

The Course of Reform at the Chinese Academy of Sciences

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The Chinese Academy of Sciences (CAS) was established in 1949 as the country's leading institution of learning and comprehensive research. It has nurtured many important fields of research and has played an important role in developing new technologies such as computers, integrated circuits, robotics, new materials, and lasers. The government recently affirmed its role as a center in China for world-class basic research, for training the next generation of scientists, and for incubating high-tech industries.

At the same time, the move from a planned economy to a market economy has had a great impact on the country's science policy and its scientific institutions. Market competition has triggered the need for technology that can generate profits, and applied research and development is heavily emphasized by the government and society. On the other hand, the 123 institutions created since the 1950s suffer from many problems. They are over-staffed, weakened by serious inbreeding, closed to outsiders, and far less dynamic in both personnel and research than similar institutions abroad. Therefore, it is essential that CAS undergo major reforms to keep up with developments in China and throughout the world.

The reforms under way are designed to address these issues. In basic research, we have made the institutions more open to university professors, increased mobility into and from the institutes, introduced a system of peer review and competition, enhanced international collaboration, and given more opportunities to a younger generation of scientists. Following the example of the Max Planck Gesellschaft in Germany, we have established young scientist groups and new centers in the life sciences and the earth sciences that emphasize multidisciplinary research. In addition, 100 open labs have been established, and special funds have been set aside to enhance collaboration with universities.

Basic research can be favored when the economy is strong, as was the case in the United States after World War II and recently in Japan. But governments are often concerned about losing their competitive advantage, as happened in Japan during the 1960s, the United Kingdom in the 1980s, and the

United States in the 1990s. So it is no surprise that China is now emphasizing applied research and development. However, scientists know that science is an important part of human culture that, along with the humanities, propels ourselves and society. And it is the responsibility of the scientific community to preserve a balance between the growth of basic and applied research.

China's population of 1.2 billion people is huge and increasing, but its resources per capita are low and the environmental degradation is serious. Sustainable development depends on the application of science and technology, combined with the restoration of such traditional philosophies as "living in harmony with nature" and "frugality is a merit." Chinese people have dreamed of modernization for many years, and their desire to become rich has been ignited by the current policies of reform and increased openness. However, too rapid development could create serious problems and instability if it is not guided by morality and science.

CAS has taken these factors into account in setting its spending priorities for its income, which last year totaled \$325 million. About 30% of its activities are devoted to basic research, another 30% to population, resources, and the environment. The remaining 40% are spent on technology development.

Within those categories are many new projects. For example, we have set up the first phase of the Chinese Ecological Research Network (CERN) with 29 field stations in regions with a variety of environmental problems. Scientists are making long-term observations and conducting comprehensive studies on ways to reverse further degradation. They also are teaching the local people about appropriate technologies for agricultural and industrial production. The technological sciences are driven mainly by market forces. In the last 10 years CAS has established relations with more than 3000 factories and companies, with cooperation in the form of technology transfer and contract research. We encourage our scientists who want to pursue the application of their ideas to join industry or to establish their own company. About 10% of the CAS staff is now working in industry, and we will keep their status in the Academy for some time to help them to adapt to the new situation.

These developments have led the Academy to take a close look at itself and its

operations. A development plan for the next 5 to 10 years has been submitted to the government and includes suggestions for building some large facilities like the third-generation synchrotron light source, a tau-charm factory, and a new telescope. The scientific community is debating which facilities should receive the highest priority, judging each one on the basis of its scientific value, technical challenge, and financial impact. It is unlikely that the government will approve and finance every one of them.

Ten years ago we were funded directly by the government, but now half of our budget is obtained through competition on a contract basis, which includes government and industrial projects. Although our budget has grown by more than 200% in the last 10 years, most of the increase has been offset by a high annual rate of inflation. Finding money for research will continue to be the main challenge to progress.

In order to increase efficiency and improve competitiveness, it is necessary to reduce the number of permanent staff in our institutes. However, we are doing it in a gentle way. We do not lay off our employees, but some will retire at the age of 60, following a rule that exists for all government employees. Others will be retrained and given new assignments. We think that our employees have talents and abilities above the average for the country. And while some of them may no longer be at the forefront of research, their experience and knowledge can still benefit the nation as a whole. We encourage those scientists who cannot obtain funding, along with those who are still healthy and active in retirement, to take part-time jobs with industries and schools.

At the same time, we shall increase the number of postdoctoral researchers, temporary staff, and visiting scholars, and fill the vacant positions with brilliant young scientists. We hope to achieve a constant flow of young talent into the institutes, and we expect most of them will shift into industry or university positions after 10 years of research training.

China is now entering a crucial period in its 4000-year history. It has the chance to adopt a course of sustained development that relies on its cultural tradition, on modern science and technology, and on the support of friends around the world. The history of China and the experiences of overseas Chinese have repeatedly demonstrated the power of Chinese culture and its ability to retain its core values while adapting to new situations. Chinese scientists are well aware of the difficulties ahead, but they are also aware of their historical responsibility and their role in making China a modern society. If they succeed, their contribution will benefit not just their country, but the entire world as well.

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