

Get to Know CAS Research through the Lens of the “Annual Top 10 Science Advances” of 2018

By SONG Jianlan and YAN Fusheng (Staff Reporters)

“*Zhongzhong*” and “*Huahua*,” the two monkey clones produced by CAS biologists, entered the limelight on February 27, 2019, when the related research was ranked first place in the 2018 top 10 scientific advances of China. Along with the monkey clones were some other CAS projects well-known to the public, such as “*Wukong*,” the satellite named after the monkey king, which was sent into space to detect possible dark matter particles. The winners were announced at a ceremony held by the Chinese Ministry of Science and Technology in Beijing.

Every spring since 2006, the Chinese academic community has celebrated excellence in science by recognizing the most important domestic research advances over the past year. By doing so it aims to promote major progress in fundamental research and increase public awareness of science.

Nominated by the country’s leading scientists, the candidates have to survive two rounds of ballots to earn a position in this highly competitive ranking. Those who decide their fate in this rigorous competition include Members of CAS and the Chinese Academy of Engineering, principal investigators of major projects such as the National Basic Research Program (dubbed “973 Program”)



The successful production of monkey clones “*Zhongzhong*” and “*Huahua*” was ranked first in the 2018 annual list of top 10 science advances of China. (Credit: ION)

and directors of State Key Laboratories.

Dominating the list again in 2018, CAS took 7 out of 10 places, collecting the 1st, 2nd, 4th, 6th, 8th, 9th and 10th positions. CAS scientists had participated in these winning projects either as principal investigators or as major contributors. In this issue of *BCAS* we recognize and honor these stars.

1st: Cloned Monkeys for Biomedical Studies

Non-human primates are the best animal models for studying human biology and disease, given that they are genetically the closest to human beings. Cloning these animals, however, has been a longstanding challenge; many attempts have ended in failure. That changed in early 2018. Read more on page 14.

2nd: All Eggs in One Basket: Creation of Functional Single-chromosome Yeast

Generally, a nucleus-bearing cell has multiple chromosomes, to hold the double-helix chains called DNAs in different “baskets.” All in all, the coding on the “eggs” – those chains – programs how the cell produces the biochemical molecules vital for its entire life duration and hence might deserve careful protection. The number of chromosomes varies across species: Human cells each have 46 chromosomes, mice cells 40, fly cells 8, and rice cells 24. How important is the number of “portions” into which a genome is divided? What will happen if we, human beings, change the number of chromosomes? Can we put all of the genome of an organism into one single chromosome without affecting its activity? These questions remained a long-standing mystery until scientists from two CAS institutes in Shanghai made the first successful attempt ever to manipulate the number of chromosomes in a eukaryotic cell. Read more on page 16.

4th: Starving Tumor Cells to Death: DNA Nanorobots as Cancer Therapeutic Agents

Scientists have long sought to use smart nanorobots to spontaneously spot and cure human diseases. A breakthrough made in early 2018 by a joint team brought us one step closer

to this goal. The team designed a kind of DNA origami-based nanorobots as cancer therapeutic agents. Once introduced into the circulation, these nanorobots can deliver thrombin precisely to tumor-associated blood vessels, trigger clotting at the tumor site, cut the blood supply to tumor cells and starve them to death. Read more on page 18.

6th: Hunting for Dark Matter: The First Direct Detection of a Break in the Teraelectronvolt Cosmic-ray Spectrum of Electrons and Positrons

An artistic illustration of DAMPE, the DArk Matter Particle Explorer, also known as “Wukong.” (Credit: DAMPE collaboration)

The sixth place winner was the Dark Matter Particle Explorer (DAMPE), nicknamed “Wukong” after the monkey king, the hero in the Chinese tale “Journey to the West,” for its contribution to the worldwide search for dark matter. Read more on page 20.

8th: Witness Intracellular Events: New Imaging Technology of Nano- and Millisecond- Scale

Seeing is the most direct way we have to recognize and understand our macroscopic world. This also applies when it comes to gaining insights into the microscopic world in a cell. In 2018, CAS researchers developed a novel microscopic tool, which makes it possible for us to see many interesting interactions involving intracellular organelles and cytoskeletons for the first time. Read more on page 23.

9th: Having It All: Enhancing Nitrogen Response in Rice While Inhibiting Its Height

A team at the CAS Institute of Genetics and Developmental Biology (IGDB) led by Prof. FU Xiangdong offered tips on increasing the efficiency of nitrogen use in rice without sacrificing the benefits of dwarfism. This might help reduce use of chemical fertilizers in agriculture and is thought to herald a new round of green revolution. Read more on page 25.

10th: New Story of “Out of Africa:” Human Occupation on Chinese Loess Plateau Dated to ~2.12 Ma

Updated age of human habitation on the Loess Plateau of China indicates that human beings might have emigrated out of Africa earlier than believed. (Credit: GIG & IVPP)

How our ancestors evolved and emigrated has long been heatedly disputed and investigated. Scientists all over the world have been working hard to reconstruct the emigration history of early humans by identifying and dating ancient sites of human habitation.

The age of the lowest layer of an artefact-carrying sequence, recently found in Lantian County on the southern Loess Plateau of China, turned out to be even earlier than that of the Dmanisi site in Georgia, which was formerly thought to be the oldest outside Africa. Hence the updated age of Lantian might imply a new story of “Out of Africa.” Read more on page 27.