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Towards Excellence in Science

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Science is a human enterprise in the pursuit of knowledge. The scientific revolution that occurred in the 17th Century initiated the advances of modern science. The scientific knowledge system created by human beings, the tremendous productivity brought about by science, and the spirit, methodologies and norms formulated in scientific practice since the 17th Century have long become essential elements of modern civilization. Today's world is characterized by rapid knowledge expansion, an explosion of data and information and the globalization of economies. In these times, scientific excellence is an essential principle for transforming human thinking and ways of life. Furthermore, scientific discovery is a major driver of national prosperity and social and economic sustainable development. The strategic importance of scientific excellence to the overall wellbeing of a nation and to its competitiveness should never be underestimated.

Chinese science has reached a new stage in striving for scientific excellence. As a result of over a century of hard work from several generations of scientists, China has built up an almost complete infrastructure for science and technology to support its scientific enterprise. Chinese science has made steady advances in recent years thanks to continuously increasing investment, an expansion in the scientific workforce, and growth in international scientific collaboration. The rapid economic development of the country has made all of this possible. The Chinese scientific community is an increasingly devoted contributor to global science. The pursuit of excellence has become the responsibility and mission of Chinese scientists in their efforts to make greater contributions to global science and national social and economic development.

The achievement of excellence in science is not just the responsibility of the scientific community but also of society in general. Chinese science today still faces formidable challenges and problems in this regard, some of which are deep-rooted, such as a limited historical foundation in its scientific culture, a somewhat distorted orientation in the value placed on science, and insufficient attention to and confidence in striving for genuine innovation. These challenges have resulted in a weak scientific ethos, some lack of directions in research focus, and even occasions of scientific misconduct in the community. These problems can also be attributed to insufficient guidance for research excellence, and the inadequacy of policies and mechanisms for promoting scientific excellence. The nurture of scientific values and standards is of vital importance for the implementation of science and technology structural reform and of the innovation-driven development strategy of the country.

This Statement calls on the Chinese scientific community, government and society-at-large to adhere firmly to the true values of science and accepted norms of behavior in striving for and achieving scientific excellence. Much effort is needed to take urgent measures to establish excellence-oriented evaluation systems and funding mechanisms for Chinese science, and to build up a research ecosystem that supports healthy and sustainable development of science in China.

1. Nurturing the Value of Scientific Excellence

To establish the values and concepts of scientific excellence, the scientific community needs to bear in mind the mission of science and to steadfastly explore the advancement of knowledge. Chinese scientists must be very clear about the responsibility of science and must raise their consciousness to the application of science for the benefit of humanity.

Taking the exploration of truth and the discovery of new knowledge as the mission:

The contribution of science to the progress of human civilization and its extensive and profound impact on social and economic progress all greatly depend on the discovery and creation of new knowledge. Science aims to seek truth by means of discovery and creation of new

knowledge. It enables humankind to continuously free itself from ignorance and perplexity, and advances the human condition from the realm of necessity to that of freedom by a continuous expansion of our understanding of new frontiers in knowledge, the external world and ourselves. To achieve scientific excellence, Chinese

science needs to improve its mode of doing science and upgrade any long-formed and outdated research notions such as the practices of simulation and follow-up research which lead only to incremental advances. Efforts need to be made to continuously explore the scientific unknown by opening up new fields and research directions, advancing new concepts, theories and methodologies, and discovering and addressing new scientific challenges. Efforts need to be made to respect and protect the freedom of scientists to seek new truths. There is a need to guide scientists to regard the exploration of new phenomena and the creation of new knowledge as their primary social responsibility, truly allowing scientific research be free from the undue external influence and from enticement of material benefits and individual fame.

Committing to serving and benefiting society and humanity as the goal:

Science has an endless frontier and is an unlimited source of new possibilities which can serve society and benefit humanity. Science enriches people's spiritual world, inspires their wisdom and creates new ways of development, providing new ways and means of addressing problems and challenges. Today, mankind faces various severe challenges including global climate change and a shortage of energy and other resources. China is at a critical stage in achieving further progress in its industrialization, urbanization and modernization and is compelled to realize major knowledge-based and innovation-driven transformations for its mode of development. To achieve scientific excellence, Chinese science must focus on major societal challenges, provide new approaches to further improve the quality of peoples' lives and supply new vitality to the country's sustainable development while further advancing new knowledge. Chinese science needs to provide reliable scientific evidence to the government for appropriate decision-making and also contribute to addressing global challenges, positioning Chinese science to serve the needs of China and of the world.

Committing to the development of scientific spirit and culture as the core principles:

Science at its best is characterized by high ideals and spirit, and an enduring creativity founded in its culture and traditions. The scientific spirit and culture embody rich values such as respecting truth and talent, encouraging exploration and innovation and adhering to scientific reasoning and methodology. These values continue to enrich and develop human society and are essential elements which underpin the value chain of modern science as it contributes to innovation and our understanding of civilization. To achieve scientific excellence, the scientific community needs to consciously advocate and uphold the scientific spirit, promote the value and focus of science in seeking truth and innovation, establish management structures and mechanisms that suit the characteristics and rules of scientific research, and discourage scientific behavior aimed only at short-term success or individual benefits. Scientific excellence will be enhanced by the exploration and construction of new systems that suit the characteristics and trends of modern science, developing the research culture and traditions necessary for the progress of science and society.

2. Establishing Behavioral Norms for Scientific Excellence

The establishment of behavioral norms for scientific excellence requires the strengthening of self-governance and self-regulation in the scientific community and efforts to guide scientists to respect the rules of scientific research and to adhere to the behavioral norms and ethical standards that promote the progress of science. Efforts also need to be made to improve these norms and standards in scientific practice, and through gradual improvement, create the desired scientific culture of excellence.

Strengthening the self-governance and self-regulation of the scientific community:

The history of science reveals that maintaining scientific rigor and advancement towards scientific excellence results from efforts in strengthening the self-governance of the scientific community and in safeguarding the freedom and independence of scientific exploration. Sound self-regulation is a prerequisite for self-governance of the scientific community. Scientists make discoveries and create new knowledge through free exploration and inspire each other to new ideas through intellectual exchange. Scientists should adhere to rational skepticism and should not assume theories and doctrines not subject to suspicion and criticism, nor should they bow to any absolute authority. The pursuit of scientific excellence requires the courage and confidence of scientists to rationally and bravely challenge conventional scientific paradigms. Therefore, scientists should be encouraged and motivated to make innovations and their enthusiasm and aspiration for innovation must be fostered by allowances for set-backs and failures in the

exploration of the unknown.

Upholding the reliability and innovativeness of research methods:

The establishment and development of the modern scientific system is closely linked to the research and development of reliable and advanced research methods. The rapid advance of the modern scientific knowledge system is dependent on its methodological foundation, which emphasizes empirical evidence acquired by careful observation and meticulous experimentation, scrupulous theoretical systems created through sound logic and precision mathematics, and the bi-directional nexus between rational foresight and empirical research. Major scientific breakthroughs often result from the transformation of research methods and instruments. The pursuit of scientific excellence also needs innovation in scientific methods and in the research and development of new technological approaches and research tools. New methods and tools focus scientific effort on continuous improvement and support a core principle of scientific excellence; the maintenance of objective, practical, rigorous and meticulous attitudes and behaviors. The more frequent use of large datasets increases the need for transparency and open science.

Upholding the moral standards of sincere cooperation, honesty and integrity:

Modern scientific research is an undertaking that pools the collective wisdom of the whole of humankind. It allows new knowledge to become the shared wealth of the whole of society through publication of research findings and the correction of scientific errors through collective efforts, rational reasoning and questioning by scientists themselves. These processes constitute the critical basis for the continuous and cumulative progress of science, and are important mechanisms for safeguarding scientific excellence. To pursue scientific excellence, scientists must honor the work of others and properly respect the rights of discovery of others. Scientists need to evaluate the accomplishments of others in a fair manner, while respecting the rights of others to rational skepticism. The balance of respect and skepticism is fundamental to professionalism in the scientific community. Scientists should accurately record and report their research findings, honestly present their data and research results, and specifically protect the reputation of science by consciously opposing scientific misconduct.

Assuming the social responsibilities of scientists:

New scientific knowledge, while creating huge material and spiritual wealth for human society, can also have adverse effects and may even challenge the social ethics and practices long held in society. In the modern world, where science and technology have profound impacts on our ecosystems and socio-economic structures, the rational application and risk management of scientific research and research outcomes has become particularly important. Scientists have great responsibility for how scientific and technological advances are used and a responsibility for preventing serious adverse effects. To strive for scientific excellence, scientists must firmly bear in mind that the goal of science is to benefit society and humankind. Scientists need to observe scientific ethics and norms in scientific research, respect nature, life, the value and dignity of people and prevent the inappropriate application of scientific knowledge. Scientists should assume responsibility for evaluating the consequences of science and technology applications, give the public timely forecasts and report on the possible risks and side effects of applications from scientific research, and commit efforts to the enhancement of the public's overall rational understanding of science.

3. Setting up an Evaluation System that Promotes Excellence

Setting up research evaluation, funding and management systems which prioritize scientific excellence is crucial to the promotion of quality science. With scientific excellence as the driver, high-quality research will be the first priority and scientists will be motivated to design and conduct excellent research.

Supporting and improving the peer review system:

Peer review is an important component of modern science and a necessity for improving the scientific research profession. Through quality control by merit-based selection and the collective correction of errors, peer review plays an important role in the healthy advancement of international science. Although peer review mechanisms are commonly used in scientific assessment, influence and interference from non-academic spheres do occur now and then. To strive for excellence, it is important to ensure that scientists play a major role in scientific assessment, and that efforts be made to guard against inappropriate administrative intervention and misconduct both within and outside academia. It is important to prevent overly detailed, too frequent and sophisticated evaluation, and peer review with unclear orientation in value. It is also important not to reduce peer review to a formality or a simple management tool.

Shaping an open, fair and standardized assessment mechanism:

To strive for excellence, efforts need to be made to ensure that the responsibility for evaluation be entrusted to those experts who are professionally recognized

and capable. The transparency of evaluations and the supervision of assessment process needs to be strengthened, and academic abuse or the irresponsible behavior of experts needs to be effectively prevented. Efforts need to be made to create a fair competitive environment in which peer review experts are requested to carry out justified evaluation with strict adherence to protocols, while preventing undue influence and intervention from both individuals and institutions. Efforts also need to be made to set up standardized and institutionalized best practice and procedures for peer review.

Adhering to evaluation criteria that promote innovation and excellence:

The core purpose of science evaluation is to improve the quality of scientific research and to effectively promote genuine research. To promote scientific excellence, it is essential to encourage genuine and transformative research as the primary principle of evaluation. There is a need to guide scientists to commit themselves to research excellence and to focus on major scientific issues of transformative significance that require long-term commitment and effort but often have a higher risk of failure. There is a need to set up specific evaluation criteria relevant to the range of research activities and their differences in nature and objectives. There is a need to avoid simplified actions that over emphasize quantitative criteria for short-term performance. There is a need to carefully scrutinize evaluation results that are not based on consensus and have different balances of opinions. There is a need to strengthen diagnostic and development-oriented evaluation, and promote the constructive role of evaluation. There is a need to set up a mechanism to fairly evaluate collaborative achievements so as to facilitate exchange and collaboration between scientists and even academic disciplines. There is a need to guard against policies and actions in the evaluation of scientific institutions and talent that lead to hasty work. Evaluation-related incentives should not induce researchers and institutions to carry out rushed research for sub-optimally quick results and short-term or individual benefits.

Excellence in science is a common and ongoing goal of the whole international scientific community and must be based on openness. To catalyze the wisdom of all scientists and to allow science to benefit the whole of humanity requires extensive exchange, communication and cooperation between scientists and colleagues in the global scientific community. Chinese scientists will join hands with their colleagues across the world to pursue scientific excellence and promote the continuous progress of science and the sustainable development of human civilization.