

# CONNECTION

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2022 In Review  
P.03

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method to spatially deconvolve  
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Pursuing Innovation*



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## MESSAGE FROM THE EDITOR-IN-CHIEF

The past year 2022 is one with opportunities and challenges, but also one with extraordinary achievements. As always, Zhejiang University takes on its responsibilities as a globalized research university. In November, we host the 16th TWAS General conference, in which the Hangzhou Declaration was released, heralding a new era of global cooperation in basic sciences. In the same month, the ZJU representative of the UNESCO Chair in Entrepreneurship Education attended the 30th anniversary of the UNIT-WIN/UNESCO Chairs Programme held in Paris.

ZJU is also continuously assuming its social responsibility. We held the 2nd forum on regional coordinated development strategy in China, in which several monographs and reports were released. In November, the first stem cell research project of the engineering application system got underway in China's Space Station.

In the field of research, ZJU scientists discovered molecular mechanisms for virus-vector co-evolution, made new progress in bioimaging based on multi-feature deep learning, found critical thermal transition driving spring phenology of Northern Hemisphere conifers, reported the first method to spatially deconvolve traditional bulk RNA-seq data at single-cell resolution, made progress in why anxiety leads to "sociophobia", realized photonic 3D Chern insulator, and many more.

Meanwhile, our students are focusing on their responsibilities as the young generation. In November, 30 ZJUers from 18 countries gathered together to attend the International College Model United Nations (ICMUN) Conference, focusing on "employment issues during the pandemic". Moreover, ZJU undergraduates won the third prize in the 2nd Annual "Reimagine Our Future" Undergraduate Sustainability Competition. Also, don't forget to check out our world-champion teachers!

As always, we truthfully invite you to share with us your thoughts. At this particular juncture, we sincerely wish you a very happy new year!



LI Min, Editor-in-Chief  
Director, Office of International Relations



2022 was undoubtedly a year of many challenges and changes, but it was also a year of great achievement.

We released ZJU's refreshed global strategy, joined hands with our global partners to launch the inaugural SDG Global Summer School, and hosted the TWAS 16th General Conference, where the released Hangzhou Declaration stressed the vital role of basic sciences to attaining SDGs. We held up to 50 bilateral meetings with our global partners from 15 countries, and organized Sino-German Sustainable Development Forum, and Asia-Pacific Carbon Neutrality Symposium.

We were also thrilled to celebrate ZJU's 125th anniversary with more than 100 leading universities around the world, which sent their warm congratulations via videos and letters. The year also saw ZJU researchers make further advancements in science, technology, social sciences, arts and humanities.

We look forward to continuing to work together over the coming year in pursuit of our collective vision to shape a better world.



# ZJU NEWS ROOM

## International

Hangzhou Declaration released at ZJU, heralding a new era of global cooperation in basic sciences



On November 24, the 16th General Conference of the World Academy of Sciences for the advancement of science in developing countries (TWAS) was successfully concluded at Zhejiang University. The Conference was organized by TWAS and hosted by Zhejiang University. Nearly 800 scholars, including 90-plus Chinese scientists, participated in the Conference.

The theme of the conference was "Basic Sciences for Evidence-based Decision-making and Sustainable Development in the Global South".

Hangzhou Declaration was released in the conference, stressing the vital role of basic sciences to attaining sustainable development goals and promoting the well-being of humanity, and calling for more emphasis and investments on basic sciences in development countries.

HE Lianzhen, vice president of Zhejiang University, delivered closing remarks.

"Hangzhou Declaration sends a strong call for inclusiveness, interdisciplinarity and cooperation in the development of basic sciences. As one of China's leading universities, ZJU not only feels the weight of responsibility but also sees the opportunities ahead."

### ZJU representative of the UNESCO Chair in Entrepreneurship Education attends the 30th anniversary of the UNITWIN/UNESCO Chairs Programme



Established in 1992, the UNITWIN/UNESCO Chairs Programme is an inter-sectoral network and it is well placed to address some of the global issues. From Nov. 3rd 2022 to the 4th, the programme celebrated its 30th anniversary in Paris.

Prof. XU Xiaozhou, chairholder of the UNESCO Chair in Entrepreneurship Education at Zhejiang University, delivered a video speech. He pointed out that since the establishment of the Chair, a global cooperation network has been successfully established and

it becomes a platform for international cooperation.

WAN Nian, PhD student at the Zhejiang University College of Education and exchange student at Sciences Po, attended this meeting. He addressed the contributions of the Chair to the academia and shared other contributions made by the Chair to host international meetings, publish manuals and launch online courses through MOOC.

## Public Engagement



### The 2nd Forum on Regional Coordinated Development Strategy in China held at Zhejiang University

Themed on "regional coordinated development and Chinese modernization", the 2nd Forum on Regional Coordinated Development Strategy in China was held on Zijingang Campus of Zhejiang University on November 20, 2022.

A cohort of experts and scholars contributed their unique views. For example, HOU Yongzhi believed that promoting regional coordinated development requires proper handling of various relationships in the process of regional development, and that a systematic approach should be adopted. HE Lansheng asserted that "harmony" is the soul of Chinese agricultural and rural modernization.

Three new books were also released at the Forum, i.e., Report on Western Region Development of China (2021), Typical Cases of Cross-Regional Cooperation in Zhejiang, and Digital Yangtze River Delta Strategy 2022 Digital Rule of Law. Major research topics on regional coordinated development and Chinese modernization, the project of Regional Development Policy Brain, and the China Coordinated Regional Development Index Report (2022) were also released.

### The first stem cell project of engineering application system of China's Space Station "in orbit"

On November 12, the Tianzhou-5 cargo spacecraft was successfully lifted off and loaded with the stem cell experimental unit designed by the research team led by Prof. YU Luyang and Prof. WANG Jinfu at the Zhejiang University College of Life Sciences. The first stem cell research project of engineering application system got underway in China's Space Station. The microgravity environment in space can cause severe bone loss and osteoporosis in astronauts. The team will further analyze the phenotypic changes in terms of differentiation



of bone marrow stem cells and the genetic profile and epigenetic features of differentiated cells in the microgravity environment in space.

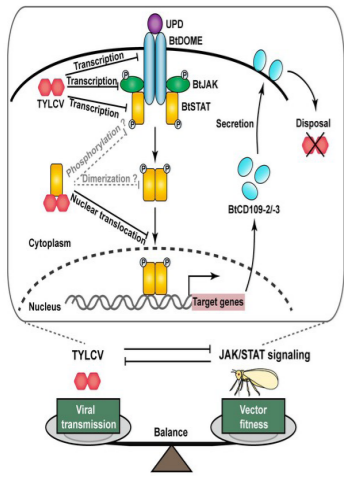
Looking ahead, the team will further

their research into the influence of the deep space environment on osteogenesis, identify relevant targets for bone metabolic diseases, and provide new clues to drug development and intervention strategies.



# REASERCH

## ZJU scientists discover molecular mechanisms for virus-vector co-evolution



On October 3, the team led by Prof. WANG Xiaowei at the College of Agriculture and Biotechnology, Zhejiang University published a research article entitled "A balance between vector survival and virus transmission is achieved through JAK/STAT signaling inhibition by a plant virus" in the *Proceedings of the National Academy of Sciences of the United States of America*.

Since how viruses and insect vectors adapt to each other remains poorly understood, a detailed analysis of the molecular mechanisms will improve

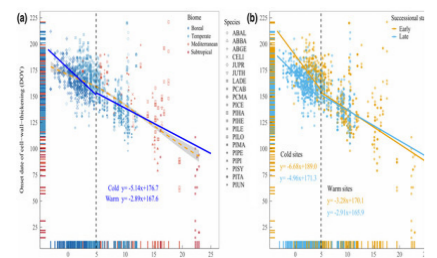
our understanding of virus–vector co-evolution.

The authors showed that the vector Janus kinase/signal transducer and activator of transcription (JAK/STAT) pathway plays a crucial role in mediating adaptations between the begomovirus tomato yellow leaf curl virus (TYLCV) and whiteflies. The study also demonstrated that the JAK/STAT-dependent TYLCV–whitefly interaction plays an essential role in striking a balance between whitefly fitness and TYLCV transmission.

## New progress in bioimaging from SI Ke's group based on multi-feature deep learning

On November 3, Prof. SI Ke's group from Zhejiang University reported an article titled "A multi-feature deep learning system to enhance glaucoma severity diagnosis with high accuracy and fast speed" in the *journal Biomedical Informatics*, and successfully applied in accurate glaucoma severity diagnosis.

Current multi-feature deep learning methods in glaucoma diagnosis mainly focus on distinguishing health and



## Scientists discover critical thermal transition driving spring phenology of Northern Hemisphere conifers

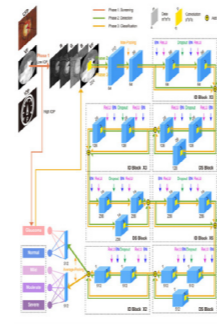
glaucoma without further identification of the severity of glaucoma, leading to very limited significance for clinical treatment guidance. Prof. SI Ke's group proposed a multi-feature deep learning (MFDL) system, which can potentially assist ophthalmologists in efficient and accurate glaucoma diagnosis that could aid the clinical management of glaucoma.

MFDL could assist ophthalmologists who are not specialized in glaucoma severity diagnosis, especially in remote communities. It allows for rapid glaucoma screenings during primary

On November 30, Prof. HUANG Jianguo's team at the Zhejiang University College of Life Sciences published a research article titled "A critical thermal transition driving spring phenology of Northern Hemisphere conifers" in the *journal Global Change Biology*.

The team compiled a dataset of weekly phenological measurements of 20 coniferous

care visits and provides individualized healthcare advice for glaucoma patients, which is a promising approach to benefit wider patients.



species from 75 sites over the Northern Hemisphere, identifying a threshold temperature of  $4.9 \pm 1.1^\circ\text{C}$  that separates the Northern Hemisphere conifers into cold and warm thermal niches. With continuous global warming, a more uniform trend will be expected in spring phenology, while early and late-successional species would shift further apart.

The study provides evidence for integrating the identified thermal threshold into Earth-System-Models for better predictions of global climate-carbon feedbacks.

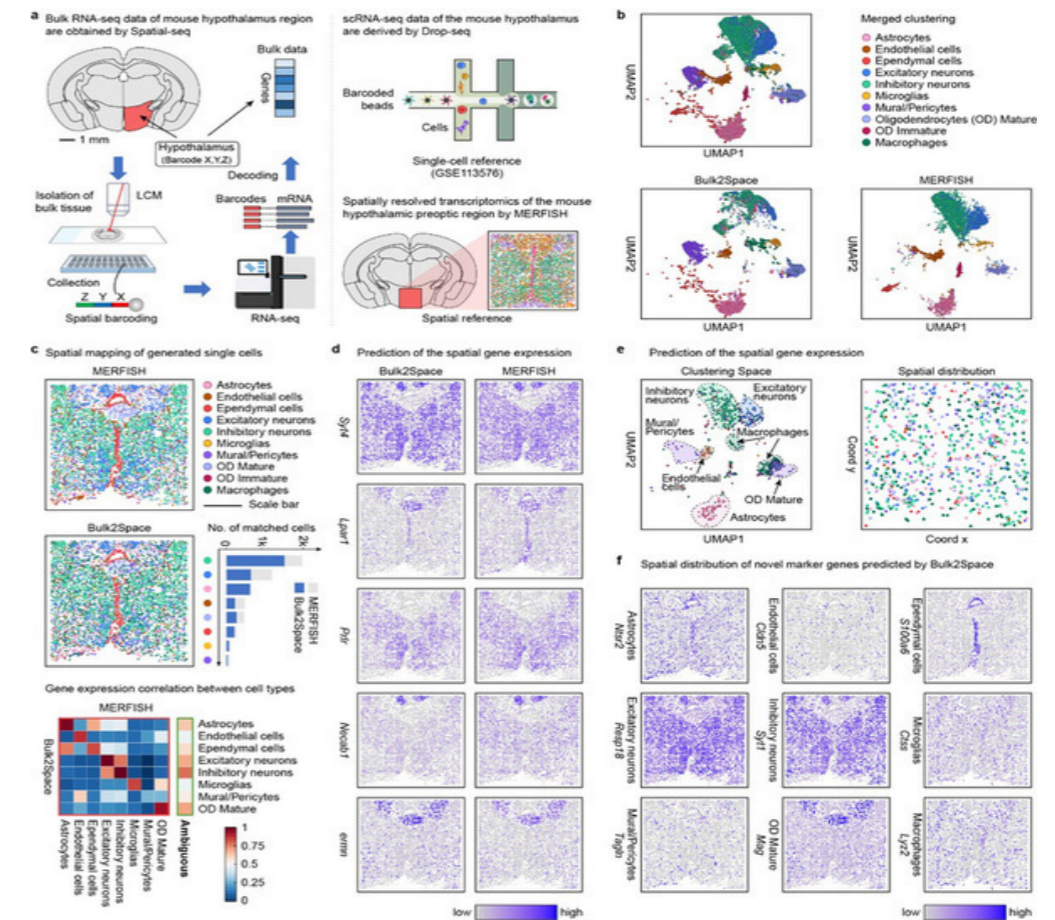
# Research Highlights

## Scientists report the first method to spatially deconvolve traditional bulk RNA-seq data at single-cell resolution

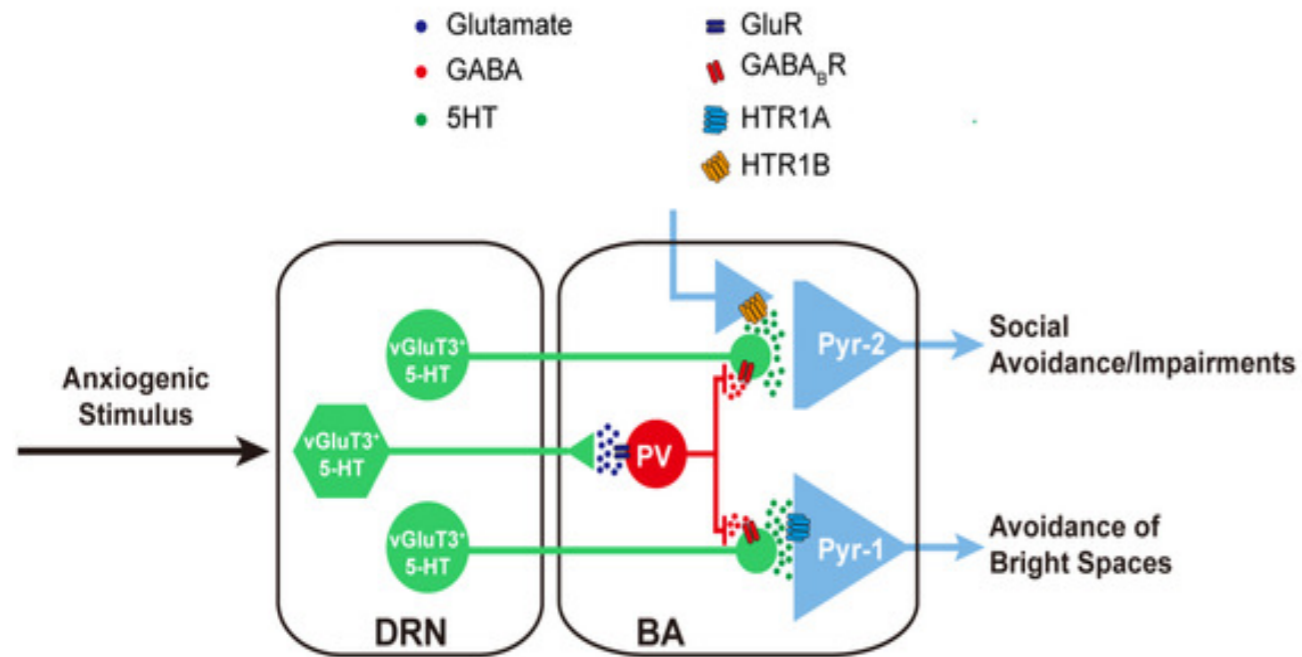
Time-consuming and costly as current technologies of single-cell sequencing (scRNA-seq) and spatially resolved transcriptomics are, applications of this area are severely limited. Thus, it's challenging for systems biology to obtain spatially resolved single-cell gene expression profiles from bulk data by leveraging the existing data resources.

However, the research team of Prof. FAN Xiaohui from the Zhejiang University College of Pharmaceutical Sciences together with Professor CHEN Huajun's team from the Zhejiang University School of Computer Science and Technology, and Prof. GAO Yue 's team from Academy of Military Medical Sciences, has recently published an article entitled "De novo analysis of bulk RNA-seq data at spatially

resolved single-cell resolution" in the *journal Nature Communications*, which proposed a spatial deconvolution algorithm, Bulk2Space, to reconstruct the bulk transcriptome at single-cell spatial resolution for the first time using deep learning frameworks such as  $\beta$ -VAE, showing that Bulk2Space can reconstruct the hierarchical structure of the mouse isocortex region and reannotate ambiguous cells in the mouse hypothalamus. The benchmark test confirmed that Bulk2Space performed robustly and superior to other methods in both simulated and biological datasets. It has also been applied to various biological and disease scenarios. The algorithm is now open-accessed on GitHub.







### Why does anxiety lead to “sociophobia” ?

Recently, research team led by Prof. LI Xiaoming at the Zhejiang University School of Medicine conducted an in-depth study regarding changes in brains caused from anxiety. Results are published in a cover article entitled “Distinct serotonergic pathways to the amygdala underlie separable behavioral features of anxiety” in *the journal Nature Neuroscience*, revealing the DRNvGluT3  $\cap$  5-HT-dependent precise control of BA neurons in the regulation of different behavioral features of anxiety. Different anxiety-related behaviors are proved to be mediated by different neural circuits and molecular mechanisms.

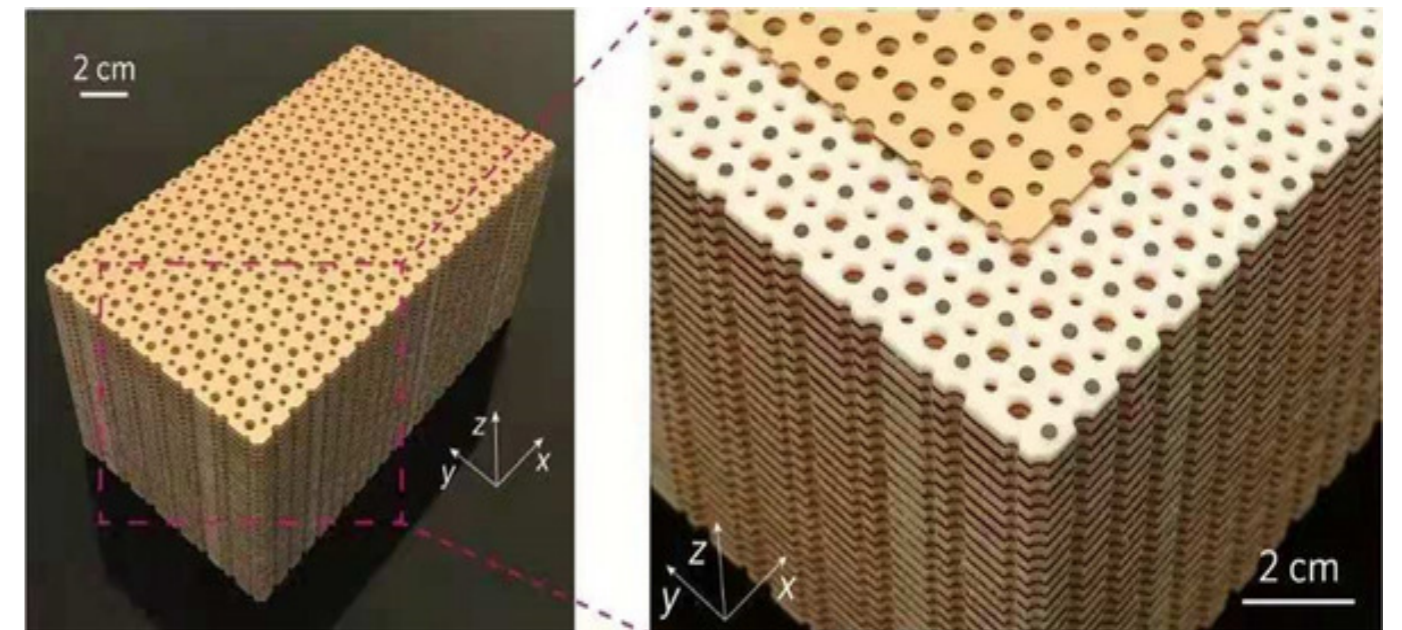
This is the first time that scientists have discovered the elaborate neural circuit mechanisms and the specific neuromolecular basis of different anxiety-related behaviors, from the perspective of behavioral phenotypes. With their self-developed genetically encoded GPCR-based sensor for 5-HT (GRAB5-HT2h) to record the dynamics of extracellular 5-HT levels in the BA in social or anxiogenic conditions, Team Li provides novel approaches concerning the occurrence and pathogenesis of anxiety disorders through the symptomatology, reveals the heterogeneity of 5-HT neurons and amygdala glutamatergic neurons from a new perspective—the heterogeneous projection and cell-type specific connectivity, and expands the understanding of the functional diversity, the structure and the function of 5-HT and the amygdala.

### Photonic 3D Chern insulator realized

Prof. YANG Yihao from the International Campus of Zhejiang University and his collaborators at Nanyang Technological University announced their latest breakthrough: the world's first realization of a long-elusive material called the 3D Chern insulator. These results are featured in *the journal Nature*, entitled “Topological Chern vectors in three-dimensional photonic crystals”, which open up new perspectives in the fundamental topological phases of matter.

To overcome the above challenge, for the first time, Prof. Yang and his collaborators use magnetically tunable 3D photonic crystals to achieve the experimental demonstration of a 3D photonic Chern insulator and extend the Chern number from scalar to vector. Additionally, they extend the famous Haldane model from 2D to 3D, and observe the topological phase transition from Weyl semimetals to 3D Chern insulators. This work, for the first time, establishes a connection between knot theory and topological photonics.

The experimental validations of such photonic Chern insulators are limited to 2D, and the realization of 3D Chern insulators remained elusive prior to Prof. Yang's work.





# SPOTLIGHT ON

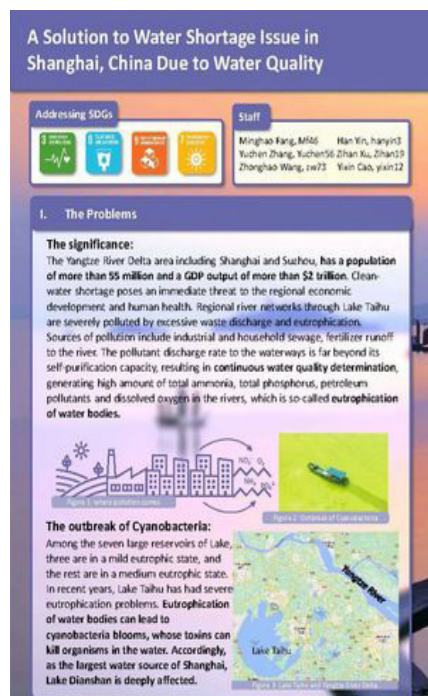
## A special session of the "UN General Assembly"

On November 26th, 30 ZJUers from 18 countries gathered together to attend the International College Model United Nations (ICMUN) Conference, which was focused on "Employment issues during the pandemic". Foreign and local students speaking on behalf of their assigned countries shared different ways of solving unemployment caused by the pandemic, as well as strategies for supporting small and medium-sized enterprises. Participants also addressed such topics as the digital development of governments and enterprises, the protection of feminine rights and well-being, health care issues and so on.



The event was not only a platform for participants to express opinions on important topics but also helped them to better their research skills, gain public speaking experience, practice their

oral Chinese, and learn about different countries' politics in a friendly and multicultural way.



## ZJUI undergraduates win the 2nd Annual "Reimagine Our Future" Undergraduate Sustainability Competition

Recently, FANG Minghao, XU Zihan, ZHANG Yuchen, WANG Zhonghao, CAO Yixin, and YIN Han, the 2022 undergraduates of ZJUI, won the third prize in the 2nd Annual "Reimagine Our Future" Undergraduate Sustainability Competition with their ingenious proposals. Hosted by UIUC, this 8-week international competition calls for innovative and feasible plans or solutions to promote the United Nations' Sustainable Development Goals (SDGs). Their project, "A solution to water shortage issues in Shanghai, China due to water quality", revolves around four sustainable development goals.

The team proposed a series of measures to improve the water quality of Dianshan Lake and provide sufficient high-quality water for Shanghai citizens.

The global responsibility of ZJUers is not only reflected in their global competence, but also in the actions for sustainable development. Prof. ZHANG Yuanhui, founding professor of University of Illinois at Urbana-Champaign (UIUC) also thought highly of the team and claimed that the sustainable world relies on the young generation like them.

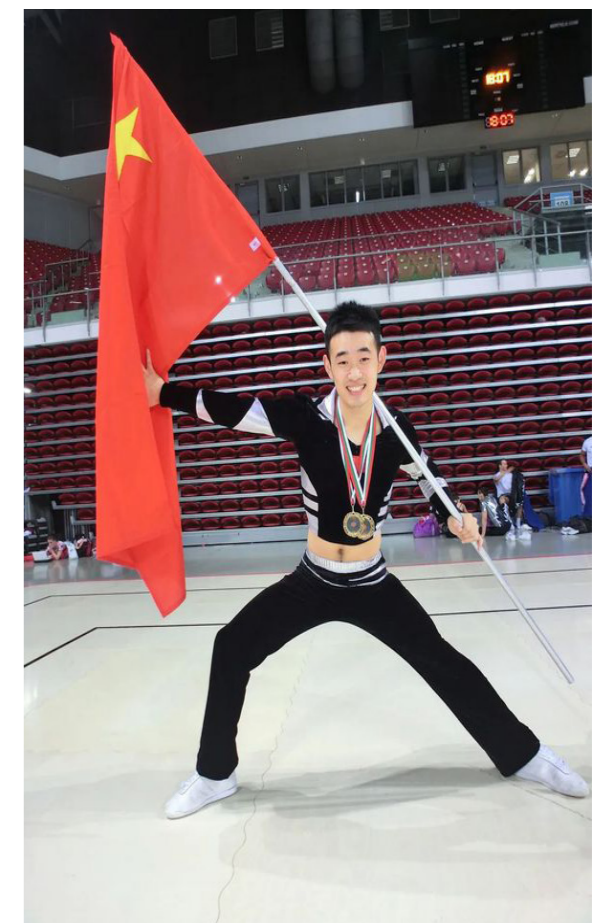
## Faculty

### ZJU's world-champion teachers

Here in Zhejiang University, students are accessible not only to some world champions, but also to several invigorating classes set up by those shining stars. In this series of ZJU's world-champion teachers, let's spotlight on their stories.



**XU Yaping** is an international-level athlete who has won sprint kayak world championship. During the athlete career, she has taken part in great competitions and reaped eight gold medals in total. In 2011, Xu joined ZJU as a teacher, being the first in China to teach water sports in university. Behind the glory of the world champion is hard-working day in and day out. Step by step, she gradually became who she is today.



**SHOU Minchao** is an international-level athlete as well as an international referee of aerobics. He was selected to the national team in 2007 and has won 8 championships during his athletic career. In 2020, Shou joined Zhejiang University as an aerobics teacher. Beyond the instruction on techniques, he attaches greater importance on practicing the concept of lifelong physical education.