . . Before 1948, no organized research . . . in any field of science existed [in mainland China]. Insect control was practically unknown to the average farmer, who in his lifetime never saw a sprayer or a duster . . .".

Universities (for example, the University of Nanking since 1888) and

research institutes (for example, the National Agricultural Research Bureau since 1935) made significant contributions through organized scientific research long before 1948. Many average farmers not only *saw* but *used* sprayers and dusters before 1948; in fact, one of us (R. C. Liu) worked in China for the NARB supplying such tools to farmers.

Either the author left mainland China too early to know the organization and achievement of scientific research in China before 1948, or he has a different definition of "organized scientific research."

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I left China in November 1947, after having served as a university professor, a senior technical adviser to the Chinese National Relief and Rehabilitation Administration, and an officer of the United Nations Economic Commission for Asia and the Far East. My professional duties brought me to agricultural centers in all provinces south of the Yangtze River. Before leaving China, I devoted six months to collecting technical information from different ministries, government agencies, and research institutions in Nanking and Shanghai. In short, I am not unfamiliar with pre-Communist conditions as Liu, Tso, and Chang have suggested.

My statement that prior to 1948 the *average* Chinese farmer never saw a sprayer or duster in his lifetime is based on my talks with farmers in the provinces I toured, on my inspection of production facilities of the factories in which the equipment (mostly small hand sprayers and dusters) was manufactured, and on the size of the farming population in China. I would like to remind Liu *et al.* that over 75 percent of China's pre-Communist population, estimated to be 400-500 million, were engaged in agriculture. To equip only a small fraction of the nation's peasantry would have required millions of such hand sprayers and dusters; this huge quantity was far beyond the production capacity of the hastily equipped factories, which were medium-sized production shops by American standards.

Since it has been mentioned that Liu played a part in supplying such tools to farmers, I wonder if he could

tell how many of those units shipped to, say, Kwangtung and Fukien provinces actually reached the hands of "average farmers." I maintain that my statement is based on facts, part of which better remain untold. To say that a limited number of *fortunate farmers*, rather than "many average farmers," had access to sprayers and dusters is closer to actual conditions before 1948.

I am well aware of the work done at the University of Nanking and in the National Agricutural Research Bureau. Again, may I remind the gentlemen that from the outbreak of the Sino-Japanese war in 1937 to the end of World War II, the University of Nanking and major universities in north, east, and central China had to operate on improvised wartime campuses in west China. Those of us who have lived through the baptism of fire in China know what it was like trying to hold body and soul together and carry on teaching, with some research in addition. It is unfortunate, but true, that Chinese scientists barely had made a good start in the mid-1930's, when their research activities were interrupted by war.

As to my definition of "organized research," since my article deals with mainland China in its entirety, the term refers to the nation as a whole and not to a few isolated instances. It follows that by "organized research" is meant well-planned, administered, and coordinated research activities; it involves cooperation among related disciplines, and participation by various scientific institutions with national leadership and support, *in fact as well as in name*. I believe that those familiar with the history of scientific development in China will agree that no such organized research existed in any field of science prior to 1948. Instead, most of the pioneering work in science on the mainland was the fruit of tenacious efforts made by a small number of struggling scientists with or without outside help. Some research projects, like those in the University of Nanking, were supported in part by the China Foundation for the Promotion of Education and Culture, an independent organization administered jointly by Chinese and American educators; and others, like those in Lingnan University, were subsidized by religious and other organizations in America. Even in national universities, support from government funds was less than generous. As could be ex-

pected, research activities were generally spotty, uncoordinated, and executed on a short-term basis. It is not surprising that in the years before 1948, contributions made by the scientific community in China as a whole fell short of creating a significant impact on the world of science, however admirable some individual efforts may have been.

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Multiple Authorship

Multiple authorship has several inherent problems. Bibliographers must list entries under several author names, abstracting services must add extra index entries, and, when the description of new species is involved, it becomes even more objectionable.

In taxonomic papers it is recommended that the authority of each species follow the species name the first time it appears in a paper; for example, *Mycoplasma pneumoniae* Chanock, Dienes, Eaton, Edward, Freundt, Hayflick, Hers, Jensen, Liu, Marmion, Morton, Mufson, Smith, Somerson, and Taylor-Robinson, 1963 [*Science* **140**, 662 (10 May 1963)]. Obviously the recommended procedure will not be followed in citations of this species, and the authority will become Chanock *et al.* Henceforth only Chanock will get credit for naming the species. Had Chanock *et al.* followed the recommended practice in their citation of species, they might have realized that the list of authorities for *M. pneumoniae* would cause inconvenience for other authors in the future.

In taxonomic papers, especially, the number of authors should be limited, and editors should demand justification for the inclusion of more than three or four authors' names. In the paper cited, six column-inches out of 22 were devoted to the list of authors and their institutions. The fact that each man contributed to the research (as acknowledged in the references) does not necessarily mean that all should be authors. The naming of new species has always been highly competitive, and the man who first recognizes a species as unique should be entitled to describe it.

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