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**Reform of
Scientific
Establishment**

公元12世纪 我国就已发明火药箭
公元20世纪 我国成功地发射世界先进水平的运载火箭
公元21世纪 我国的火箭技术拭目以待……

**ANCIENT SCIENTIFIC
PARTNERSHIP**

East-West:

Bridging the Scientific Chasm

by Our Correspondent Ling Yuan

The chilly winter wind tore at Robert Temple's parka as he paced the Marco Polo Bridge snapping photographs. He eyed the details around him with intense concentration.

The 43-year-old former Kentuckian knew a surprising amount about the bridge which Marco Polo had written about in the 13th century. The legendary Italian explorer had been awestruck by the bridge, which he described as wide enough to allow 10 horsemen to ride across it abreast.

Temple, however, had never been to China before. His knowledge about ancient China had come from painstaking research over the past few years.

"We went there not because Marco Polo described it but because of the arches," Temple explained. The bridge's 11 spans are segmental arches, an engineering innovation that gives more strength and uses less construction material than the semicircular arches that were being used in Europe at the same historical period.

For Temple, who was paying his first visit to China in the company of Joseph Needham, the world's foremost authority on Chinese science and technology, the bridge in Beijing's southwestern suburbs was one of China's major but unsung discoveries and inventions — inventions that have contributed greatly to what is often, but wrongly, thought of as "Western civilization."

The two men came to China in November, 1986, partly to celebrate the publication of the Chinese edition of *The Collected Papers of Joseph Needham* and partly to do further research. For



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Joseph Needham ponders reporter's question.

example, Needham said in a press conference that he planned to visit the Dazu Grottoes in Sichuan Province to confirm whether the carvings there contain the first known sculpture of a handgun.

"It's held by a character that has two horns on his head, some sort of devil, and (the gun) actually has flames and a cannonball coming out of it," Needham said.

Needham and Temple were accompanied by director-producer Michael Gill and cinematographer Michael Fox, both of whom had been involved with the "Heart of the Dragon" television series. The two filmmakers were there to document what might turn out to be Needham's last trip to China, since the scholar is now 86 and afflicted with arthritis.

"A Brilliant Distillation"

Temple, who has lived in England for the past 20 years, is the author of *China: Land of Discovery and Invention*, a popular condensation of Needham's life-work, the definitive multivolume

Science and Civilization in China.

The new book describes 100 outstanding Chinese discoveries and inventions — from the spinning-wheel and paper money to the umbrella, rocket, and movable type — culled from Needham's work in support of what Temple calls one of history's forgotten secrets: that more than half the inventions on which the modern world is based originated in China. The book has already been published in England and will soon be released in the United States by Simon and Schuster under the title *The Genius of China*.

Temple never expected to become so deeply involved with the history of Chinese science. To be sure, his interest in one kind of science, cooking, was aroused at an early age when he used to follow Col. Harland Sanders around demanding, unsuccessfully, to know what the secret ingredients were that flavored what later came to be known as "Kentucky Fried Chicken."

He majored in oriental studies and Sanskrit after entering the University of Pennsylvania at 16, and it was there that he was introduced to the work of the man he considers "the greatest scholar of the 20th century."

When Needham started writing his books about China in 1948, he envisioned a six-volume work that would be completed in a few years' time. But the more he learned about ancient Chinese science, technology, and civilization, the more there was to learn. He soon realized he had stumbled upon an "absolute gold mine."

So far, 15 books, some more

than 1,000 pages long, have been published by Cambridge University Press, and at least another 10 are projected. During his visit to Beijing, Needham said the project was so gigantic that he wondered if he would live to see it finished, but added that he takes a "Taoist" attitude towards it and does not worry.

The Needham Research Institute in Cambridge is cooperating closely with more than 30 scholars from all over the world to compile future volumes, on subjects ranging from Chinese mycology, the study of mushrooms, to Chinese psychopathology.

The books, which have been bestsellers all over the world, are a far cry from his early vision of the project, which he "by no means" intended to be academic. In addition, the volumes are expensive and long. Even some libraries cannot afford them, and those that can often have long waiting lists of readers.

Needham had always intended to make his work accessible to the average reader, but as the scope of the work expanded and the years went by, he came to realize he could no longer hope to accomplish that task himself.

When Temple went to Needham in 1984 and offered to write a popular book oriented to the general reader, the scholar immediately gave him a go-ahead, and even offered Temple access to masses of unpublished materials and manuscripts in progress.

Temple had already published several books related to the history of science, but condensing Needham's voluminous research into one 254-page book was no easy task. And he also wanted the book to be ready in time for Queen Elizabeth II's visit to China in October, 1986.

So for more than a year he worked 14 hours a day, pushing himself to exhaustion perusing typescripts, proofs and sections of the unpublished portions of Needham's work.

The result is a beautiful book graced with hundreds of previously unpublished photographs and drawings. And because Needham's own accounts of some Chinese discoveries and inventions are still in manuscript, Temple's volume will be the only source for these materials until the larger project is complete, which may not be for many years.

Temple recalled, "I was very nervous when I gave the result to him to see what he thought of it, and I was very worried that I hadn't done a good enough job."

But Needham was not only enthusiastic enough about Temple's book; he wrote an introduction to it, calling it a "brilliant distillation" of his larger work. He later commented that *China: Land of Discovery and Invention* would "certainly reach many more people than those who have time to read my own more detailed volumes."

Needham did comment, in a letter to *Beijing Review*, that he felt there were "some mistakes ... and various statements which I should like to have seen expressed rather differently" in Temple's book, but he added, "I still think that the work as a whole is admirable."

According to Temple, Needham's only criticism was that "he wanted to have the section on warfare not to be the end, because he didn't like people to finish reading the book thinking the Chinese were warlike." But Temple said the publishers refused to change the order of the material. "I was very sorry his wishes were not respected," Temple added.

"Conversion" to a New Field

Before Needham found his life's work in the study of ancient Chinese science, he had established himself as a pre-eminent biochemist. His *Chemical Embryology*, published in 1931, laid the groundwork for modern embryology.

Because of his achievements, he was elected Fellow of the Royal Society in 1931, and was named Sir William Dunn Reader in Biochemistry at Cambridge in 1933.

He was well on his way to greater achievements and fame when he underwent a "conversion" that he likes to compare to St. Paul's on the road to Damascus.

The catalyst for his conversion was the arrival of three Chinese students at Cambridge University's biochemistry laboratory in 1936. One of them, Dr. Lu Gwei-Djen, the daughter of a Nanjing doctor, later became his longtime chief collaborator. The more Needham got to know them, the more he realized how "exactly like my own their minds were," and the more fascinated he became by their tales of how the Chinese had been the originators of what he had always believed to be Western discoveries.

This kindled his interest in the history of science, technology and medicine in China. In 1942, the Royal Society asked him to go to China as its envoy. He ended up staying there throughout World War II as scientific counselor at the British Embassy in Chongqing and developed many contacts with leading Chinese scholars in many disciplines.

They told him what to read and what books to buy, and, once the war ended, the British Air Force shipped his thousands of volumes back to Cambridge. The books later became the nucleus of the Needham Research Institute, the world's largest library on the history of Chinese science. Needham and his associates recently moved into a new building which will house the institute and library.

The war years paved the way for a complete switch in Needham's academic pursuits. When he returned to Cambridge in 1948, he dropped his research in bioche-

mistry completely to write a book about Chinese contributions to science, technology, and medicine prior to the 15th century.

Setting the Record Straight

What Needham found in his research exceeded his expectations — many of the West's greatest achievements turned out not to be independent discoveries, but borrowings from China. Over the years, his findings have astonished not only Westerners, who tend to think modern civilization is based on the Scientific Revolution and other Western developments, but also the Chinese, who have themselves lost touch with the splendors of their past.

The field of agriculture is just one example. Needham learned that modern agricultural techniques, which heralded the great European Industrial Revolution, came about because of ideas and techniques imported from China.

The planting of crops in rows, intensive hoeing of weeds, the modern seed drill, and the iron plow all came from China. In addition, the Chinese were using the trade harness and collar harness while farmers in the West were choking their horses and

draft animals with straps around their throats.

Others of Needham's findings were just as surprising. Without the importation from China of the rudder, the compass, and multiple masts, Christopher Columbus would not have been able to sail to the Western hemisphere and Europe would have been hard put to establish colonial empires overseas.

In addition, Germany's Johann Gutenberg was not the first to invent movable type; Britain's Sir William Harvey was not the first to discover and describe the circulation of the blood; and his countryman, Sir Isaac Newton, was not the first to discover the First Law of Motion....All had been discovered or invented, sometimes hundreds of years earlier, in China.

"The \$64,000 Question"

When one leafs through Needham's and Temple's books, the inevitable question comes to mind: if the Chinese were so advanced in antiquity and the Middle Ages, how was it that their many ingenious inventions and discoveries failed to develop into modern science?

In his introduction to Temple's book, Needham calls this "the \$64,000 question." In his opinion, Chinese inventions and discoveries prior to the 15th century were absolutely important to all humanity, but they failed to develop systematic theories. Without such theories, the Western scientific and technological revolutions would never have happened.

But the fundamental factors that accounted for the development of modern science across Europe were the decline of medieval feudalism and the rise of capitalism and the ascendancy of the entrepreneurial bourgeoisie in the 17th century. During the same period, however, China was sinking deeper into the morass of feudalism and deep-rooted bureaucratism.

Needham concluded that Chinese feudalism inhibited further scientific progress in China, and in particular the kind of breakthrough that occurred in Europe.

Today, the Chinese still see remnants of "feudalism" as major obstacles to their nation's economic and social development, and the determination to catch up with the West in science has been a

Joseph Needham talks with reporters at the Beijing Friendship Hotel.

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rallying point for everyone from China's top leaders to its ordinary workers and farmers.

Temple commented during his visit to China that he saw the efforts being made to speed up scientific progress and that he had no doubt that the country would succeed in its endeavor.

"I've been particularly impressed by the extremely high level of intelligence of some of the senior officials I have met, and I think the intelligence of the average Chinese is higher than that of the average Westerner. This is a unique factor which cannot be changed," he said. "The Chinese certainly could become world leaders in computer technology....It would be only appropriate since the Chinese invented binary arithmetic by which computers operate."

However, he warned that the "will to support science and technology is essential." He commented, "I think it is safe to say that sending rocket scientists

to paddy fields during the 'cultural revolution' was the sort of thing that was not likely to lead China to becoming a world leader in science and technology."

Bridging the Chasm

In a 1946 lecture, Needham said: "I personally believe that all Westerners, all people belonging to the Euro-American civilization, are subconsciously inclined to congratulate themselves, feeling with some self-satisfaction that, after all, it was Europe and its extension into the Americas which developed modern science and technology. In the same way I think that all my Asian friends are subconsciously inclined to a certain anxiety about this matter, because their civilization did not, in fact, develop modern science and technology."

Needham's 40 years of work have disproven both misconceptions. He has offered solid evidence to prove that modern

science is not exclusively European in its origins, and that many other nations of the world, including China, have made major contributions to the modern world. Both his monumental volumes and Temple's popular version will help to foster a clearer mutual understanding and bridge the mental chasm between East and West.

Temple may have summarized Needham's aims as well as his own when he wrote in the preface to his book:

"It is now time for the Chinese contribution to be recognized and acknowledged by East and West alike. And above all, let this be recognized by today's schoolchildren, who will be the generation to absorb it into their most fundamental conceptions about the world. When that happens, Chinese and Westerners will be able to look each other in the eye, knowing themselves to be true and full partners."

Robert Temple on the Marco Polo Bridge with a British film crew.

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