Scientific leap-forward in the critical period: the thirteenth Five-Year Plan of the Chinese Academy of Sciences (CAS)

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In a news release conference on 31 August, President Chun-Li Bai of the Chinese Academy of Sciences (CAS) announced the thirteenth Five-Year Plan (2016–2020) for the CAS. This Plan is of particular significance to the science and technology (S&T) development of China, as the government has just initiated a nationwide reform in S&T management systems with unprecedented breadth and depth, and the CAS just began the most drastic reorganization in its 60-year history [1], aiming at elevating the unique capability of CAS in China’s drive to become an innovation country.

The CAS Plan selects eight innovation areas for development: interdisciplinary basic research, advanced materials, energy, ocean science, resource and ecological environment, information science, photoelectric science and space science, together with large basic research support facilities and a data/computation platform. Within this ‘8 + 2’ framework, 60 sub-areas with the potential of making breakthroughs and 80 research directions for cultivation are listed. Among the targeted sub-areas that have attracted much attention are frontier sciences such as condensed matter materials, particle physics, galaxy structure, brain science and brain-inspired intelligence technology, as well as areas directly related to public health such as the causes and control of air pollution.

Ambitious goals are set for 2020—to establish CAS as one of the major research institutions in the world in several areas of strategic importance, to become leading pioneers in some newly emerging interdisciplinary frontier areas, to produce important research advances, technologies and products, to provide more efficient mid- and upstream S&T support, and to elevate innovative capability and international competitiveness in related industries.

As noted by CAS President Bai, while China now ranks among the leading countries in several important frontier areas, the overall research and innovation capacity still lags behind more advanced countries. Despite impressive growth in the number of researchers and scientific publications, deficiencies are evident: the impact of scientific publications is low, major research innovation is scarce, and many research programs are duplicative and fragmented, follow-up rather than pioneering in nature.

The cause of these deficiencies is both structural and cultural. Strict adherence to subspecialties in research and education still plagues many research institutions, while cross-disciplinary fertilization has become a rich source for innovation. The current CAS reorganization initiative is aimed at breaking such structural barriers in existing research units. In higher education, similar efforts have also led to the merging of universities and emergence of interdisciplinary research institutes over the past two decades. Nevertheless, while institutional structure and management systems may be changed quickly, it takes a much longer time to change the culture of scientific institutions. For example, despite the awareness of the need for nurturing the innovative spirit of our students, university and graduate school education remains didactic, authoritative and discipline-bound.

To address the cultural aspect, the CAS will reinforce mechanisms for multi-track research evaluation and merit-based resource allocation, and initiate new programs for nurturing young talents. Rapid progress in the development of the University of Chinese Academy of Sciences, with strong emphasis on cross-disciplinary education and integration of high-quality research with teaching, signifies CAS’ commitment in training the next generation of innovative scientists. Also emphasized in the CAS Plan are domestic and international collaborations with openness and resource sharing, encouraging CAS scientists not only to participate, but also to initiate and lead large international science projects.

As the prime research organization in China, CAS shoulders the responsibility for leading the leap-forward development of Chinese science. Ambitious goals are now set for the next five years, but their realization will depend on the success of the ongoing reform in institutional infrastructure, concerted efforts in developing educational programs and in cultivating a culture conducive to innovation. A five-year period is short, but it may turn out to be the critical period in China’s drive to become a country of innovation.

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