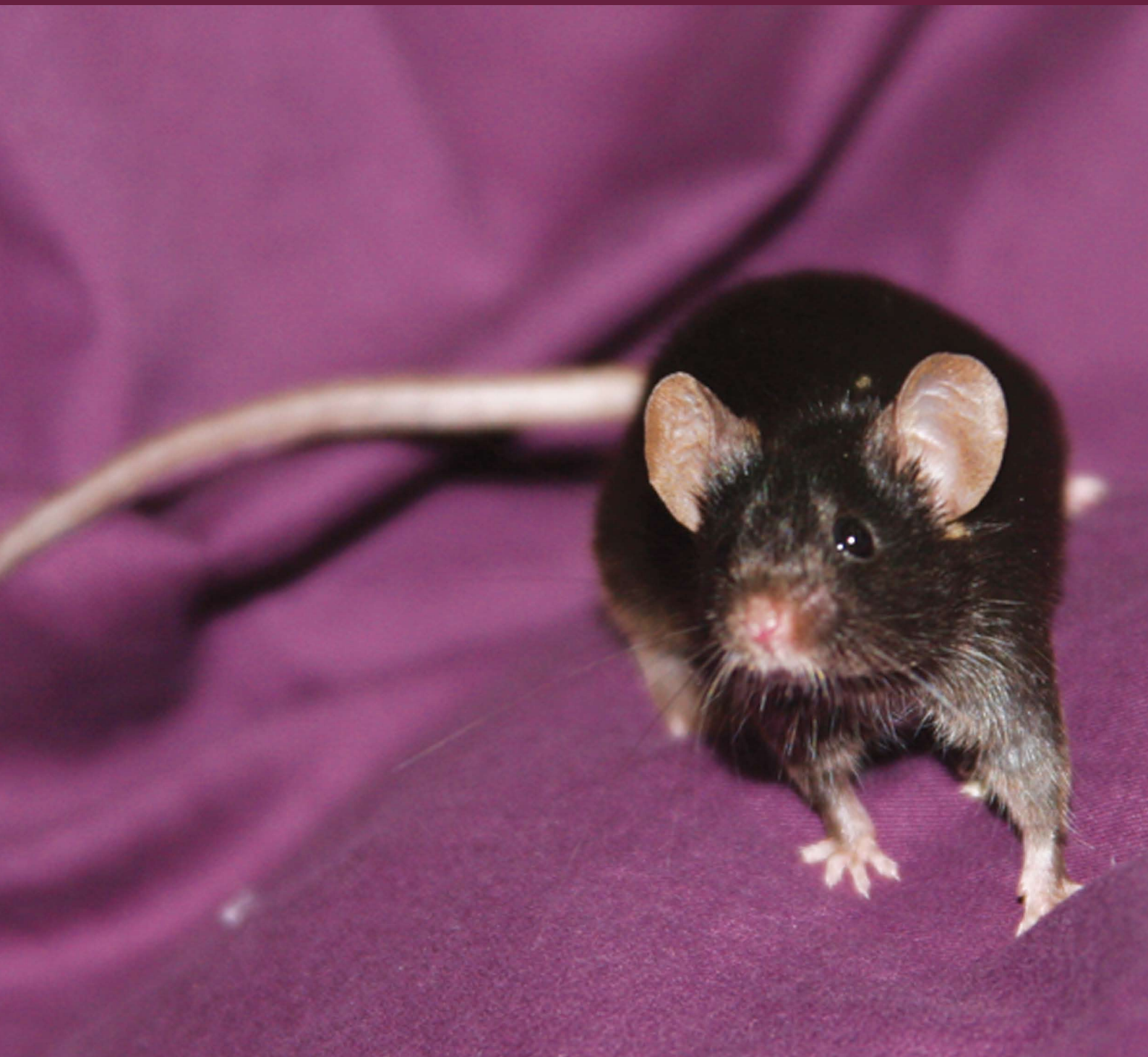


# Major S&T Demand of Innovation-driven Development in China



**“Tiny”, the first iPS mouse from tetraploid complementation.** *Credit: ZHOU Qi from the Institute of Zoology, Chinese Academy of Sciences*



# Pressing Demand for S&T from China's Socioeconomic Transformation

## 1. Energy & resource challenges and urgent demands

China's shortage of energy and resources is becoming increasingly evident. For instance, proved reserves of petroleum and major mineral resources are grossly insufficient. There is an acute lack of understanding, collection, storage, research and development of bio-resources, and more than 90% of the seed supply of major crops and horticulture come from foreign firms. In terms of water resources, China is facing worsening shortage, pollution, ecological deterioration and disasters with a possibility of severe water crises.

Socioeconomic development and national security make pressing demands on research into energy and resources, including development of technologies for clean, efficient and safe exploitation of coal and their comprehensive use, and for clean and efficient use of mineral resources; breakthroughs in key technologies for electricity production with new and renewable energy sources (such as solar energy, wind energy and biomass) and their large-scale utilization, the development of a large-volume, stable and safe energy storage system and a long-distance energy transmission system, and the establishment of distributed and multi-energy complementary smart grids; safe and sustainable development of nuclear fission energy focusing on nuclear fuel breeding and development of new fuels, research and development of new methods and processes for nuclear waste reprocessing and transmutation; basic and engineering research into nuclear fusion energy for independent design and establishment of experimental reactors of fusion engineering and for mastering, developing and accumulating key expertise concerning fusion reactors; analysis of hydrocarbon distribution patterns, upgrading exploitation capacity for seabed and interior resources and research into unconventional petroleum exploitation; a clear understanding of metallogeny, tapping mining potential, improving prospecting and exploitation technologies for interior minerals and manufacturing capacity for related equipment; capacity building for

basic research into hydrology and water resources; key technology development for the integrated management of water resources; enhanced research into links between land, energy, ecosystems and biodiversity; schemes to address climate change, water problems and water safety; and acclimatization and improvement of wild species and exploration of new gene resources.

## 2. Industrial structure challenges and urgent demands

China's manufacturing and materials industries generally remain at the middle or lower end of the industrial chain with excessive consumption of resources and high dependency on key and core technologies from abroad. Its export growth is driven mainly by low prices and large quantities. The information industry, especially the computer industry, is entering a stagnant stage with diminishing market dynamics.

Socioeconomic development in China puts an urgent demand on S&T studies in manufacturing, materials and information, including research and development of technologies for intelligent manufacturing, substitute materials, environment-friendly materials and energy conservation and emissions reduction; innovation capacity building for key and core manufacturing technologies, and for comprehensive utilization of resources, so as to support China's advance from the middle and low end of the industrial chain to the high end and to become a strong manufacturing country; and solutions to essential issues for the development of the information and communication industry by independently establishing platforms for software and hardware development. Innovative technologies, products and services with high market value must be urgently developed to enhance S&T capacity for exploring transformative breakthroughs in technology.

## 3. Agricultural modernization challenges and urgent demands

In China's agriculture, the contradiction between small-

scale operation and food safety as well as modernization becomes ever more apparent. Steadily diminishing areas of arable land and water shortages have an increasingly significant impact on agriculture. The use of many farming resources undermines sustainable development of the agricultural food system. Decreasing self-sufficiency in grains poses a huge threat to food security.

The problems with China's agriculture generate pressing demands on the research and development of technologies for tapping animal and plant germplasms and molecular breeding; sustained and efficient use of resources; and agriculture information application. They are expected to provide powerful S&T support to safeguard sustainable development of China's agriculture, its self-sufficiency and food security.

#### **4. Population, health and aging challenges and urgent demands**

China is facing a variety of health problems and diseases caused by population aging and lifestyle changes, creating urgent demands on life science and studies in relevant fields, including the prevention and control of Hutchinson-Gilford Progeria Syndrome, senile diseases and neurodegenerative disorders; in-depth studies of pathogenesis and new methods of diagnosis and treatment for chronic diseases such as cancer and diabetes; transplantable organ supplies via stem cell studies; treatments for cognitive, behavioral and mental impairments through brain science and behavioral science studies; development of anti-virus drugs and vaccines against major infectious diseases such as hepatitis C and AIDS, and emerging or newly emerging infectious diseases; and establishment of a national store for technology and drugs against major infectious diseases.

#### **5. Eco-environment and urbanization challenges and urgent demands**

China is facing increasingly grave challenges in ecosystem degradation, environment deterioration, more conflicting interests between people and land that are exacerbated by urbanization, and eco-environment restraints and stresses on socioeconomic growth. These put urgent demands on studies in eco-environment and urban development, including intensive studies of key mechanisms underlying eco-environment deterioration; undoing or lessening the damage of pollution to the ecosystem and public health; breakthroughs in key technologies to slow climate change and adaptation; developing green innovation technology in cities; exploring a green mode for sustainable urban development; and promoting eco-

environment conservation in a more automatic, intelligent and networking way.

#### **6. Space & ocean development challenge and urgent demands**

China's space exploration and security is facing challenges and its ocean development confronts various problems in terms of energy and resource exploitation, maritime rights and powers, eco-environment and information acquisition. To address the difficulties, urgent priority was placed on space and ocean sciences and research in relevant fields, including task-oriented development of space technology and relevant high technologies; capacity building for global acquisition of high-resolution remote sensing data from satellites and for space information assurance; capacity building for monitoring and early-warning of space debris and the space environment so as to ensure the long-term sustainability of space activities; expanding capacity for marine energy and resource exploitation; developing high and new technologies and equipment for seabed exploration; setting up a long-term in-situ automatic observation system and marine observation satellite remote sensing system; analyzing marine eco-environment data; revealing the driving mechanisms underlying marine eco-environment evolution, and enhancing capacity in marine environment and disaster simulation, monitoring and forecasting.

#### **7. New security challenges and urgent demands**

With continuous S&T development, national and public security problems have generally gone beyond the traditional domains of land territory, territorial waters and airspace, and entered areas such as food, energy, space, ocean and even the Internet. To address new problems facing national and public security, priority is demanded on research in such fields as computing, Internet technology, biotechnology, space and marine technology and nuclear science, including an understanding of the causes of and responses to emergencies and mass incidents; development of monitoring, response, early-warning and preventive systems to provide technology support for social harmony and stability; technology, systems and platforms for GM food safety assessment and monitoring; monitoring, early-warning and reduction technology for space debris; and improved capacities for information acquisition, forecasting and service of space environment trends; establishment of a maritime domain awareness network to understand the marine environment and its changes; and improvements in the safety, surveillance and management of nuclear power stations.