



In This Issue

InFocus | Flying to Mars

The launch of *Tianwen-1*, a Martian probe named after an ancient masterpiece of Chinese poetry, announced the beginning of China's Mars Exploration Program (CMEP), signaling that this country's deep space exploration has gone beyond the Earth-Moon system for the very first time.

Mars represents a major focus of China's deep space exploration in the following decades. Extending into 2050, CMEP consists of three stages, namely orbiting, landing and roving, and involves sample return and a prospect research station on Mars. As the first mission under this program, *Tianwen-1* will orbit the red planet for global, extensive observation and then send a rover onto its surface for in-situ investigations focusing on chosen locations of specific scientific interest. The data and materials collected

by the mission will help answer some important questions, from the origin and evolution of our solar system, the existence of extraterrestrial life, to whether or not human habitation is possible on this planet.

CAS has played a crucial role in proposing and setting the scientific goals of CMEP; and now it is taking charge of a series of projects important for the implementation of the program. For more detail, please refer to page 71.



Image credit: CNSA

People | Promoting International Cooperation in Space Science amid COVID-19



Image by courtesy of Prof. Ip

Prof. Wing-Huen Ip, having earned international reputation with his research in cometary physics, planetary science, solar system evolution and exoplanets, and particularly his work on Cassini-Huygens mission to Titan and Saturn, assumed the office of Executive Director of the International Institute of Space Science – Beijing (ISSI-BJ) in June. As the only partner of the well-known International Institute of Space (ISSI) in Bern outside Switzerland, this young, small institute shares the same Scientific Committee with ISSI, and also many working tools as well – workshops, forums, international teams... Since its launching in 2013, ISSI-BJ has been welcoming scientists from both Asian and Western countries for transdisciplinary and transcultural research in space science. Just as its innovations gaining momentum, the COVID-19 pandemic came and threw lots of things into uncertainty, forcing the scientific community to move many activities online. How will ISSI-BJ adjust its development strategy to adapt to the rapidly changing situation and meanwhile stick to its commitment to promoting transdisciplinary and transcultural cooperation? Prof. Ip shares his ideas with BCAS, and comments on the newly launched Mars Exploration Program of China.

Turn to page 74 for more.

Special | Hunting Antibodies from Convalescent Serum to Combat COVID-19

As reported recently in the *Science* journal, a joint team of Chinese scientists identified two human-origin monoclonal antibodies capable of blocking SARS-CoV-2 binding to its cell receptor, and hence protecting the injected animals from COVID-19. These antibodies were harvested from the blood of a convalescent donor once infected with COVID-19.

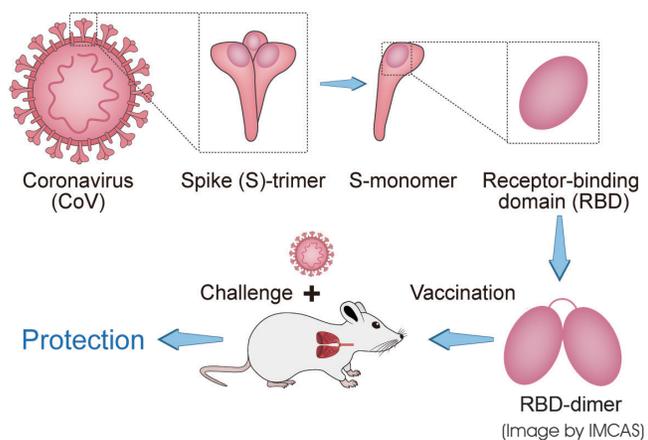
To find out how the scientists get to these virus-neutralizing antibodies from the convalescent donor's blood, please turn to page 78.

Special | Targeting COVID-19, MERS, and SARS with a Universal Vaccine Strategy

To fight against life-threatening infections caused by coronaviruses, particularly the ongoing COVID-19 pandemic, scientists at the CAS Institute of Microbiology (IMCAS), together with their collaborators, developed a universal vaccine strategy against COVID-19, MERS, and SARS.

Coronaviruses, known for the crown-like spikes on their surface, use a particular region on called receptor-binding domain (RBD) to mediate cell entry. Though as a promising vaccine target, RBD antigen could induce very limited immune protection. By putting two RBD

antigens together into the RBD-dimer, scientists can greatly enhance such protection from COVID-19, MERS, and SARS in immunized animals. These inspiring results have endorsed the approval of a COVID-19 vaccine for clinical study, which has proceeded to Phase II since July 10th, 2020. For more details, please turn to page 81.



Highlights | Constructing a Comprehensive Genomic Map for All Soybeans

Recently, a joint team of Chinese scientists at the CAS Institute of Genetics and Developmental Biology (IGDB) constructed a new genomic map that contains almost all the genetic information of soybeans by assembling the genomes of 26 representative strains around the world into one comprehensive pan-genome, a set of genomes that tends to encompass the entire gene set of all strains of a species. This map tells you what genes are presented in all strains (core genome) and what genes only in some strains of a species (variable genome), which is expected to benefit the upcoming efforts in soybean breeding by associating genetic variations to agronomic traits. Please turn to page 84 for more details.

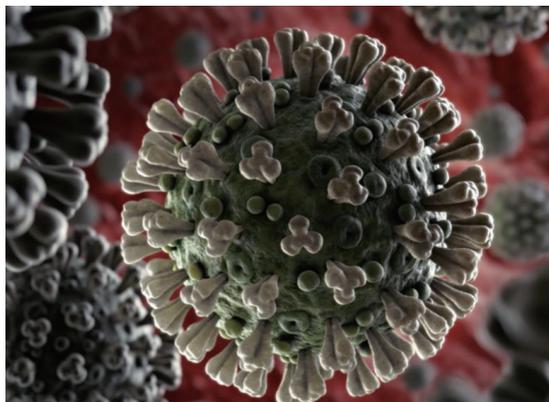
Highlights | Engineering Native Proteins into Covalent Drugs

Recently, a group of scientists presented a general platform to create covalent protein drugs from various protein-protein interactions by incorporating an unnatural amino acid into one of the proteins, which can then target the other *in vitro*, on cell surfaces, and in mice.

As a proof of concept, they chose the binding pair of PD-1/PD-L1, a typical ‘loophole’ that tumor cells can exploit to evade immune detection and elimination; therefore, the blockage of this coupling is therapeutically relevant. By expanding functionality at a picked amino acid in PD-1, they engineered PD-1 into a covalent binder, which greatly revives or enhances the anti-tumor immunity of T cells in immune-humanized mice by binding covalently to PD-L1. Furthermore, the researchers also demonstrated the feasibility to extend this technology to other binding pairs whose blockage or enhanced binding can convey therapeutic benefits. Please turn to page 87 for more details.

Perspective | China’s Fight against COVID-19

Since the outbreak of the then unknown disease, China has been striving to contain the mysterious infection, which till now still has no cure or conclusively effective vaccine available. Experts from different sectors and disciplines joined together to combat the virus. Early to middle January saw Chinese scientists identify the pathogen as a novel RNA virus, sequence its whole-genome and share the data online with the whole world; and in parallel, diagnostic kits were swiftly developed, manufactured and distributed to qualified labs... Meanwhile, synergic actions were rapidly taken across the country to prevent the infection from spreading, and make sure the infected can be located, diagnosed and treated as early as possible.



At a time when uncertainties still lingering, authors from the Chinese Academy of Engineering review the measures taken in the country’s urgent responses to the epidemic, and share their thoughts over the experience and lessons from China’s containment of this vicious virus. For detail, please turn to page 92.

ThinkTank Report | Addressing Structural Problems in Basic Research

Although China’s basic research has made rapid advances, it is still far from meeting the needs of innovation-driven and innovation-led industrial development, according to a task force of the Academic Division of Chinese Academy of Sciences. In its report, the consultation group calls for paying due attention to a series of structural problems, because these problems are having significant impact on the direction selection and output efficacy of basic research in the country.

To address the current structural problems, argues the task force, the first thing to do is to encourage enterprises to increase their input in this regard. This could not only meet their own development needs, but, more importantly, change the investment structure, and make the goals of basic research more significant.

Refer to page 95 for the report.