

**Second China-U.S. Workshop on
the Challenges of Emerging Infections, Laboratory Safety and Global Health Security**

Wuhan National Institute of Virology

May 17-19 2017

Wuhan, China

Summary

To address the interconnected life science challenges associated with emerging infectious diseases and further enhance cooperation between China and the United States in the areas of global health, biosafety, and biosecurity, the U.S. National Academy of Sciences (NAS), the Chinese Academy of Sciences (CAS), and the Wuhan Institute of Virology of CAS held the *Second¹ China-U.S. Workshop on the Challenges of Emerging Infections, Laboratory Safety and Global Health Security* in May 2017 in Wuhan, China. Experts from China and the United States gave presentations on science behind combating emerging infections, high containment laboratories, including commissioning; construction; operation and sustainment; and the importance of conducting innovative life science research while managing the risks. Techniques like gain-of-function, gene editing, and other novel biotechnologies were discussed as was the emergence and public health response to outbreaks of new animal and human diseases of concern to China and the United States. The Chinese and American approaches to biosafety and biosecurity in laboratories, life-science ethics, laboratory leadership and organizational cultures were addressed to advance a better understanding of these issues from the perspective of experts in each country and to seek agreement on best practices in these areas. A large group of graduate students was in attendance and took part in the robust discussions which followed each presentation. Subsequent meetings will be held in the United States in 2017 and in China in 2018.

The workshop aimed to build bridges between Chinese and American scientists and use the eminence and national leadership of the convening CAS and NAS organizations to improve scientific and technical cooperation in areas of mutual concern to China and the United States. Although some presentations focused on specific research in the areas of gain of function, gene editing, targeting and delivery and other novel biotechnology, public health response to outbreaks, emerging infectious diseases, and global health security, each speaker considered issues associated with biological safety; laboratory management and maintenance; staff education and training; the efficient and sustainable operation of animal, plant, and public

¹In September 2015, a group of experts and representatives from the NAS, CAS, Chinese Center for Disease Control and Prevention (CCDC), and other Chinese institutions held the first *Workshop on Challenges of Emerging Infections, Laboratory Safety, and Global Health Security* at the CAS Institute of Microbiology in Beijing. The workshop allowed American and Chinese experts to discuss human and animal infectious-disease challenges that transcend national borders and impact both countries. Participants at the workshop also discussed guidelines for the use of CRISPR Cas9 and other gene editing technology that led to a summit on human gene editing co-convened in the United States by NAS, CAS, and the U.K. Royal Society. The co-chairs of the workshop agreed to continue to share information on regulations, to continue dialogue on biosafety and biosecurity best practices, especially at high containment laboratories, and to explore the possibility for more U.S.-Chinese collaboration on issues related to global public health. The workshop concluded with the experts identifying promising areas for collaborative partnerships between Chinese and American scientists and institutions and an agreement to hold a second meeting in Wuhan, China.

health research laboratories; and clinical applications for improving global health security when they presented their findings and during the public question and answer period following each presentation. Of particular importance were discussions related to efforts by both countries to achieve the right balance among safety, security, regulation, and scientific progress in conducting and advancing life-science research. After the SARS outbreak of 2002 the Chinese scientific community focused on the linkage between disease and security, specifically the insecurity that a naturally occurring disease outbreak could create. The United States continues to struggle to regulate research using new techniques to edit genes and, after several high profile accidents, is considering better ways to address safety and security in high-containment laboratories without hindering the important science that takes place inside.

Participants identified three broad areas for further collaboration between the United States and China: (1) Issues related to emerging infections, understanding disease reservoirs, disease emergence, disease surveillance, natural versus human origin of disease, data sharing, and building capacity for research during public health emergencies. (2) Anticipating risk in the life sciences and medicine related to biotechnology innovation, such as identifying certain experiments that are too risky to conduct. (3) Governance of science to reduce risk, such as doing research in centralized laboratories versus distributed labs, managing research costs, learning from past technical and bureaucratic mistakes, best ways to diminish risk without hindering science and addressing technical risk for the laboratory versus social risk for the community.

A unique feature of the workshop was that it brought together the leadership of four biological safety level four (BSL-4) laboratories: The Galveston National Laboratory (GNL) in the United States, the Wuhan Institute of Virology (CAS) the Harbin Veterinary Research Institute (Chinese Academy of Agricultural Sciences), and the Kunming Institute of Medical Biology (Chinese Academy of Medical Sciences). After extensive planning, commissioning, construction, testing, and international collaboration, all three of the Chinese laboratories are close to opening their BSL-4 laboratory spaces for research. Sharing practical advice and experiences and creating ties between institutions that operate these facilities is crucial to prevent the misuse or accidental release of dangerous pathogens. The leadership of the GNL has years of experience operating a high containment laboratory, including recent experience working with authorities to respond to and mitigate the consequences of an Ebola case in the United States. The meeting laid the foundations for future exchanges, both scientific and practical, between the leaders and researchers at these laboratories.

To educate political leaders and others about the topics discussed during the workshop, the organizers agreed to write a joint white paper outlining issues of mutual concern and to work to form an official partnership via a memorandum of understanding between the Galveston National Laboratory and the Wuhan Institute of Virology (and possibly the other Chinese BSL-4 laboratories) so that these labs can more easily work together on short-term and long-term joint projects. The experts identified several general areas for promising future exchanges including creating joint BSL-4 research projects that are beneficial for both the United States and China, better ways to share samples, strains, and strain collections between laboratories,

and improving and sharing best practices for training laboratory staff, particularly staff that work at the BSL-4 level. The organizers plan to hold further face-to-face meetings in the United States at the Galveston National Laboratory late in 2017 and in China at the Kunming Institute of Medical Biology in 2018. Topics for the next workshop at the Galveston National Laboratory will likely center around specific high biocontainment “operational” issues such as:

- An overall strategy and creating centers for effective high containment laboratory staff training
- Creating and maintaining clinical care facilities in BSL-4 space and training clinical staff
- Conducting “well-documented” studies under BSL-4 conditions including practical aspects of non-human primate experimentation in the BSL-4 space
- Development and maintenance of best practices for long-term safe and productive BSL-4 operations
- Community relations and outreach efforts and the differences and similarities between interacting with the communities surrounding laboratories in China and the U.S.
- Conducting vector studies to identify animal virus reservoirs and combat emerging infections caused by viral agents requiring high-containment facilities

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Sessions and Presentations

Gain of function research, gene editing, targeting and delivery and other novel biotechnology

- Genome engineering and other life-sciences technologies: challenges and opportunities
- Construction and rescue of a functional synthetic baculovirus
- High-throughput functional genomics: coding, non-coding, and beyond

Public health response to outbreaks and issues

- Antibody dependent enhancement in Dengue and Zika virus infections
- Engineered human antibody constant domain as a candidate against Ebola virus
- Antiviral drug discovery and development
- Improving the laboratory’s role in emergency health response: communications during a crisis

Emerging infectious diseases and global health security

- Biosafety, biorisk, and biosecurity – natural spill-over: Ebola
- A One Health Strategy for responding to emerging infectious diseases
- Pathogenicity analysis of bat SARS-like coronavirus
- Severe fever with thrombocytopenia syndrome (SFTS) in China from first discovery
- Coronaviruses: Global threats to humans and animals
- Existing weapons against the emerging Zika virus
- Avian influenza at the animal-human interface: global challenges for scientific contributions to control
- Non-structural Protein 1: A Key for Flavivirus transfer from host to vector

- Rapid response to Zika virus emergence: diagnostics and vaccine development

High-level biosafety laboratory: construction, commissioning, and sustainment

- Practical aspects of maximum biocontainment laboratory operations (in session 1)
- Brief and status quo on accreditation for biosafety laboratories in China
- Biocontainment operations and maintenance at UTMB and training for other containment facility operators
- National high containment facilities for animal diseases control and prevention in Harbin, China
- Kunming National Primate Research Center of High-level Biosafety: Future Perspective

Biosafety, biosecurity and bioethics

- Biosafety and bioethics considerations for emerging disease control research
- Regulatory issues affecting the operation of a functional high containment lab: Obtaining, shipping, maintaining, and exchanging high hazard pathogens in today's regulatory environment. Does the science matter?
- Leadership, responsibility and progress: the value of healthy organizational cultures

The role of CAS and NAS in enhancing cooperation between the U.S. and China on emerging infections, laboratory safety and global health security

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