

## ASSOCIATIONS OR ACADEMIC SOCIETIES AND PERSONNEL





# **SERVICES FOR THE SCIENTIFIC** AND TECHNOLOGICAL WORKERS

.265 Number of Recognition and Award to S&T Workers in **2020** 



Number of Recognition and Award to Young S&T Workers Under the Age of 40 (under the age of 45 in 2018 and later) Unit: 10,000 persons



MARS ROVER ZHURONG Zhurong is China's first Mars rover. On May 22, 2021, the Zhurong rover arrived on the surface of Mars and began its exploration. As of May 5. the Zhurong rover had worked for 347 Martian days and has traveled a total of 1,921 meters.



DARK MATTER PARTICLE EXPLORER WUKONG Wukong is China's first space astronomical satellite. Launched in 2015, it aims to discover and study dark matter, an invisible substance that does not interact with the electromagnetic force yet makes up about 25 percent of the universe.

## **YUTU 2 LUNAR ROVER**

The Yutu 2 lunar rover landed on the far side of the moon on Jan 3, 2019. It is the first lunar rover to set foot on the dark side of the moon. As of Jan 6, the Yutu 2 lunar rover had traveled 1,003.9 meters, and it is still exploring the unknown region.



MICIUS QUANTUM COMMUNICATION SATELLITE Micius is the world's first space quantum science experimental satellite. Launched in 2016, the satellite has conducted many experiments in basic sciences related to quantum communication and quantum mechanics.



### SDGSAT-1

The world's first scientific satellite dedicated to serve the United Nations' 2030 Agenda for Sustainable Development. Launched in 2021, the satellite will provide data support for the evaluation and research of multiple indicators for the sustainable development goals.

# **CHINA TO PROMOTE WIDESPREAD INNOVATION FOCUSED ON**

# Country is celebrating remarkable achievements in those fields

hina promotes all-encompassing innovation that focuses on science and technology. The country has also planned how to realize high-level scientific and technological self-reliance and selfimprovement

Zhang Yuzhuo, vice-president of the China Association for Science and Technology, wrote these remarks in an article published in the Beijing-based Business

Scientific and technological self-reliance and self-

improvement embody the country's development

practice and logic during the past century, Zhang

wrote. The Party has led people to create achieve-

ments such as the first atomic and hydrogen bombs

and missile and satellite launches in the 1960s and

Management Journal in late 2021.

and help them get rid of imitation. It is also necessary to consolidate the first impetus role of innovation in advancing high-quality development and use inclusiveness of science and technology to achieve common prosperity.

It is necessary to gather strategies, plans and policy resources to support scientific and technological selfreliance and self-improvement. It's also necessary to help companies to innovate by offering them guid-

Scientifically and technologically leading companies and new-type research and development institutions should be expanded and become the pacesetters in industrial reforms.

Attracting and training innovative professionals is also important for cementing a foundation of scientific and technological self-reliance and self-improvement. Trust should play a key role in employing professionals while training in capacity for innovation Fields such as manned space flight, Mars exploration and energy engineering made new breakthroughs last year.

The development of national laboratories was enhanced while the implementation of major scientific and technological projects was also promoted last year.

The Chinese government wants to advance scientific and technological innovation, improve industries

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Monday, May 30, 2022

Number of S&T workers reported by the media in 2020

#### Full-time S&T Workers Unit: 10.000 people



Volunteers in S&T Field

Unit: 10,000 people





Number of Participants Unit: 10,000 people-time



Number of Science **Popularization Caravans** 

2021 1,286 2018 **1,245** 2016 **1,345** 2014 **808** 2012 607

Number of Beneficiaries

Unit: 10,000 people-time

2021 **3,551.3** 

2018 2,806.8-

2016 2,867.8

2014 **1,864.0** 

2012 **1,500.0** 

Number of S&T

2020 267,396

2017 66,418 2015 380,770 2013 315,486 2011 180,384

Popularization and

Publicity Activities



**C919 PASSENGER JET** The C919 is China's first narrow-body airliner. The plane is designed to seat around 160 to 170 passengers, and it made its maiden flight in May 2017.

**TIANGONG SPACE STATION** 

Tiangong Space Station is a national-level space laboratory assembled in orbit with multiple

modules. It is used to carry out large-scale space science and technology experiments that require long-term human participation. The space station is expected to finish construction around 2022.

1970s. It has implemented strategies of reinvigorating the country through science, education and development that is driven by innovation. These strategies have been engrained in the country since the reform and

opening-up policy adopted in 1978. It further prioritizes innovation on the key place of national development and advocates stimulating creativity in professionals during the new era. It deepens reform with tenacity, develops systematization of scientific and technological innovation and takes solid steps toward high-level scientific and technological self-reliance and self-improvement.

Chinese scientists have embodied the spirit of patriotism, innovation, dedication, collaboration and education over the past century. The spirit demonstrates the style of high-level scientific and technological self-reliance and self-improvement, Zhang said. It is necessary to inspire scientific and technological workers to endure hardships, dare them to innovate

ance and establishing platforms for them.

The industrial and supply chains are designed to be controllable. Cooperation between enterprises and universities should be furthered to develop safe and reliable innovation chains with strong capacities to deal with emergencies and changes.

Upstream and downstream companies can enjoy closer partnerships in terms of innovation and cooperate to increase their capabilities of coping with risks.

It is necessary to comprehensively enhance the systematization of scientific and technological innovation to guarantee scientific and technological selfreliance and self-improvement.

New relationships among companies, universities and research institutions should be promoted. It is necessary to systematically decide major tasks and also to organize and implement major projects to efficiently utilize professionals, technologies and capital. It is possible to enhance the efficiency of both scientific research and innovation activities to advance systematization of scientific and technological innovation.

High-level research-type universities can perform their functions as social innovation incubators while national scientific research institutions should highlight their leading role in cutting-edge fields.

and critical thinking should also be more greatly prioritized.

It is necessary to value both scientific and technological innovation and the popularization of science and promote advocacy of science and innovation in the society, which is an important symbol of social civilization.

A good innovative and creative environment should be provided to attract, gather and train professionals. Doing so will help make China's innovative development attractive and appealing among global professionals.

Open innovation may be a key path to realizing scientific and technological self-reliance and selfimprovement.

It is necessary to adapt to the world's development trends of mutual learning and coexistence, while also embracing the concepts of opening-up, trust and cooperation to participate in the establishment of a global innovation system.

It is important to promote China's scientific and technological development to contribute more to the progress of human civilization and make the country's modernization an integral part of the modernization of all mankind.

China's capacity for innovation was further enhanced in 2021, according to a government report.

and depend on innovation to increase development quality this year, the report said.

It will enhance the capacity for scientific and technological innovation in 2022 by continuing to implement a three-year plan (2021-23) for the reform of the scientific and technological systems.

It plans to promote the development of national laboratories and nationally significant labs, help higher learning institutions and scientific research organizations to play their roles and improve management of major scientific and technological projects this year.

It will support different regions in increasing their scientific and technological input, enhancing the popularization of science and promoting international scientific and technological cooperation in 2022.

It aims to advocate scientists' spirit and increase support for young scientific research workers to motivate professionals to concentrate on their studies. It will keep promoting development of key technologies, further cooperation among companies, universities and research institutes and advance commercialization of scientific and technological achievements. It plans to strengthen the protection and application of intellectual property, promote startups and investment and innovate in scientific and technological finance services.

#### LARGE HIGH ALTITUDE AIR SHOWER OBSERVATORY

Located about 4410 meters above sea level in Haizi Mountain, Sichuan province, LHAASO is the world's highest and largest cosmic ray detection instrument. It began construction in 2018, and has entered its scientific operation phase in late 2021.

**XUELONG 2 ICEBREAKING RESEARCH VESSEL** 

Xuelong 2 icebreaker is an advanced polar research expedition vessel that entered service in 2019. It is set to expand scientific knowledge on the natural conditions of the South and North poles.

The five-hundred-meter Aperture Spherical Telescope is the largest single-dish radio telescope in the world. Located in Pingtang county, Guizhou province, the telescope finished construction in 2016, began operation in 2020 and has been opened to the global scientific community since 2021.

FAST

**S&T POPULARIZATION** ACTIVITIES

445 425 2013 2015

**FUXING BULLET TRAINS** The Fuxing is a new family of high-speed electric multiple unites trains developed by China. It has a top speed of around 350 kilometers per hour and was put into use in 2017. As of the end of 2021, the Fuxing trains had operated safely for 1.36 billion km and transported 1.37 billion passengers.



## **HUALONG ONE**

Hualong One is China's third-generation pressurized water nuclear reactor plant. It is one of the safest and most widely accepted third-generation nuclear reactors in the market. In March, the Hualong one demonstration project in Fuqing, Fujian province, was completed and has entered commercial operation.

# DONGFANGHONG 3 DEEP OCEAN RESEARCH SHIP Dongfanghong 3 is China's biggest and most advanced deep ocean scientific research ship. It entered service in 2019, and has expanded China's offshore marine geological research, marine oil and gas exploration and other capabilities.

TANKUN HEAVY CUTTER SUCTION DREDGER Tankun is the largest heavy cutter section dredger in Asia. The ship began production in March 2019. It powerful equipment for China's wastal and channel dredging and and reclamation operations.

#### The Experimental Advanced Superconducting Tokamak is an instrument that aims to unlock the secret behind nuclear fusion, the same mechanism that powers the sun. In recent years, EAST has set numerous world records in nuclear fusion technology, paving the way for a new source of unlimited clean energy.

EAST

**SHENHAI-1 DRILLING** PLATFORM Shenhai-1 is the world's first 100,000-ton deep-sea semi-submersible oil 248,734 production and storage platform. The 40-story behemoth began production Participants in 2020 in June 2021, and had Unit: 10,000 person-time

Number of Activities on Publicizing S&T for Teenagers

Unit: time



## **SURVEY ON CHINESE POPULATION'S SCIENTIFIC LITERACY**

Proportion of Population with Scientific Literacy



# Chinese science and technology combat global issues

#### By Yuan Shenggao

produced over 1 billion cubic meters of natural gas

by Feb 13, 2022.

Although China has made notable achievements in scientific research over the years, the Chinese scientific community should further collaborate with their international peers to expand research and innovation capabilities and tackle common challenges amid the current global situation, said senior Chinese officials.

Wan Gang, president of the China Association for Science and Technology, called on the Chinese science community to unite scientists across the globe and bring scientific exchanges and technological cooperation to the forefront, in order to work under the principle of building a community and shared future for mankind.

This will require Chinese scientists to be more collaborative and advocate principles of open science without borders to facilitate new innovations and solutions to the common issues faced by all humankind, Wan said in an article.

At present, the global situation has been fundamentally shaken by particular issues including the COVID-19 pandemic. The new phase of the scientific and technological revolution and industrial reform is now unfolding. At this moment, there is an urgent demand for collaboration among the global community engaged in scientific research, Wan said.

A senior Chinese official once said innovation is the decisive factor in promoting economic and social development and addressing the common challenges of mankind. Such global cooperation can boost higher-level openness and provide systematic solutions to the common concerns of people all over the world.

the world in their relevant research and helped some developing countries and vulnerable groups get vaccines and medicine at lower costs. Since the Chinese government announced that it would peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060, China has taken many routes and put in substantial efforts to pursue the goals.

In recent years, technological innovations have played a key role in China's energy field, with new achievements continuously emerging. China's ultra-supercritical coal-fired power generation and ultrahigh voltage power transmission technique achieved a world leading level.

Nuclear power projects, such as Hualong One technology - China's domestically developed third-generation reactor — are also a crucial step in this effort.

The utilization scale of renewable energy in China ranked top across the globe. By the end of 2020, the cumulative installed capacity of renewable energy in China accounted for about one-third of the total installed capacity in the world.

Among them, the cumulative installed capacity of hydropower, wind power and photovoltaic power generation all ranked first in the world, providing strong support for the utilization of clean and low-carbon energy.

Accelerating the development of new energy vehicles is also a key path to move towards the goal of carbon neutrality. In 2021, the global market of new energy vehicles maintained rapid growth. The sales volume of new energy vehicles in China has exceeded 3 million for the year.

innovation confidence. It worked hand in hand with BRI countries and regions in scientific and cultural cooperation, education, public health, digital economy, green development and other fields, Wan said A senior official said: "Science and technology are powerful tools for development and may also be the reason for risks. We should proactively study and judge the conflicts, social risks and ethical challenges brought about by science and technology and improve the laws and regulations, ethical review rules and regulatory framework." "Moreover, the Chinese science community should deeply participate in global governance, provide valuable Chinese insight and help shape the concept of science and technology for the greater good. In this way science and technology can better promote human well-being and make greater contributions under the principle of building a community of a shared future for mankind."

At present, a new phase of the scientific and technological revolution is taking place. And scientific and technological innovation is profoundly influencing the production and lifestyles of human society, Wan said.

Entering a new stage of development, China is more determined to deepen opening-up and global cooperation in science and technology and advocate the spirit of open science without borders, barriers and discrimination, Wan added.

**ACADEMIC EXCHANGES** Number of pilot cities and parks pioneering their work under the

> Number of groups providing service under the framework of "Innovation China"

theme of "Innovation China'







**OPENNESS AND COMMUNICATION ACTIVITY ON TECHNOLOGY** 



2,248 Experts in International Nongovernmental S&T Organizations in 2020

Source: Statistics Yearbook The Annual Statistics Report on the Development of CAST GRPHICS BY MUKESH MOHANAN / CHINA DAILY

At present, China has established cooperation relationships in scientific research with more than 160 countries and regions. It is a member of more than 200 international organizations and multilateral frameworks. It has signed up to 115 intergovernmental scientific and technological cooperation agreements.

The China Association for Science and Technology and its regional offices across China have joined 372 international scientific and technological organizations. It has firmly set eyes on some major projects such as the International Thermonuclear Experimental Reactor based in France and paved the way for more cooperation in epidemic prevention and control amid a grim COVID-19 situation.

Some major projects, such as the Five-hundred-meter Aperture Spherical Telescope — the world's largest single dish radio telescope – and the Shanghai Synchrotron Radiation Facility project, were put into service and opened to global visitors.

Since the outbreak of COVID-19, Chinese scientific and technological workers have been actively promoting a shared system to deliver anti-epidemic knowledge and information.

They quickly isolated and identified virus strains and shared the whole genome sequence with the World Health Organization. They carried out frequent information exchanges on scientific journals and initiated close cooperation in virus tracing, clinical diagnosis and treatment, vaccination experiments and testing of infected people. Those efforts have provided basic information for scientists around

44-3

At the 2021 World New Energy Vehicle Congrass, automobile enterprises from 15 countries established the "Hainan consensus" which advocated the green and low-carbon development of the whole life cycle and the whole industrial chain of new energy vehicles through low-carbon energy supply, low-carbon material supply, low-carbon production process and low-carbon transportation.

While dealing with global climate change, land desertification has also become an increasing concern. As a major force in tackling desertification around the globe, China has adhered to the principle of "ecology and green development are the priority" and made every effort to solve land desertification over the decades.

International collaboration on science and technology is also a significant component of the Belt and Road Initiative which takes cultural exchanges and people's connections across the globe as a main subject, Wan said.

Under the framework of the BRI, China has adhered to the principles of peace and cooperation, openness and inclusiveness, to pursue mutual benefit and win-win results. With full respect for the development targets of BRI countries and regions, China carried out scientific and cultural exchange projects, constructed jointly managed laboratories, set up science and technology industrial parks and guided better commercialization of research results, Wan said. Under the principle of building a community with a shared future for mankind, China held fast to the global vision and built up its

SHENHAI YONGSHI MANNED SUBMERSIBLE Shenhai Yongshi (Deep-sea Warrior) is a manned submersible designed to operate around 4,500 meter depths. It entered serve in 2017 and has carried out numerous missions to study ocean resource exploration, geochemistry research and marine biology.

HAIYI UNDERWATER GLIDER Haiyi is a series of underwater gliders that has an operating depth ranging from 300 meters to 7,000 meters. In 2017, Haiyi dove 6,329 meters, setting a new world record for underwater glider diving depth.

HAIDOU-1 UNMANNED SUBMERSIBLE Haidou-1 is an advanced remote-controlled unmanned submersible. On April 23, 2020, it set a national diving record of 10,907

meters in the Mariana Trench.

FENDOUZHE MANNED SUBMERSIBLE Fendouzhe (Striver) is China's new deep-sea manned submersible with full ocean depth capability. On Nov 10, 2020, vehicle set a new national record by diving 10,909 meters in the Mariana Trench. It

entered service in March, 2021.

10,907n 10,909m

7,000m



# Xue Qikun, 59

esilience, determination, and a strong drive for excellence toward solving a major scientific question are the qualities that transformed Xue Qikun L U from a poor student from rural Shandong province to one of the country's most accomplished physicists.

In early 2013, after four years of rigorous experiments Xue and his team published their discovery of the quantum anomalous Hall effect in the journal Science, sending a shockwave through the global physics community.

A world-renowned experimental physicist in condensed matter physics, superconductors and opological insulators. He is an academician of the Chinese Academy of Sciences and a fellow of the American Physical Society.

Xue received the first prize of the 2018 State Natural Science Award for his discovery of ne quantum anomalous Hall effect in a lab experiment. He became the first Chinese citizen to win the Fritz London Memorial Prize in 2020. He is currently the president of the Southern University of Science and Technology in Shenzhen, Guangdong province.

The journal's reviewers called Xue's discovery a "milestone" and "one of the most awaited phenomena in topological physics". In April 2013, C. N. Yang, who won the Nobel Prize in physics in 1957, called Xue's work "the first Nobelprizeworthy physics paper from a Chinese lab".

The effect can create "highways for electrons" in topological insu lators, a class of exotic material that is conductive on the outside but insulating on the inside, without the use of a strong magnetic

If used in everyday gadgets, the effect may greatly reduce energy consumption and heat dissipation, allowing engineers to design more compact and powerful electronics and photonics, Xue said. "Creating new scientific theory and discovering new phenomena and effects are the crown jewels of fundamental research," Xue said.

"The discovery of the quantum anomalous Hall effect represents a major contribution by Chinese physicists to humanity's treasure trove of knowledge." In 2020, Xue left his position as the vice-president of Tsinghua University and brought his teaching philosophy to the Southern University of Science and Technology, where he hopes to continue to cultivate a wealth of world-class scientific talents capable of creating major original breakthroughs

in basic research. Xue said a quality research university should encourage scientific exploration, tolerate failure, uphold academic freedom and enhance basic research.

It should also have an evaluation and support system that is beneficial for nurturing young talents, providing sustained support for basic research, and creating original innovations and breakthroughs, he added.

# Cai Tao. 40

or Cai Tao, an associate researcher with the Tianjin Institute of Industrial Biotechnology at the Chinese Academy of Sciences, blue is not a color associated with sadness, but with hope and success.

For over six years, his team focused on a single task: how to synthesize starch in a way that is similar to the process in plants, but do it much faster.

Unlocking this insight is key to sustainability on Earth and future space exploration as it theoretically allows scientists to recycle carbon dioxide and turn this common industrial byproduct and greenhouse gas into food.

With the aid of supercomputing and clever bioengineering, Cai streamlined the complex natural starch-making process via photosynthesis into 11 steps, with the final product being starch, whose solution turns blue upon contact with iodine.

An associate researcher at the Tianjin Institute of Industrial **Biotechnology of the Chinese** Academy of Sciences. In 2021, a team consisting of Cai and the institute's director Ma Yanhe became the first in the world to artificially synthesize starch from carbon dioxide in a lab experiment.

The new technique was published in the journal Science and would revolutionize agriculture if proven to be economically viable at the industrial level. The research was named one of China's top 10 scientific advances last year by the High-tech Research and Development Center of the Ministry of Science and Technology.

"On July 24, 2018, our solution turned light blue for the first time after hundreds of failed experiments. It was a great moment of ntrospection and awe," he said. "We overcame countless difficulties over the years, and for us that light blue in a tube shone like a bright ray of hope."

Cai's findings were published in the journal Science. The Ministry of Science and Technology, the Chinese Academy of Sciences, and the China Union of Life Science Societies at the China Association for Science and Technology unanimously named it one of China's biggest original breakthroughs in basic sciences last year.

Reflecting on his achievement, Cai said maintaining curiosity, bravely forging a new path, and having the perseverance to push through the rigorous and monotonous work are the key to success for young scientists. Aligning personal research

interest with the major strategic needs of the country and the most challenging scientific questions

ing original breakthroughs, he said. "I hope more young scientists, including myself, can keep calm and remain focused on solving the basic scientific challenges behind our country's needs and make our mark on China's path toward achieving self-sufficiency in science





themselves

A world-renowned chemical physicist who specializes in basic research on catalysts and its creation, process and industrial applications. He is an academician at the Chinese Academy of Sciences, the Academy of Sciences for the Developing World and an honorary fellow of the Royal Society of Chemistry in United

Kingdom. One major application of the nano-confined catalysis concept Bao is currently the president is the creation of a new type of of the University of Science catalyst that can directly convert and Technology of China. carbon monoxide and hydrogen He received the first prize derived from coal gasification into of the 2020 State Natural light olefins without using a lot of Science Award, China's water and energy, Bao said. This highest academic accolade creates a new path to the efficient for basic sciences, for his industrial development of water groundbreaking work on "nanoand energy-saving coal chemicals. confined catalysis". Another application of the con-

# CHINA'S SCI-TECH COMMUNITY DEDICATED TO OPENNESS

he new round of scientific, technological and industrial innovation being promoted globally is having a profound influence neers and other professionals working in this field.

institutions, in a bid to give full play to its irreplaceable role in aca-Scientific and technological innovation serves as an important demic innovation engine driving social development. All countries should uphold The association insists on carrying forward the scientific spirit, peace, development, cooperation and win-win partnership, and work popularizing scientific knowledge, organizing science education together to cope with unknown risks and challenges.

openness, cooperation and innovative development. It focuses on increased from 3.27 percent in 2010 to 10.56 percent in 2020. frontier science and technology, the main economic battlefield, major Moreover, it highlights international sci-tech exchanges and coop-State needs and the improvement of people's lives and health. eration. The association and its branches nationwide have joined 372

ontributed to the building of a community with a shared future for its confidence and actions to increase opening-up and cooperation.

The China Association for Science and Technology, which is the rgest non-governmental organization of sci-tech professionals in

on the world's development pattern. The international environment is becoming more complex with rising uncertainty and promote the construction of world-class sci-tech journals and

activities among the youth, and improving the scientific literacy of all China's sci-tech community has always adhered to the concept of citizens. The proportion of Chinese citizens with "scientific qualities"

The community is also committed to improving the innovative international sci-tech organizations, aiming to participate in global progress of science and technology, as well as stimulating the vitality sci-tech governance and play a unique role in non-governmental of sci-tech innovation, promoting the spirit of scientists, and strength- international sci-tech exchanges and cooperation. Although profound ening the ethical governance of science and technology. changes have been taking place in both the domestic and international It has proactively participated in global sci-tech governance and environment on the new stage of development, China will strengthen

> Wan Gang, president of the China Association for Science and Technology

A world-renowned scientist in photogrammetry and remote sensing. He is an academician of the Chinese Academy of Sciences and the Chinese Academy of Engineering, and an honorary member of the International Society for Photogrammetry and Remote Sensing.

Li, also a professor at Wuhan University, Hubei province, has won numerous prestigious awards, including the first prize of the 2020 State Scientific and Technological Progress Award and the ISPRS Brock Gold Medal Award for his outstanding contributions to photogrammetry. He has trained over 200 doctoral students, and is one of the key contributors that transformed China into a global geomatics powerhouse.

# Bao Xinhe, 63

assion, communication, unyielding curiosity and a keen eye for detail, along with decades of rigorous hard work, are some of the secrets that led to Bao Xinhe and his team discovering a new type of catalysis that holds promising industrial applications in fields

of energy, oil refining, advanced materials and other sectors. The concept of "nano-confined catalysis" provides important guidance on the design of highly efficient catalysts, which are defined as substances that facilitate chemical reactions without undergoing any permanent chemical changes

cept is a catalyst designed to clean traces of carbon monoxide from hydrogen at room temperature, thus preventing the gas from deactivating the precious metal

catalysts found in hydrogen-oxygen fuel cells, Bao said. "People think that breakthroughs are made by a sudden stroke of genius, but in reality, making discoveries requires the longerm accumulation of knowledge and sharp intuition, so you an spot the tiniest anomalies and design the right experiments o rigorously probe the mechanisms behind them," he added. For example, Bao's colleagues and students often contact

him late at night to discuss the details of experiments and their results. With a strong emphasis on attention to detail, basic science

and communication, Bao's lab has become a cradle of quality chemists, training more than 100 PhD students and more than 40 post-doctorate researchers.

"China is rich in coal but lacking in petroleum, so the effective and clean conversion of coal and natural gas into chemicals and other products is a matter of national importance," Bao said. "Basic research should target key scientific questions that affect socioeconomic issues."

"The key to making efficien chemical reactions with less enviid energy impact li in a deep understanding of reaction mechanisms," Bao said.

know how the reactants are converted into products, and what will come out in the end. It functions like a black box. The nanoconfined catalysis concept can shed some light on this, leading to more precise and controllable

efforts to shine.

Liang Jianying, 5

nation's railway system, thus kick starting the era of high- the years. and technology.

300 kilometers per hour high-speed train. "The shoulders of kilometers. giants can be shaky and hard to stand on, we have to become On July 20, 2021, after five years of hard work by Liang giants ourselves," she said.

speed from 200 to 300 km/h means overcoming numerous transportation in the world to date. technical obstacles.

The challenge did not faze Liang, and by December 2007, Chinese high-speed trains with independent intellectual she created China's first high-speed train with a speed property debuting new styles and speeds," she said.

rom a common technician to the chief engineer between 300 to 350 km/h. In 2010, she broke the world behind some of China's biggest technological inno-speed record at the time with CRH380A, a bullet train from vations in transportation, Liang Jianying said she the *Hexie* series with an operation test speed of 486.1 km/h.

was fortunate to have worked in a time of rapid "China is a vast country with huge traffic demand and development in China's high-speed railway sector, which has complex geography. With so much support from my country, provided ample opportunities for her team's ingenuity and if I was not able to create the best train in the world, then I would be letting the nation down," Liang said. This is the

In 2004, China published a plan to greatly expand the belief that compelled Liang to achieve excellence throughout speed rail. China had to import high-speed trains at that In 2017, the new and improved *Fuxing* series bullet train

time, and Liang soon realized the importance of building entered service, gradually becoming the mainstay of China's innovation capability and being self-sufficient in science high-speed rails. As of the end of 2021, there were 1,191 *Fuxing* trains in operation and they had safely served over Two years later, Liang was tasked with designing her first 1.37 billion passengers across approximately 1.36 billion

and her team, China's first 600 km/h high-speed magnetic But designing a bullet train is no easy task. A single train levitation train made its debut in Qingdao, Shandong provcan contain over 500,000 components, and improving its ince. It is one of the fastest examples of ground-based public

"I believe that in the foreseeable future, there will be more

The vice-president and chief engineer of China Railway Rolling Stock Corporation Qingdao Sifang, the company behind the Hexie and Fuxing bullet trains, which have propelled China to the position of a global powerhouse in highspeed trains.

Liang and her team received the Special Prize of the 2015 State Scientific and Technological Progress Award for developing the Beijing-Shanghai highspeed railway network. She is currently the director of the National Innovation Center of High Speed Train.

"However, we don't always

chemical reactions."



down by the great grandfa- tant needs, he added. ther of renowned geomatics and geospatial In March, Li and his team at the State Key

information scientist Li Deren. motto. At the age of 83, he is still serving at Wuhan University, Hubei province, pubhis country through his life-long passion of lished China's first global radar orthophoto. surveying and processing geographic infor- An orthophoto is an aerial or satellite mation using satellites and other remote- image without geometrical distortions,

sensing technologies. prize of the 2020 State Scientific and Tech- This makes an orthophoto a key tool for nological Progress Award for developing agriculture, resource management, urban advanced Earth observation systems, which planning and other industries. can swiftly provide high-definition images Li said the map covers a land area of more and information for applications including than 200 million square kilometers, and the disaster relief, infrastructure construction scientific data from the map are available for and environmental protection.

experts a total of 15 years to complete. Now, eign data, and pursue technological innova-Li is hoping to improve that system further tion to become more self-reliant," he said. and create more digital products that can "The most important element of the scihelp countries around the world achieve entific spirit is to seek truth from facts. We sustainable development

geomatics is a discipline critical to national or foreign technologies." security and economic development," he "We have to make original breakthroughs

Collecting geographic data on nature and try," he added.

ove my China, strengthen my human activities helps experts and policycountry" is the first tenet of makers to arrive at informed decisions on the family teachings passed sustainable development and other impor-

Laboratory of Information Engineering in Li said he is glad to have lived up to that Surveying, Mapping and Remote Sensing

allowing scientists to measure the true dis-Last year, Li and his team received the first tances of features within the photograph.

researchers around the world.

The project took Li's team of nearly 100 "We want to remove our reliance on for-

should respect science and scientists, but we "Science should serve the country, and can't place blind faith in existing teachings

that can solve the critical needs of the coun-

On May 30, China celebrates its sixth annual National Science and Technology Workers' Day. It is a day that commemorates China's latest scientific and technological achievements and the innovative, insightful and industrious workers that created them. Highlighting this year's theme of "striving for innovation excellence", "achieving self-reliance and strength" in sci-tech, we have profiled nine noted Chinese scientists and engineers. Each has pushed the global scientific frontiers, spurred economic growth, fulfilled the country's crucial needs or safeguarded public health. Together, they represent a diverse and inclusive group portrait of China's scientific and engineering community Despite their different ages, genders and backgrounds, they are all pioneers of our time and the pride of a nation

# Li Yu, 78

ne intriguing fact about China's historic victory over extreme poverty is that part of its foundations were built on edible fungi and decades of innovative research.

Revitalizing rural China, promoting green development and pushing the envelope to better research and serve the nation's strategic needs are themes highlighted in the 14th Five-Year Plan (2021-25). Li Yu, a noted mycologist and an academician at the Chinese Academy of Engineering, managed to achieve all these goals using tiny mushrooms.

"This is because growing fungi is not labor-, time- or resourceintensive. They are easy to plant and they require little investment," he said. "They grow very fast and they yield good financial returns. Thus, it is a first-choice industry for poverty alleviation." China's agricultural industries produce a huge amount of plant stalks and animal manure every year, which can pollute the environment if not handled properly, Li added.

"Now, we can turn agricultural waste into fertile bags of nutrients for growing fungi," he said. "After they are harvested, we can process what's left in the bags into fertilizer, effectively turning trash into treasure."

"This will build a sustainable cycle in which farmers earn extra income from waste, consumers get tasty and healthy fungi products and the environment is cleaned in the process." Since 2012, Li and his students have spent over 280 days most years traveling to 40 significantly impoverished regions across seven provinces to introduce fungi species and teach villagers how to use modern equipment and techniques to cultivate them.

His efforts have blossomed into a 35 billion yuan (\$5.38 billion) production and manufacturing industry that features unique products made from fungi including chips, supplements, tea and ice cream, all while lifting 35,000 families from more than 800 villages out of poverty.

"Scientists, especially agricultural scientists, should not farm on the blackboard," Li said. "They need to get their feet in the field and use their research to help farmers become rich and live better lives."



A world-renowned mycologist who specializes in engineering and industrialization of fungi science and edible fungi. He is an academician at the Chinese Academy of Engineering and the president of the International Society of Medicinal Mushrooms.

His research has made substantial contribution to China's poverty alleviation effort, lifting hundreds of villages out of absolute poverty. In 2021, he received the honorary title of National Poverty Alleviation Models for his success in poverty eradication.

# Tu Youyou, 92

his year marks the 50th anniversary of the discovery of artemisinin, the active compound that serves as the backbone for the most common and effective antimalarial treatment today According to the World Health Organization, about 240 million people in sub-Saharan Africa have benefited from artemisinin-based combination therapies. By the end of 2021, China had trained tens of thousands of antimalaria technicians for deve ing countries and built ma prevention and control cen for 30 countries.

During the 1940s, China ravaged by malaria, with 1 30 million cases each yea June 2021, the WHO annou China had eliminated this ease within its borders.

Tu Youyou, a 2015 Nobel Prize laureate for her discovery of malaria drug artemisinin, was thrilled to hear the WHO's ly followed, prompting Tu to ask her colleagues how many countries had not eradicated malaria and how Chinese researchers could help.

Last month, during a meeting with officials from the National Administration of Traditional Chinese Medicine, Tu said the number of cases and mortality rates of malaria have rebounded in some parts of the world. In 2020, there were an estimated 241 million cases of malaria

of malaria cases and 96 percent of malaria deaths in 2020.

monthly briefs on her team's research and often offers her advice on key projects.



# Zhu Tao, 49

hu Tao said recently that CanSino Biologics has been working hard to bring the future of COVID-19 vaccinations, where they may replace the "jab" with a "huff", the procedure being as simple as "sipping

The recipient takes a deep breath from a cup containing the aerosol of the vaccine, holds the gas for around five seconds, and slowly breathes out. The whole process takes around 10 seconds and is completely painless, making it ideal for individuals who are scared of needles, he said.

The vaccine has recently entered late-stage clinical trials Preliminary data show that it is safe and can deliver broad protection against the COVID-19

virus and its mutated strains. Inhaled or nasal spray COV-ID-19 vaccines are widely regarded as a game changer in the global fight against the highly transmissible Omicron variant, which primarily targets the upper airway. These types of vaccines will bolster the mucosal immunity of the respiratory tract, thus providing a first line of defense against the pathogen.

As a result, researchers in the United States, Canada, the United Kingdom, India and Japan are developing these types of vaccines. WHO for emergency use. CanSino Biologics is one of the global front-runners in the race. "We have always valued scien-

tific and technological innovation as the No 1 source of productivity," he said. He added that an innovative spirit, a strong will to overcome difficulties, and conducting research in a rigorous and thorough manner are key to success for scientists "We scientists should continue to nurture quality talents and make new innovations, and contribute our insight and effort to achieving self-reliance in science and technology,"

A vaccine expert and the chief scientist at CanSino Biologics. He is a member of the Chinese People's Political Consultative Conference National Committee. China's highest political advisory body

Zhu is one of the key scientists behind Convidecia, a singledose adenovirus-based viral vector vaccine for COVID-19, which has been listed by the

LUSTRATIONS BY YANG LIU AND LI XIAOTIAN / CHINA DAILY

# Wang Yingjun, 68

or Wang Yingjun, the greatest joy is to see her work on biomedical materials can help so many patients and seniors live a better life. Over the last four decades, Wang has focused on creating and improving biomedical materials and high-end medical equipment.

She invented the implant for regenerative restoration for load-bearing bone with large defects, which has led to products that have been used in over 400 hospitals in China and Europe, saving more than 300,000 patients from amputation and disability.

Now, Wang and her team are spearheading a demonstration center based on the Biomaterials Innovation and Cooperation Platform to develop and commercialize new biomedical materials and high-end medical equipment.

In the 1980s, there were not many Chinese researchers working on bioactive materials. At the time, the living and lab conditions were poor and Wang had no one to help her, but she loved her work so much that she would often stay up all night in the lab, or pour water on her dorm bed as cooling during the hot summer months.

"Once I entered this field, I couldn't help but to keep working hard, overcome obstacles and contribute wholeheartedly," she said. "Younger generations of scientists are becoming more capable, but the fighting spirits, dedication and principles from the older generations should be passed down and adopted."

"Scientific research is doing what others have not done, so there won't be innovations without the innovative spirit," she said. "There is no shortcut or short sighted pursue of success when making innovations."

At the same time, a successful scientist should always be curious and hungry for new knowledge, which is important for inter-disciplinary research such as biomedical materials.

New technologies such as artificial intelligence, big data, 3D printing, as well as new advances in biology and life science are contributing to the development of biomaterial research, she said, adding the hardest part for a scientist is to keep innovating and venture into unfamiliar fields.

"Doing research in a lab is hard and industrializing scientific research is even harder, but I have no regrets," she said. "My dream is to let the Chinese people have access to world-class biomaterial made by Chinese scientists."

# for Tissue Restoration and Reconstruction. She is a noted biomedical material expert who has developed original

breakthroughs and products in bone, teeth, tissue engineering and regenerative medical materials.

An academician of the Chinese

Academy of Engineering and

the director of the National

**Engineering Research Center** 

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She is also the recipient of the 2016 State Preeminent Science and Technology Award, China's highest honor for a scientist, announcement. But a sense of and the Medal of the Republic, urgency and responsibility quick- China's highest state honor.

worldwide, claiming around 627,000 lives, according to the WHO. The African region carries a disproportionately high share of the global malaria burden. It was home to 95 percent

The mosquito-borne infectious disease remains a serious public health challenge, and it is important for the international community to enhance collaboration toward achieving a malaria-free world, she added. At the age of 92, Tu may not be able to work as hard as she did decades ago, but she reads

Understanding how artemisinin acts on the malaria parasite, how to overcome drug resistance of artemisinin-based combination therapies and whether it can be used to treat other diseases are some of the focal points of her team's research. As Tu often said, artemisinin is a gift given by China to the world. Today, artemisinin stands as the embodiment of the innovative use of traditional Chinese medicine for the benefit of humanity.

